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RESEARCH PAPER

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Effects of Symbol Sets and Needs Gratifications on Audience Engagement: Contextualizing Police Social Media Communication

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Abstract

We propose a research model based on media synchronicity theory (MST) and examine how the use of different symbol sets (e.g., images and text) is related to audience engagement on social media. We include uses and gratifications theory (UGT) in the model to identify task characteristics that are relevant to message recipients in the specific context of community policing. Based on our analyses of Facebook posts by five police departments, we find first that, consistent with MST, posts conveying information garner more responses when accompanied by more natural symbol sets, and more textual content is preferred to less, but responses differ depending on the type of engagement: intimacy (likes), interaction (comments), or influence (shares). Second, posts intended for meaning convergence gratify the audience's socialization and assistance needs and are positively related to intimacy and interaction. Finally, the fit between symbol sets and task characteristics impacts different dimensions of audience engagement. These findings provide empirical support for relying on MST when studying social media and for integrating with UGT to capture contextual task characteristics. We conclude the paper with a discussion of the implications of its findings for theory and offer recommendations for practice.

Keywords: Media Synchronicity Theory, Uses and Gratifications Theory, Theory Contextualization, Social Media Use, Audience Engagement, Community Policing

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1 Introduction

Social media and networking (e.g., Twitter, Facebook, and YouTube) have become increasingly important in people's lives. The networking facility of these platforms allows participants to interact anytime and anyplace in ways that prior media and platforms did not support. As a result, social media participants can choose when and where to act as initiator, respondent, reactor, or silent follower of messages that can take written, pictorial, video, or symbolic (e.g., likes, emojis) forms. Messages and replies can be viewed immediately or on the participant's schedule. Given this expanded set of features, functions, and capabilities, researchers cannot assume that research on earlier or simpler media options applies directly to these newer media types and uses.

In this paper, we provide evidence from our study of police usage of social media to show how one highly regarded theory (media synchronicity theory, or MST) applies to social media. We investigate the factors affecting social media engagement behavior. Since MST was first proposed, it has been tested in a limited number of studies that focus primarily on interpersonal communications. Ours is the first study to apply MST theory to examine and analyze communications that take place on social media, a form of media that exhibits characteristics of both interpersonal and mass

communication. Based on MST, we propose a research model that relates both *symbol sets* and *contextual task characteristics* with the level of *engagement* manifested by the interaction, intimacy, and influence behaviors of the audience. We determine that MST is best integrated with a second theory, uses and gratifications theory (UGT), to better represent the bidirectionality of the media and the implications of the recipient's perspective on task characteristics. UGT also helps identify contextual task characters in our research model. The two theories combine to improve our understanding of social media engagement.

In the law enforcement domain, social media serves as a convenient, effective communication channel for law enforcement agencies to interact with the public through various activities, including broadcasting and announcing public safety-related events (e.g., traffic conditions and inclement weather warnings), offering self-defense and property protection tips, reporting event status and updates, and calling for assistance with policing activities (e.g., criminal investigations). These activities may help increase public awareness and build trusting relationships with the community. However, despite widespread recognition of social media's growing importance in community policing[1] and a desire to leverage social media, law enforcement agencies lack training, and have few personnel (and little if any budgetary means) to support social media initiatives, routine messaging activities, or interventions (Williams, Fedorowicz, Kavanaugh, Thatcher & Haughton, 2015). The significant role played by social media in crises such as the terrorist attacks in San Bernardino, California, in Brussels, Belgium, and in Manchester, England further highlight the importance of understanding how law enforcement agencies and the public use and respond to these communications (Athans, 2017; Braziel, Straub, Watson, & Hoops, 2016; Reisinger, 2015).

Social media and social networking topics are widely studied in the academic literature. That withstanding, research on social media communication connecting the public and law enforcement agencies is relatively rare. The use of social media in this specific context can have serious implications for public safety. For example, not only can police use social media to inform the public about community and public safety incidents, but the public and traditional media providers often initiate similar messaging that may either assist with or controvert police work. Properly employed, the police and the public can use social media to work in tandem to serve and protect the community. Lacking a trusted police social media presence, hostile messaging can interfere with law enforcement work, generate panic in a community, or incite insurgency.

Research into the efficacy of police messaging should help law enforcement agencies understand and manage their social media presence more effectively and better anticipate the reaction of the public to typical police posts or the public's reaction to an emergency incident in the community. The objective of our research is to examine how the public audience responds to social media messages posted by police departments. Our research examines *the factors (symbol sets and task characteristics) that may affect the engagement behavior* of the social media audience. Identification of the efficacy of these factors would shed light on the value and impact of social media use by law enforcement agencies and, more broadly, provide insights into the development of effective organizational social media management strategies.

We study the use of Facebook by police departments and their audiences as it is the most popular social media forum. Rather than relying on survey methodology, which has been the most widely employed method in media research, we extracted posts directly from Facebook to analyze the relationships between our explanatory and outcome variables.

The remainder of this paper is organized as follows. The next section provides background on social media use by law enforcement agencies and then reviews the research literature on media synchronicity theory, uses and gratifications theory, and the concept of social media engagement. the third section presents our contextualized research model and hypotheses. We then describe the methods and data used in our research and provide our data analysis results. Next, we discuss the implications of our research for theory and practice, followed by a final section in which we address the limitations of our study and lay out future research plans.

2 Literature Review

2.1 Background

The social media *presence* of law enforcement agencies has increased in recent years. A nationwide survey of social media use by 500 US law enforcement agencies in 2016 found that 94% use Facebook, followed by Twitter (71.2%) and YouTube (40.0%) (Kim, Oglesby-Neal, & Mohr, 2017). Among the stated purposes of social media communication, criminal investigation is the most common (88.7%),

[1] Community policing is a law enforcement philosophy that promotes organizational strategies, which support the systematic use of partnerships and problem-solving techniques, to proactively address the immediate conditions that give rise to public safety issues, such as crime, social disorder, and fear of crime. http://www.cops.usdoj.gov /html/dispatch/january_2008/nugget.html.

followed by notification of crimes (84.3%). However, agency *assimilation* of the technology into work practices has been slow (Edlins & Brainard, 2016). Many departments view social media as a stand-alone tool that is not typically integrated into police functions or organizational practices and processes. Interview and survey data show that many police departments are only minimally aware of best practice guidelines, often lack articulated goals, objectives, or strategic plans, and rarely identify or assess the value-added aspects of social media use (Williams et al., 2015). Many police departments are still developing organizational policies concerning social media use (11.7% in process; 10.5% lacking). These lacks may be caused by a number of things, including external factors (e.g., constituency-demand characteristics such as urbanization [Neiger, 2012] or population [Guzman & Jones, 2012; Yavuz & Welch, 2014]); internal capacities (e.g., bureaucratization); organization size; resource constraints (including budget and staff [Kavanaugh et al., 2012]); superiors' resistance; lack of managerial support; and inadequate training (Briones, Kuch, Liu, & Jin, 2011). Whatever the cause, there is a noted gap between what departments do with social media and their ability to assess the longer-term import and efficacy of their actions.

In terms of patterns of use by law enforcement agencies, police social media messages are likely to be reactive rather than proactive with respect to constituent demand, and less likely to be used for routine functions (Yavuz & Welch, 2014). Government agencies and/or police departments primarily disseminate information about their organizations and their activities and are less poised to offer opportunities for engagement (Brainard & Edlins, 2015; Crump, 2011; Lovejoy & Saxton, 2012; Waters, Burnett, Lamm, & Lucas, 2009). That is, communication is often intended to be one-way and asymmetrical (Waters & Williams, 2011). Because of a heavy reliance on posts that automatically feed from one social media app to others, agencies' content often does not match the interests and needs of their audiences (Neiger, 2012) even though Waters and Williams (2011) suggest that a one-way asymmetrical model is the most useful and appropriate in emergency situations.

Concerning social media *impact* and *public reaction*, some studies have found that social media use by police departments increases public confidence (trust) and satisfaction (effectiveness and perceived legitimacy) (Meijer, 2014; Ruddell, 2013). Meijer (2014) also reported that social media use generates additional engagement for a limited group of people relative to face-to-face contact in routine police patrol work, but not in time-critical situations. In a singular comparative study of social media use by different kinds of organizations, Bird, Ling, and Haynes (2012) found that users perceived government agency communications to be more accurate than those of community organizations, but the opposite held for perceived timeliness and utility. An analysis of the Facebook activities of four metropolitan police departments reveals that the different social media management strategies they employed caused different patterns of audience engagement (Huang et al., 2016). Similarly, it has been shown that some types of Twitter messages are more likely to be forwarded and shared by the audience than other types (Van De Velde, Meijer, & Homburg, 2015) and that police officers' presentation strategies in Twitter messages can affect the public's perceptions of the police (Schneider, 2016).

The public generally is supportive of law enforcement agencies, but their *responses* to police departments' social media presentation are limited. An Accenture survey of 1,300 citizens in six countries (US, Canada, UK, the Netherlands, Germany and Spain) found that 90% are willing to support social media use by their police force and believe it has an important role to play in helping deter crime (Accenture, 2012). Although Facebook (81%) and Twitter (35%) are the preferred social media platforms by police followers, the number and frequency of posts, comments or likes by the public on police-posted social media messages are generally low (Neiger, 2012). Citizens often prefer anonymity and may not feel sufficiently well-informed to help with crime-prevention efforts.

Combining the resource-constrained and helter-skelter push into police use of social media with the concomitant mission of improved community-policing relationships, this application domain is well positioned as a prime candidate for studying the impacts of media- and message-specific characteristics on community engagement.

2.2 Media Synchronicity Theory

Media vary in their abilities to reduce uncertainty and equivocality in communication and differ in their abilities to facilitate interpretation of information and development of shared understanding. Media synchronicity theory (MST) is a general framework for identifying different capabilities of media and for analyzing how these capabilities may affect communication performance (Dennis, Fuller, & Valacich, 2008; Dennis & Valacich, 1999). According to MST, communication may require different levels of media synchronicity, depending on which process is dominant in a task: conveyance of information or convergence on meaning. MST posits that communication performance is a function of the extent to which media synchronicity matches the communication processes required for accomplishing a task. To achieve better performance, conveyance tasks should use media with lower synchronicity, while convergence tasks need media with higher

synchronicity (Dennis et al., 2008). This theory identifies two categories of media synchronicity determinants: information transmission capabilities (transmission velocity, parallelism, symbol sets) and information processing capabilities (symbol sets, rehearsability, and reprocessability).

There have been only a limited number of studies in the literature testing the roles of all or a subset of the media capabilities identified in MST. Table 1 in the Appendix provides a summary of the papers using MST to analyze various types of communication in terms of their subjects, contexts, and major findings.

Our research focuses on the impact of symbol sets on the outcomes of communication. Symbol sets, which relate to both information transmission and processing, are defined as "the number of ways in which a medium allows information to be encoded for communication" (Dennis et al., 2008, p. 585). In other words, symbol sets refer to the number and types of information cues a medium can present and carry. MST predicts that natural symbol sets—such as physical, visual, and verbal cues—support media synchronicity better than written or typed texts do and, therefore, are more capable of facilitating convergence on meanings.

Research has tested the role of symbol sets in various types of communication. For example, Wheeler and Arunachalam (2009) report that differences in information presentation modes (e.g., text-only or video-only) can affect individuals' decision-making and task performance. Another study reveals that email is not less efficient than face-to-face and video conferencing communication in facilitating knowledge exchange between buyers and suppliers in new product development processes (Thomas, 2013). Jacob, Guéguen, & Petr (2010) find that when more information cues (e.g., audio cues) are included, participants are more satisfied with the information presented on a tourist-oriented website. Dennis and Kinney (1998) report that the number of information cues and immediacy of feedback have a significant impact on decision time; however, they do not affect other performance indicators such as decision quality, consensus change, and communication satisfaction.

Although MST is considered a general theory, most research on media characteristics has been carried out in specific contexts. Contextual factors, such as task characteristics and requirements (Dennis & Kinney, 1998), as well as culture and language (Klitmøller & Lauring, 2013), have been shown to have an impact on communication outcomes. For instance, Niinimäki, Piri, Lassenius, and Paasivaara (2012) use MST to examine global software development projects in which multiple types of media were used. They find that to achieve intended communication outcomes, the symbol sets selected (e.g., text instead of verbal cues) must match the task requirements (e.g., conveyance of program source code). Lan and Sie (2010) compare SMS (short message service), email, and RSS (really simple syndication) in mobile learning settings and demonstrate that the use of a type of media may result in different performance levels for different types of tasks. For example, because of its immediacy, SMS may be more appropriate for delivering time-sensitive information (convergence tasks), while email may be more useful for transmitting a large amount of information (conveyance tasks). In addition, task characteristics such as analyzability, urgency, and complexity can influence an organization's selection of communication methods and media (Koo & Jung, 2011). Similarly, Palvia, Punjani, Cannoy, and Jacks (2011) find that contextual constraints, such as task urgency, confidentiality, accountability, social interaction, and information integrity, can also affect communication outcomes.

Our literature review suggests that although MST is a promising theory that explains the relationships between media characteristics and communication outcomes, it has not been widely used in the literature. Research on social media communication based on MST is even rarer. Motivated by this research gap, our research intends to examine audience engagement of social media communication through the lens of MST in the context of community policing.

In addition to examining the media characteristics from the message sender's perspective, our study is also based on understanding the needs, goals, and expectations of message receivers, as social media is intended to support a high degree of interaction. Uses and gratifications theory (UGT) is a theory that helps explain why people choose and respond to different types of media and information when facing a multitude of media and message options. Coupled with MST, UGT will fill out our characterization of the response activity we examine between the police and the public members of their community.

2.3 Uses and Gratifications Theory

The key proposition of UGT is that individuals choose and respond to a particular type of media or communication messages based on their needs and expectations (Katz, Gurevith, & Haas, 1973). The underlying assumption of this theory is that individuals are goal-directed and they select only media that satisfy their requirements, pay attention only to information that gratifies their needs, and ignore irrelevant messages. This theory has been used to discover what factors motivate individuals' choice of a type of media or message and how these individuals interact with the media. Although this theory is not intended to account for the impact of the media on individuals (Katz et al., 1974), it does help us identify contextual factors that are related to the characteristics of tasks and messages in the current study.

Since it was proposed, this theory has been employed to study a variety of media, especially mass media such as newspapers (Elliott & Rosenberg, 1987), radio (Armstrong & Rubin, 1989), and television (Babrow, 1987; Bantz, 1982). With the advance of information and communication technologies (ICT), newer types of media, such as email and the Internet, also have been investigated within the uses and gratifications framework (Dimmick, Kline, & Stafford, 2000; Eighmey, 1997; Flanagin & Miriam, 2001; Ko, Cho, & Roberts, 2005). Regarding Internet studies, for example, Korgaonkar and Wolin (1999) find several motivations for its use, including receiving information, seeking entertainment, and escaping. Similarly, Papacharissi and Rubin (2000) identify five primary motives for Internet use: interpersonal utility, pastime, information-seeking, convenience, and entertainment. The study by Kaye and Johnson (2002) reveals four primary reasons that people seek online political information—namely, social utility, entertainment, guidance, and information-seeking/surveillance. Ko et al. (2005) pay special attention to user's information needs and socialization needs when using the Internet and find that users motivated by information needs tend to interact with the communication content while those with socialization needs are motivated to interact with other users.

Most research on social media uses and gratifications has attempted to identify the fundamental psychological needs of individuals. Table 2 in the Appendix summarizes the main characteristics of several exemplary studies we found in the literature. Although they have investigated different social media platforms and populations, the large majority focuses on Facebook and the users are mostly college students. Much rarer are studies of adults, and we found only one focusing a specific user population (Choi, Fowler, Goh, & Yuan, 2016). The data have been collected primarily through surveys, sometimes in combination with focus groups or interviews. Most investigate the motivations (uses and gratifications) for adoption in general, although one study also examines various features (Smock, Ellison, Lampe, & Wohn, 2011) and another (Kim 2014) the specific social recommendation feature (e.g., likes). Most of the research on how social media gratify users' needs examines similar factors, albeit in different combinations. As Table 2 in the Appendix shows, their findings are generally similar even if the relative importance of individual factors varies. For example, Chen's (2011) survey of Twitter users highlights their need to connect with others, while Johnson (2014) finds that Twitter users are more likely to use the medium to fulfill their information needs rather than their socialization needs. In their study, Quan-Haase and Young (2010) compare Facebook and instant messaging (IM) and report that Facebook gratifies the desire for social activities while IM promotes relationship maintenance and development.

Our study differs from this previous research in several significant ways. First, its population is adult users—specifically, the public participating in social media activity with police departments. Second, it directly examines user *response* to communication *content* and *symbol sets* in Facebook posts (i.e., constructs from MST), rather than self-report measures of what users find gratifying about social media sites. Moreover, we have a sample of posts from several different geographic communities. We augment the small pool of studies examining different features (image, hyperlinks, and message length, in our case) and include not only the common contextual factor of needs gratification, but also the task's time sensitivity. Together these expansions stand to deepen current understanding of social media *engagement.*

2.4 Social Media Engagement

The concept of *engagement* has been proposed as a useful perspective for assessing the effectiveness and success of the social media management strategies of organizations (Jiang, Luo, & Kulemeka, 2016; Paine, 2011). Although there is not a widely accepted definition for social media engagement, it is generally believed that engagement is a multidimensional concept that incorporates several types of psychological states and behaviors in response to social media activities. For example, people may click on the "like" button to express various responses to a post, including endorsement and agreement (Dessart, Veloutsou, & Morgan-Thomas, 2015), enjoyment and entertainment (S.-Y. Lee, Hansen, & J. K. Lee, 2016), or compliance and conformity with social norms or expectations (Chin, Lu, & Wu, 2015). Dessart et al., (2015) identified three engagement categories in the context of consumer community: affective (enjoyment, enthusiasm), cognitive (attention, absorption), and behavioral (learning, endorsing, sharing).

In addition to research that describes the activities comprising engagement, metrics have been proposed to measure the degree of engagement. Bonson and Ratkai (2013) put forth a set of simple objective metrics for assessing stakeholder engagement on corporate Facebook accounts by measuring an account's popularity (percentage of posts with likes), commitment (percentage of posts with comments), and virality (percentage of posts with shares). Other metrics combine simple objective measures with interpretive engagement characteristics. In this vein, we adopt the 4-I model proposed by Forrester Research (Haven, 2007) to categorize social media engagement: *involvement* (e.g., site visits, page views, time spent, and link clicks), *interaction* (e.g., commenting and replying), *intimacy* (e.g., sentiment and affinity expressions), and *influence* (e.g., outreaching actions,

passing on to others, and recommendations). This characterization shares some commonalities with other research on engagement measurement. For example, in understanding the relationship between social media management strategies and corporate-public relations, engagement has been used as a performance criterion consisting of two dimensions: word-of-mouth and attitudinal loyalty (Benthaus, Risius, & Beck, 2016; Risius & Beck, 2015). The word-of-mouth dimension is notably similar to the influence dimension in the 4-I model, while the attitudinal loyalty overlaps with both involvement and interaction.

The study of user engagement is important, as these behaviors (e.g., liking, commenting, and sharing) not only transform into comparable performance metrics and quality indicators, they also stimulate follow-on activities that replicate and expand on messages across social media networks (Gerlitz & Helmond, 2013). Such activities have been used as social marketing tools to enhance visibility and to extend the reach of an organization. For instance, the number of Facebook "likes" that a movie prerelease post receives directly correlates with its box office performance (Ding, Cheng, Duan, & Jin, 2017). Thus, it is useful to be able to both measure and interpret a range of engagement metrics within the purview of a specific domain. Behavioral measures such as liking, commenting, and sharing focus on engagement as an action rather than views and impressions, which are passive measures.

User engagement through social media may also be affected by demographic factors such as age and education (Ruddell, 2013) as well as recipient interests (selective attention, cf. Harvey, Stewart, & Ewing, 2011). Important to our work are effects attributed to technical features of the communication itself (Petrovic, Osborne, & Lavrenko, 2011). Tanupabrungsun, Hemsley, Semaan, & Stromer-Galley (2016) report that highly interactive, contextual, and information-rich posts generate most retweets. Mainka, Hartmann, Stock, & Peters (2015) find that city governments that post many photos on Facebook generate more followers and likes than those that post mainly text and links. Lev-On and Steinfeld (2015) also report that images generate higher engagement levels than text and even videos, which they attribute to the time it takes an audience to view videos (see also Hofmann, Beverungen, Räckers, & Becker, 2013, and Michalska, Lilleker, & Michalski, 2016). Practitioner studies mirror these findings (Redsicker, 2017). In another study, J. Lee, Agrawal, and Rao (2015) find that a longer reaction time impedes diffusion, and somewhat counterintuitively, so too does the use of hashtags. Huang et al. (2016) report that short posts from police departments receive more likes and comments than longer ones. Finally, during crises, situational and geolocation updates are retweeted more than other on-topic tweets (Vieweg, Hughes, Starbird, & Palen, 2010). These findings demonstrate how characteristics of the message itself and the communication context can affect the impact of the message on its engagement.

MST has primarily focused on interpersonal communication and UGT on mass communication in general contexts. Bringing these two complimentary theories together in our research model using the lens of media engagement should provide additional insights into social media communication. We expect that studying the communication audience's engagement behaviors from both the police and public perspectives will inspire further research on how the audience responds to specific communication features (i.e., symbol sets and message characteristics). Evidence supporting this combined model would serve to enhance researchers' knowledge of social media's unique standing within interpersonal and mass communications, and would also inform practice in the law enforcement domain.

3 Research Model and Hypotheses

3.1 Contextualizing Social Media Communication

In this research, we use MST as the basis or theoretical foundation for our research model. We focus on one of the media capabilities comprising the MST framework, specifically the effects of symbol sets (information cues) in social media communication. This research model is contextualized to take into consideration the particular situations and task characteristics that may affect the specific communication outcome we examine here—audience engagement—in the specific context of community policing.

There have been increasing calls for contextual theorizing for information systems (IS) research (Hong et al., 2013; Te'eni, 2015; Te'eni, 2016). Context is defined as "situational opportunities and constraints that affect the occurrence and meaning of organizational behavior as well as functional relationships between variables" (Johns, 2006, p. 386). Context is believed to have both a direct and indirect impact on not only the process of theory development, but also the resulting theory (Hong et al., 2013; Johns, 2006). Note that in this paper, the term "context" may be used at two levels: one at the domain level (law enforcement or community policing), and the other at the task level (task characteristics).

Hong et al. (2013) recommend two contextual theorizing approaches: single-context theory contextualization and cross-context theory replication. With the first approach, a general theory can be contextualized by adding, removing, or decomposing core constructs in the theory and then incorporating

contextual factors as antecedents or moderators. The second approach requires a theory-grounded meta-analysis to replicate a theoretical model and consolidate findings in different contexts. This research will primarily use the single-context theorizing approach, but will also compare our findings with other studies across contexts (see Section 5.6 and the discussion in Section 6.1.2).

When formulating MST, Dennis et al. (2008) identify three contexts for decision-making and problem-solving tasks in interpersonal communication: familiarity with the task on an individual level, among other individuals, and in relation to the media. However, the social media communication under study in this research permits more than just interpersonal communication. It also exhibits commonality with mass media communication. Consequently, we choose to contextualize our research model based on UGT, a theory that addresses media choice in mass communications by including the perspective of the user/recipient. The addition of UGT allows us to include contextualized factors related to task goals.

3.2 Research Model

Although it is fairly clear from prior research that different types of media may have different capabilities (Dennis et al., 2008), the same media type also may present varying symbol sets and gratify different user needs, leading to changes in audience engagement within specific contexts. For example, a Facebook message is not merely a textual Facebook message: it may range from a short, plain text to a long passage accompanied by photos, videos, and links to external sources. Similarly, in response, the audience may simply flag a "like" symbol or take the time to write up a comment, which may contain only a single character or word (e.g., "k" to signal agreement) or may be a lengthy soliloquy with emojis and pedigreed authorship.

Our intent is to delve into typical social media communication alternatives more deeply to further delimit the symbol sets and task characteristics these permit and the responses they elicit. In doing so, we contribute to the media choice and performance literature regarding the effects of content and context on communication outcomes and enhance our understanding of the strengths and limitations of these communication options.

Based on MST and UGT, we characterize social media communication using two groups of features: *symbol sets* and *task characteristics*. In our data set, there are three types of symbol sets—namely, image, hyperlink, and text. *Image* represents the visual cues depicted in a message. *Hyperlink* indicates if a message contains a clickable link to a webpage. *Text* is best represented by some measure of its ability to represent content; thus, we use *message length* as an indicator of information complexity and volume (Jones et al., 2004).

The task characteristic group includes contextual factors representing gratifications of audience needs, as well as the task's *time sensitivity* (i.e., how urgent a message or a task is). The *needs gratification* factor captures the purpose of each message: to gratify the audience's information or socialization needs, which are the two most common motivations for Internet and social media use (Bumgarner, 2007; Ko et al., 2005; Quan-Haase & Young, 2010; Smock et al., 2011). In addition, we recognize that in the domain of community policing, some members of the public may be motivated to assist law enforcement agencies with policing activities (e.g., criminal investigations). Although not previously identified in the uses and gratifications literature, we believe that this motivation is highly relevant in police-public communications. Other motivations that have been referenced in the literature, such as passing time and entertainment, are less applicable in this domain context and are excluded. In addition, time sensitivity is important and highly relevant for emergency and crisis management in the public safety domain. Especially in extreme circumstances (e.g., terrorist attacks, school shootings, or natural disasters), interaction between law enforcement agencies and the public may completely deviate from regular (i.e., routine) patterns of communication (Brooks, Bodeau, & Fedorowicz, 2013). Through the lens of MST, messages for gratifying information-seeking needs are designed primarily for information conveyance (requiring low synchronicity), while those for meeting socialization and assistance goals are oriented more toward convergence on meanings (requiring high synchronicity). We also place time-sensitive messages, which require fast information transmission and processing capabilities (high synchronicity), into the category of convergence and development of shared understanding of emergency situations.

For the purposes of this study, audience engagement is the communication outcome of interest. The current study measures engagement using three dimensions of the engagement based on the 4-I model (Haven, 2007): *intimacy, interaction, and influence*.[2]

To summarize, we build a research model by following the theory contextualization guidelines of (Hong et al., 2013): (1) we ground the model in the general theory: MST; (2) identify context-specific factors about task characteristics (the UGT concepts of needs gratification and time sensitivity) by evaluating the law

[2] It was impossible to measure involvement due to the limits placed by Facebook's data-availability policy restricting access to data on site visits, page views, time spent, and link clicks.

enforcement context; and (3) model the task characteristics as both explanatory variables and moderating factors. Figure 1 presents our research model, which consists of two groups of factors (MST's symbol sets and UGT's task characteristics), the communication outcome (audience engagement), and the proposed relationships between the factors and the outcome.

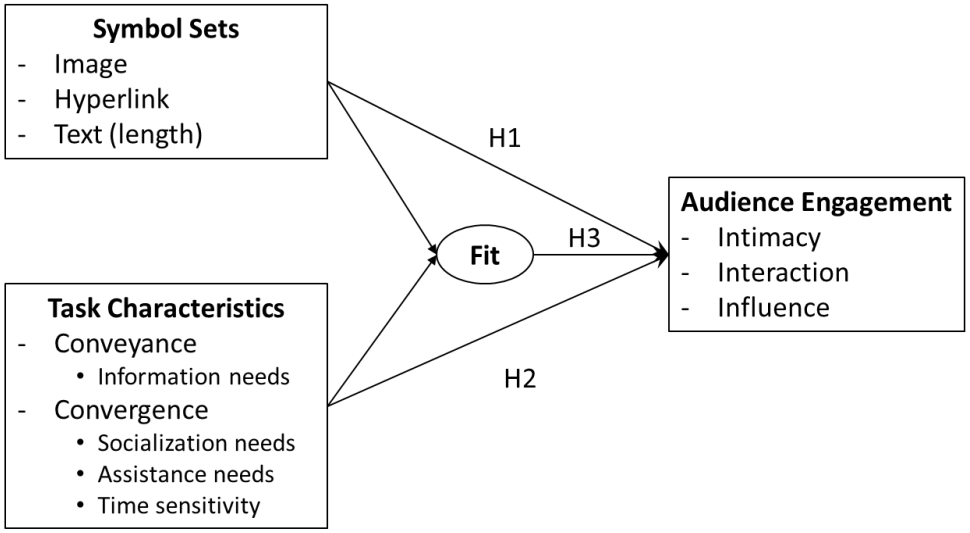

Figure 1. Research Model and Hypotheses

3.3 Hypotheses

We first look at the relationships between symbol sets and audience engagement. MST generally predicts that natural symbol sets are more capable of supporting media synchronicity and that the fit between media synchronicity and the communication process (information conveyance or meaning convergence) affects the communication outcome. Because in the domain context of community policing, social media have been primarily used as an information dissemination tool (Brainard & Edlins, 2015; Crump, 2011; Lovejoy & Saxton, 2012; Waters et al., 2009), we first investigate, at a high level, how symbol sets help disseminate information to the public. Visual cues are known to be able to convey additional information beyond plain text. A hyperlink provides an external source from which more information can be attained, and thus potentially expands the information content in a message. We also recognize that longer texts may carry a larger amount of information and are more likely to attract attention and responses. As a result, we propose that:

H1: Messages with more symbol sets are associated with more audience engagement than messages with only text.

In other words, H1 hypothesizes that "the more information the better". We divide this hypothesis into three subhypotheses:

H1a: Messages with images are associated with more engagement than text-only messages.

H1b: Messages with hyperlinks are associated with more engagement than text-only messages.

H1c: Long messages are associated with more engagement than short messages.

We then look at the effect of task characteristics. UGT does not offer predictions for the relationships between task characteristics and communication outcomes, except for the identification of relevant factors. Nonetheless, a closer look at the specific task characteristics may offer a hint of the direction of impact. As mentioned earlier, among the three types of needs (i.e., information, socialization, and assistance) that motivate the public to engage in a police department's social media activities, the primary motivation of the public is to seek information and updates as the medium affords a timely, relatively anonymous, and low-cost method for the audience to receive information. Beyond this typically passive baseline communication for information conveyance, the audience may also be interested in forming a "social" relationship with the police department by participating in a dialogue. Followers of the police may also be willing to provide assistance in criminal or emergency situations, especially in response to a call for information that helps to address or resolve an incident. As for time sensitivity, it is not unreasonable to expect that an urgent message (e.g., a warning of an active shooter) or a moderate one (e.g., preparations for an incoming storm) may receive more public responses than regular updates of a police department's routine work. Nonroutine messages are likely to attract more attention (and therefore responses) than those considered to be routine.

Therefore, we expect that, in general, the meaning convergence type of communication is more capable of engaging the public:

H2: Messages for meaning convergence are associated with more audience engagement than those for information conveyance.

Specifically, we propose that:

H2a: Messages intended for gratifications of the audience's socialization needs are associated with more engagement than those addressing information needs.

H2b: Messages intended for gratifications of the audience's assistance needs are associated with more engagement than those addressing information needs.

H2c: Messages exhibiting high time sensitivity are associated with more engagement than those exhibiting low time sensitivity.

H2d: Messages exhibiting moderate time sensitivity are associated with more engagement than those exhibiting low time sensitivity.

Moreover, symbol sets and task characteristics may interact, and this interaction likely affects the level of audience engagement. According to MST, it is the *fit* between media synchronicity and communication processes that ultimately affects the communication outcomes (Dennis et al., 2008). That is, the association between symbol sets and audience engagement may change with different task characteristics. In addition, we expect that a category-based analysis will show which types of contents are most successful when they include the added symbol sets.

H3: The fit between symbol sets and task characteristics is associated with audience engagement.

MST predicts that media with lower synchronicity help achieve better communication performance for conveying information, while media with higher synchronicity are more suitable for convergence on shared understanding (Dennis et al., 2008). In this theory, natural symbol sets (e.g., visual cues) are more capable of supporting synchronicity than less natural cues (e.g., text) are. Therefore, we expect that convergence tasks (e.g., socialization and assistance seeking) will benefit more from visual cues, while text and URLs may be sufficient for information conveyance tasks:

H3.1a: Messages intended for gratifications of the audience's socialization needs are associated with more engagement when enclosing images.

H3.1b: Messages intended for gratifications of the audience's assistance needs are associated with more engagement when enclosing images.

H3.2a: Messages intended for gratifications of the audience's socialization needs are associated with less engagement when enclosing hyperlinks.

H3.2b: Messages intended for gratifications of the audience's assistance needs are associated with less engagement when enclosing hyperlinks.

H3.3a: Messages intended for gratifications of the audience's socialization needs are associated with less engagement when the message is long.

H3.3b: Messages intended for gratifications of the audience's assistance needs are associated with less engagement when the message is long.

The transmission velocity capability in MST deals with the speed a medium delivers a message to its audience. MST predicts that convergence tasks require faster communication speed and synchronicity than conveyance tasks do and thus will benefit from more natural cues. Although media transmission velocity is not equivalent to task time sensitivity, it signifies requirements for the speed of communication and message delivery. That is, urgent tasks will require a higher level of media synchronicity so as to reach the audience faster. We predict that visual cues, which support high synchronicity, will help generate more engagement when used for time-sensitive messages than for routine messages, while less natural cues such as URLs and long text will be less effective for time-sensitive tasks:

H3.4: Messages exhibiting high time sensitivity are associated with more engagement when enclosing images.

H3.5: Messages exhibiting high time sensitivity are associated with less engagement when enclosing hyperlinks.

H3.6: Messages exhibiting high time sensitivity are associated with less engagement when the message is long.

4 Data and Method

4.1 Data

Using the public APIs provided by Facebook, we extracted a data set containing three months of social media activities (May 1 through July 31, 2014) for five Massachusetts (US) police departments: Billerica, Burlington, Peabody, Waltham, and Wellesley. These police departments are located within a 30-mile radius

of each other and all are small communities in the suburbs of Boston. The five departments were selected based on the researchers' professional knowledge of town and agency demographics, to enhance the comparability of the analysis. In addition, our personal relationships provided us with the opportunity to interview their officers and personnel who managed their social media presence. Findings from the analysis of qualitative interview data are reported in a different paper (Williams et al., 2018). Table 1 reports basic sample statistics about each of the five towns including area, population, median income, median age, percent of residents of 25 years or older with bachelor's degree or higher, police department budget, and the number of Facebook friends at the time of data collection. Among these five towns, Wellesley is a smaller, wealthier community with a much larger proportion (83.7%) of college-educated residents.

Table 1. Community Demographics

Community	Area (sq. miles)	Population (2014)	Median income (2013)	Median age (2010)	College education (2010)	Police dept. budget (2012)	Facebook friends (2014)
Billerica	26.4	42,393	$91,882	40	23.4%	$6,994,575	609
Burlington	11.9	25,765	$95,191	42	47.3%	$6,561,398	1,469
Peabody	16.9	52,366	$64,553	45	29.1%	$9,161,116	977
Wellesley	10.5	29,412	$158,044	38	83.7%	$5,295,047	390
Waltham	13.6	62,756	$74,501	34	48.3%	$13,623,218	208

Our sample comprised 1,224 wall posts made via the five official police departments' Facebook accounts during the three-month period of the study. We also extracted the number of "likes", comments, and shares for each post. For Billerica, all messages on Facebook were reposts from Twitter, which has a 140-character limit on message length. For Burlington, 223 posts originated as tweets while the remaining posts were created directly on Facebook. For the other three police departments, none of the posts originated on Twitter. Some police departments allowed followers and friends to post on the account wall while others did not. However, because of how Facebook handles security, we were unable to get the wall posts of the individual friends.

In this and the following sections, we use the terms "post" and "message" interchangeably. In a similar manner, photos, images, and pictures also all refer to the visual cues contained in messages.

4.2 Method

Using an open coding approach, we performed a manual content analysis and identified 10 content categories from the messages posted by the five police departments:

- **Accident**: Information about a specific incident such as a vehicle accident or a personal injury that might need medical attention.
- **Announcement**: Posts containing general information, news, etc.
- **Crime**: Posts related to a specific criminal incident, seeking public assistance in solving a crime, or reporting updates or arrests related to a crime.
- **Event**: Information about a future activity often with a specific date and time, aiming to generate participation in the event.
- **Interaction**: Posts aimed at a specific individual or individuals rather than information f the general public or responses to posts from others.
- **Promotion**: Posts intended to present a positive image of the police.
- **Property/Pets**: Posts informing the public about lost and found items or pets, and pet care (e.g., hot car warnings).
- **Safety**: Warnings to the public about safety concerns such as fraud schemes, ways to protect home or children, and general safety tips.
- **Traffic**: Posts notifying the public either to avoid an area or that a prior traffic incident has cleared.
- **Weather**: Posts providing the public information about a weather event and needed preparations.

Coders assigned each post to a specific content category. Because these categories were not necessarily mutually exclusive, it was possible that the content of a message was related to more than one category. In this case, we assigned the message to the category that captured its most prominent content.

In addition, we grouped messages into the three needs gratification types: information, socialization, and assistance. The information type includes all messages

in the Accident, Announcement, Event, Safety, Traffic and Weather content categories, plus those Crime messages that report arrests and crime investigation progress. The socialization type consists of messages in the Interaction and Promotion content categories, as well as those Property/Pets messages that were intended to interact with the audience. The assistance type is a mixture of Property/Pets messages seeking information about lost and found pets and Crime messages calling the public for crime investigation tips and information leads. One of the authors of this paper performed the grouping of content categories into needs gratification types and the co-authors examined and agreed upon the results.

We also coded the time sensitivity level for each message manually as one of three levels: routine (e.g., "The Billerica Police Daily is out!"), moderate (e.g., "Catch basin cover stolen earlier today from Bridle & River. Thanks to the alert citizen that helped us arrest two."), or urgent (e.g., "Wire down 14 Elsie Av. Road is closed. Residents must access off Old Middlesex Turnpike.").

Two coders (graduate students majoring in information systems) independently categorized the messages, with the intercoder reliabilities for the content coding and time sensitivity coding of 0.86 and 0.81, respectively. In-depth discussion between the coders resolved inconsistent code assignments. In these coding tasks, the coders were completely unaware of the hypotheses and goals of this present study.

To assist in the understanding of the patterns discovered in the quantitative analysis, we conducted interviews with the police officers responsible for social media in the five police departments. We asked each interviewee a series of prespecified questions related to their department's social media policies and activities. More details can be found in another paper (Williams et al., 2018).

4.3 Variables

The communication outcome of audience engagement consists of three dimensions: intimacy, interaction, and influence. Recall that because the Facebook API does not provide data about how many clicks and page views each wall post has, we did not include the Involvement dimension of engagement in this study. The dependent variable Intimacy is operationalized by *number of likes*,[3] Interaction by *number of comments*, and Influence by *number of shares*. These measures operationalize engagement as audience-generated actions rather than by passive measures of views or impressions.

Our independent variables for symbol sets include *image* (if the message contains a picture/photograph), *hyperlink* (if the message contains a hyperlink) and *text message length* (the number of words in the message[4]). The independent variables for Task Characteristics are *needs gratifications* (coded into the three categories as noted above: Information, Socialization, and Assistance) and *time sensitivity* (coded in three levels: Routine, Moderate, and Urgent).

The control variables include the *police department* indicator and the *number of friends*[5] (in logarithm) of the police department's Facebook account. Because different police departments post messages on Facebook in different frequencies (e.g., Billerica posted on average 55 messages per week over the three-month period and Peabody just a little more than 4 messages per week), we also calculated *weekly post frequency* (the moving average of posts per week), to capture part of the variation in these police departments' posting behaviors. In addition, given that older posts have had a longer time to accumulate responses, the *number of days since posted* (the time interval between the posting date of a message and the last day of the data collection period) is also used as one of the control variables.

5 Analysis and Results

5.1 Descriptive Statistics

The descriptive statistics show that 39.1% of the posts contain images and 26% enclose hyperlinks. The mean message length is 17.7 words (S.D. = 28.1, Max = 410). On average, each post receives 5.38 likes (S.D. = 7.59, Max = 25), 1.09 comments (S.D. = 3.43, Max = 25), and 2.55 shares (S.D. = 19.95, Max = 495).

[3] Note that the "like" button may represent more affective responses than intimacy such as endorsement (Gerlitz & Helmond, 2013) and enjoyment (S-Y. Lee et al., 2016). Therefore, using *number of likes* to represent the intimacy dimension of engagement may not be free of methodological risks. Nonetheless, among all the social buttons available on Facebook, "like" is the closest representation of intimacy.

[4] We also analyzed the number of characters to measure *message length* with essentially the same results.

[5] Due to multicollinearity with the *number of friends*, we did not include the population of the town as a control variable.

Table 2. Sample Statistics Broken Down by Department

	Billerica	Burlington	Peabody	Waltham	Wellesley
# Messages	769 (62.7%)	231 (18.9%)	62 (5.1%)	57 (4.7%)	105 (8.6%)
# Messages with images	175 (22.8%)	126 (54.5%)	48 (77.4%)	48 (84.2%)	82 (78.1%)
# Messages with hyperlinks	172 (22.4%)	119 (51.5%)	6 (9.7%)	0 (0%)	21 (20.0%)
Average message length	12.03 (11.04)	20.14 (42.39)	35.94 (37.0)	42.19 (61.02)	29.28 (26.32)
Average # likes	3.72 (5.86)	2.25 (3.58)	11.76 (9.49)	20.61 (6.44)	12.12 (8.70)
Average # comments	1.02 (3.51)	0.30 (0.9)	1.76 (3.63)	5.74 (6.22)	1.06 (1.9)
Average # shares	1.31 (18.49)	0.24 (3.16)	12.44 (39.62)	21.05 (41.50)	0.74 (3.65)
# Friends	609	1,469	977	390	208

Table 2 reports the basic descriptive statistics of the sample broken down by the five police departments. The numbers in the parentheses in the *# Messages* row represent the percentages of posts over all posts in the sample. The following two rows list the numbers of posts (and percentages of posts over all posts by each police department) that include images or hyperlinks. The numbers in parentheses in other rows are standard deviations. Tables 3 and 4 report descriptive statistics of the sample for each needs gratification category and each task's time sensitivity, respectively.

To explore whether the symbol sets in a message make a difference for audience engagement, we compared the average number of likes (as well as comments and shares) between posts with and without images; and between posts with and without hyperlinks. Figure 2 shows the relationship of images (Figure 2a) and hyperlinks (Figure 2b) with respect to these dependent variables. It is clear from Figure 2a that the audience generally prefers to see images in the posts. Unlike images, hyperlinks are not necessarily "liked" by the audience, although they comment on and share posts with hyperlinks slightly more often than those without hyperlinks.

We also charted the effect of message length measured by the number of words in a post. Figure 3 indicates that for posts containing less than 100 words, the audience tends to like, comment on, and share shorter posts. For posts having more than 100 words, the engagement level increases as the messages get longer, but only up to a certain point, beyond which the numbers of likes, comments, and shares all drop. This seems to suggest that there is a curvilinear relationship between message length and audience engagement (Track Social, 2012). We performed a regression test and found that both the relationship between message length and the number of likes and the relationship between message length and the number of comments are indeed curvilinear ($p < 0.001$). However, the curvilinear relationship is not significant ($p > 0.05$) for the number of shares. Both Huang et al. (2016) and Michalska et al. (2016) report that short posts receive more likes and comments than longer ones, but neither found the curvilinear relationship we observe in our data.

We then looked at the impact of task characteristics on audience engagement. Figure 4 presents the effects of (a) needs gratifications, and (b) time sensitivity. Figure 4a clearly displays the drastic difference in the audience response to messages gratifying different needs. The most salient one is the extraordinarily high number of shares of messages calling for assistance from the public. In Figure 4b, the engagement exhibits a mixed pattern in responses to messages with different levels of time sensitivity.

Table 3. Sample Statistics Broken Down by Needs Gratification Categories.

Needs gratifications	# Msgs	# Msgs with images	# Msgs with links	Avg # likes	Avg # comments	Avg # shares
Information	946 (77.4%)	258 (27.3%)	237 (25.1%)	3.64 (5.73)	0.94 (3.38)	1.81 (13.47)
Socialization	264 (21.6%)	212 (80.3%)	79 (30%)	11.07 (9.85)	1.39 (3.29)	1.70 (7.20)
Assistance	14 (1%)	9 (69.2%)	2 (15.4)	15.69 (9.38)	6 (5.70)	73.38 (140.3)

Table 4. Sample Statistics Broken Down by Time Sensitivity.

Time sensitivity	# Msgs	# Msgs with images	# Msgs with links	Avg # likes	Avg # comments	Avg # shares
Urgent	586 (47.9%)	34 (5.8%)	27 (4.6%)	2.60 (4.63)	0.77 (2.80)	2.29 (23.28)
Moderate	188 (15.4%)	73 (38.8%)	56 (29.8%)	7.53 (8.40)	1.97 (5.05)	6.69 (28.35)
Routine	449 (36.7%)	372 (82.9%)	235 (52.3%)	7.87 (8.80)	1.04 (3.16)	0.97 (5.53)

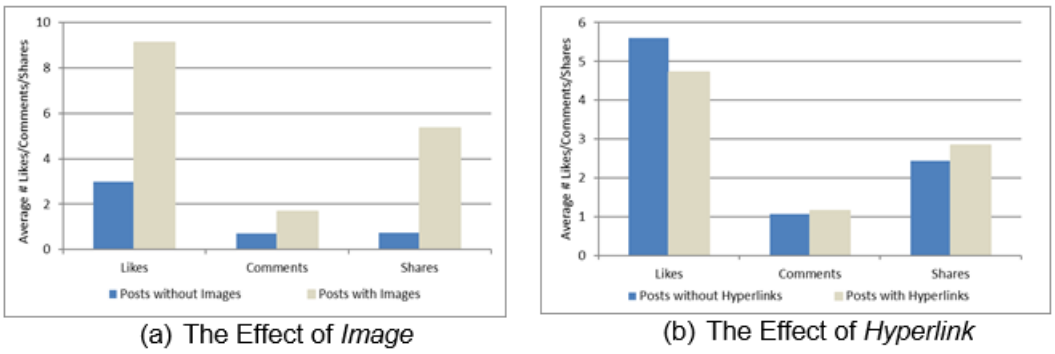

Figure 2. Average Number of Likes, Comments, and Shares Received by (a) Messages with (or Without) Images, and (b) with (or Without) Hyperlinks.

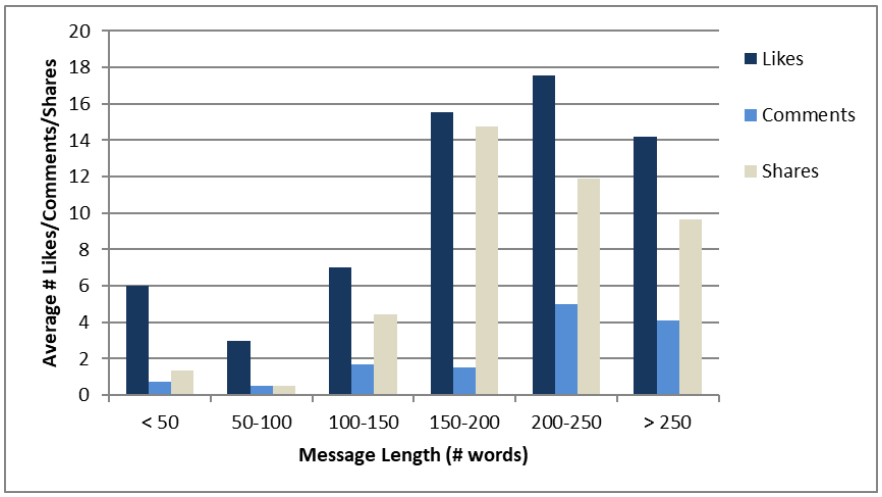

Figure 3. The Effect of Message Length (Number of Words)

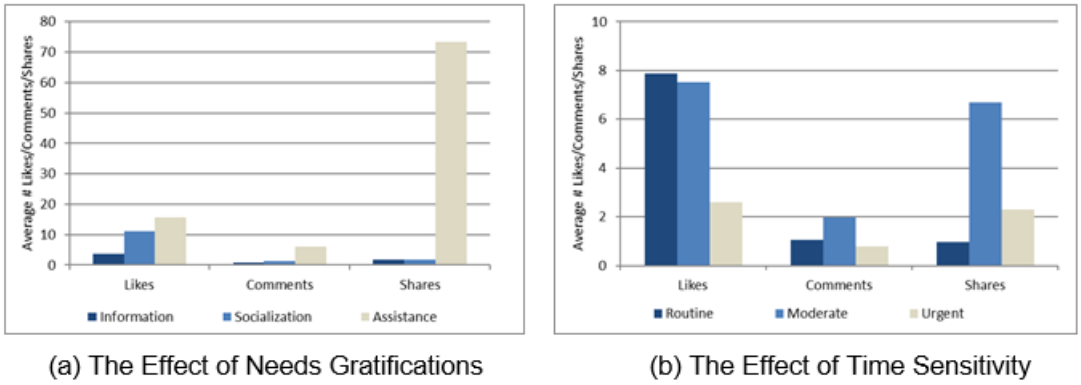

Figure 4. Average Number of Likes, Comments, and Shares Received by Messages (a) that Gratify Different Needs and (b) with Different Time Sensitivities.

5.2 Hypotheses Testing

To test our hypotheses, we performed hierarchical ordinary least squares regression. In the first stage, we included only symbol sets in the regression models. In the second stage, we added the independent variables for the task characteristics. Table 5 reports the (unstandardized) coefficients of the three information cue variables (image, hyperlink, and message length), two task characteristic variables (needs gratifications and time sensitivity), as well as the control variables from the two stages.

5.2.1 Effects of Symbol Sets

Table 5 shows that messages with images correlate significantly with more audience engagement in *intimacy* (like), *interaction* (comment), and *influence* (share) than those without images. Specifically, image posts receive, on average, 5.62 more likes, 0.81 more comments, and 5.28 more shares than text-only messages (see the Stage 2 columns). Thus, H1a is supported, confirming the association of visual cues with the targeted communication outcome. Findings reported by Lev-On and Steinfeld (2015), Hofmann et al. (2016) and Michalska et al. (2016) similarly confirm the importance of multimedia features in engagement, especially pictures and photos.

Hyperlinks have a mixed effect on the three dimensions of audience engagement. Unlike images, the inclusion of hyperlinks in posts significantly reduces the number of likes by 3.46. On the other hand, posts with hyperlinks get about 1.1 more comments than hyperlink-free messages. Hyperlinks have no significant impact on the number of shares. As a result, H1b is partially supported (only for the interaction dimension of engagement).

Table 5. Regression Analysis Results from Testing H1 and H2a

		# Likes (intimacy)		# Comments (interaction)		# Shares (influence)	
		Stage 1	**Stage 2**	**Stage 1**	**Stage 2**	**Stage 1**	**Stage 2**
Symbol sets	Image	7.10***	5.62***	0.48	0.81*	2.48	5.28*
	Hyperlink	-3.90***	-3.46***	0.75*	1.13**	1.14	2.22
	Message length	0.04***	0.03***	0.03***	0.03***	0.04	0.04
Task characteristics	Needs gratifications						
	Socialization		3.66***		1.00**		-1.91
	Assistance		3.92*		2.36**		62.32***
	Time sensitivity						
	Urgent		-1.02		1.30***		6.45**
	Moderate		2.41***		1.63***		5.92**
Control variables	# Days posted	-0.03***	-0.04***	-0.01**	-0.01***	-0.05*	-0.05*
	Weekly post freq.	0.13	0.11	0.02	0.01	0.34	0.23
	Log(# friends)	-10.69***	-8.50***	1.48	-0.76	-0.55	-3.72
	Police dept.[b]						
	Billerica		0.93		1.17**		-2.37
	Burlington	1.75		-1.80*		-0.58	
	Peabody	6.75***	4.72***	0.50	0.78	12.54*	13.29***
	Waltham	9.21***	9.15***	4.04***	4.25***	21.78***	12.16***
	R^2	0.47	0.50	0.19	0.22	0.07	0.20

Note: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

[a]Coefficients in the regression analysis results are not standardized.

[b]Because 81% of the messages were posted by Billerica (62.8%) and Burlington (18.9%) police departments, it caused a high correlation between the dummy variables representing the two police departments (0.63). One of the two dummies thus was automatically dropped from the regression by the statistic software (IBM SPSS).

Message length is positively related to the numbers of likes and comments, but not to the number of shares. For each additional word, a message receives 0.04 more likes and 0.03 more comments. H1c is partially supported (for the intimacy and interaction dimensions but not for the influence dimension).

Overall, H1 is partially supported: while visual cues tend to generate more audience engagement in all three dimensions, hyperlinks increase the likelihood of interaction but discourage intimacy and have no impact on influence. Longer messages with more information generally stimulate more user interaction and intimacy, but not more influence. However, Figure 2 also suggests that this result may not always be true. That is, for short messages with less than 50 words, the audience prefers shorter messages, and there seems to be a curvilinear relationship between message length and audience engagement for posts having 50 or more words. This is consistent with Huang et al. (2016) who likewise found that "pull" tweets (requests for assistance) received more shares and comments than other posts from the municipal police departments they studied.

5.2.2 Effects of Task Characteristics

It is obvious from Table 5 that task characteristics also can influence audience engagement. Above and beyond the public's basic needs for seeking information from police departments (information conveyance), the posts fulfilling the audience's social

motivations generate 3.66 more likes and 1.0 more comments, but not necessarily more shares. Therefore, H2a is partially supported. This means that social media communication gratifying the public's socialization needs and fostering healthy public relations can successfully attract the attention of the audience and enhance their intimacy and interaction behaviors.

Moreover, messages offering opportunities for the public to provide assistance receive 3.92 more likes, 2.36 more comments, and 62.32 more shares. H2b is fully supported. The public is motivated to seek involvement in policing events and to help law enforcement agencies. They express positive opinions toward these types of offers (with likes), interact with and give feedback to the agencies (with comments), and influence their community by forwarding the messages to their personal networks and spreading the word (more shares).

Turning to the time sensitivity analysis, for which routine messages were used as the reference level, we see that urgent posts receive 1.3 more comments and are shared 6.45 more times than routine messages. H2c is partially supported. Although the effect of size on likes is not significant, the direction of this effect shows an interesting pattern: the audience does not "like" urgent events. This makes sense as urgent messages originating from police departments often concern unfavorable events such as accidents and crimes, which naturally arouse negative sentiments.

The results in Table 5 provide full support for H2d as all the coefficients, compared with those of routine messages, are positive and significant for messages that are moderately time sensitive. Overall, H2 is partially supported.

To further investigate the impact of task characteristics, we unpacked the needs gratification factor back into the 10 content categories. Surprisingly, except for a few categories (Accident, Announcement, Traffic, Property/Pets), most categories had no significant effect on audience engagement (Weather was used as the reference category). We report the coefficients of these significant categories in Table 6. The public especially "dislikes" unfavorable events such as accidents and traffic problems. This could have been caused by the specific design of the "like" button on Facebook. At the time of our data collection, since users did not yet have the option to flag emotions (e.g., sad, sympathy, anger, etc.) other than liking, it would have been inappropriate to "like" an accident or traffic jam. However, the audience did express positive sentiments toward, comment on, and share posts about property and pets. It is also interesting to see that although the public does not necessarily express positive sentiments toward announcements, they do share this information within their own networks. This finding also supports the study of the three audience engagement categories, as there are few significant effects and no discernable patterns when only subject matter is examined.

Table 6. The Effects of Content Category (Only Showing Significant Results)

	# Likes (Intimacy)	# Comments (Interaction)	# Shares (Influence)
Accident	-5.21**		
Announcement			14.83*
Traffic	-4.67**		
Property/Pets	4.12*	3.95**	57.73***

*Note: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$*

5.2.3 Effects of Symbol-Task Fit

In the next stage, we added variable interaction terms into the models. These results can be found in Table 7. The main effects of the independent variables and control variables are not included in Table 7 for succinctness of presentation. Results in Table 7 paint a less straightforward picture regarding the interaction between symbol sets and task characteristics. For the intimacy dimension, the public prefers messages satisfying their socialization needs to include images but not hyperlinks. In posts calling for assistance, they do not like to see pictures and also prefer such messages to be shorter. For urgent posts, the pattern seems to be "the more information the better"; that is, images and message length are both positively related to intimacy. Although the presence of hyperlinks in urgent posts does not significantly increase with respect to intimacy, moderately time-sensitive posts with hyperlinks receive, on average, 5.34 more likes than those without hyperlinks. Thus, in this engagement dimension, only H3.1a, H3.2a, H3.3b, and H3.4 are supported.

Looking at interaction (commenting) behavior, image and task characteristics do not appear to moderate each

other's effects. Hyperlinks or longer posts reduce the chance for assistance gratification posts to receive more comments. On the other hand, hyperlinks help generate more comments and audience interaction for time-sensitive tasks. While more words help attract comments for socialization gratifications or urgent messages, they lead to fewer comments for assistance gratifications or moderate urgency posts. Therefore, in this dimension, only H3.2b and H3.3b are supported.

As shown in Table 5, assistance gratification posts are most likely to be shared, and the significance level is higher if the post contains images or hyperlinks. However, as the post for this need gets longer, it becomes less likely to be shared. Moreover, urgent posts with images tend to be shared more often, but hyperlinks do the opposite. In this dimension, H3.1b, H3.3b, H3.4, H3.5 are strongly supported.

Although not all the coefficients are significant, Table 7 provides some evidence for the interactions between symbol sets and task characteristics. To summarize, H3 is partially supported.

Table 7. Effects of the Fit Between *Symbol Sets* and *Task Characteristics*.

	# Likes (intimacy)	# Comments (interaction)	# Shares (influence)
Image x Gratifications			
x Socialization	3.91*	0.94	-1.85
x Assistance	-8.21*	5.13	123.64***
Hyperlink x Gratifications			
x Socialization	-5.42***	0.22	0.98
x Assistance	-5.13	-11.50***	157.12***
Length x Gratifications			
x Socialization	-0.01	0.02*	-0.01
x Assistance	-0.20**	-0.14***	-2.01***
Image x Time sensitivity			
x Urgent	5.52*	1.91	25.15**
x Moderate	-1.57	-0.27	-1.17
Hyperlink x Time sensitivity			
x Urgent	4.20	4.35**	-19.09*
x Moderate	5.34**	2.60**	9.55
Length x Time sensitivity			
x Urgent	0.15***	0.08***	0.20
x Moderate	0.01	-0.02**	0.07
R^2	0.56	0.27	0.35

Note: ** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

We also examined the interactions between symbol sets and the four significant content categories in Table 6. We summarize the results as follows:

- The multiplicity of symbol sets makes no difference for all three dimensions of audience engagement for messages reporting accidents, except that the presence of images is associated with a higher number of comments by 6.1.
- For announcement messages, the inclusion of images is associated with lower levels of intimacy (4.14 fewer likes) and interaction (2.4 fewer comments) but with a higher level of influence as measured by the number of shares (11.3 more shares). On the other hand, hyperlinks and longer text passages are associated with a lower number of shares. That is, for messages making an announcement, people prefer plain text over images and do not share an announcement post if it is long or has hyperlinks.
- Images do not matter for traffic-related messages, but hyperlinks are associated with positive sentiment and higher interaction levels (5.74 more likes and 3.74 more comments). Each additional word in a traffic post is associated with 0.03 more comments but 0.1 fewer shares.
- The interaction between Property/Pets and images is also significant. Note that this effect is negative, indicating that images are not useful in enhancing intimacy for this type of message. However, people do tend to make comments on and share messages containing pictures of lost-and-found items and pets (6.89 more comments and 200.63 more shares). Hyperlinks generate

7.45 more likes but are associated with a significant reduction in the number of shares by 174.31. Except for associating with a slight increase in the number of likes (0.34), longer messages do not help with audience engagement in the interaction and influence dimensions.

5.2.4 Effects of Control Variables

The control variables vary in their influence on the dependent variables (see Table 5). Interestingly, the *number of friends* a police department has on Facebook is negatively associated with audience engagement. In other words, the more friends a police department has, the less likely people will be to click on the "like" button, make comments, or share the messages posted by the police department. This could be due to the social loafing effect (Karau and Williams 1993), in which people expect others to respond to the posts when there are a large number of friends subscribed to an account.

The *weekly post frequency* does not affect the numbers of likes, comments, and shares, although the five police departments have drastically different posting patterns. The variation in posting patterns is partially captured by the *police department* indicator. Peabody and Waltham police departments performed significantly better than the Wellesley Police Department (the reference department) in terms of getting responses for their posts, even though these two departments posted significantly fewer messages over the three-month period (62 and 57 posts, respectively). Billerica and Burlington police departments got more likes or comments per post than the other three police departments, but their posts were shared less often. Note that among the five police departments, Billerica was the most active department in terms of social media presence and posted many messages on Facebook (769 in total). However, this did not necessarily lead to more audience engagement. Because all Facebook messages created by the Billerica Police Department were direct reposts from Twitter, which has a restriction on the number of characters in a message, the information presented in each individual message, at the microlevel, may have been perceived as less rich and useful by people, especially since they may have already been aware of the content through Twitter. In addition, the frequent "flood" of messages might also have reduced its chance of getting positive feedback from its audience. The sheer number of messages and frequent updates may have caused an "information overload" problem at the macrolevel (Hiltz & Plotnick, 2013), which diluted the audience's attention to the content of individual messages and its propensity to respond.

Although older posts have a longer time to accumulate responses, the *number of days since posted* actually exhibits a negative effect on the number of likes. It appears that as time progresses and older messages become less relevant, people do not flip back to previous Facebook pages to read old posts. This would be consistent with the reaction-time finding of J. Lee et al. (2015).

5.3 Summary of Results

Table 8 summarizes the results from the hypotheses testing. Although the three hypotheses are only partially supported, the overall pattern is quite clear and interesting. Our findings can be summarized as follows. First, the audience is generally more engaged in social media messages with more information. Overall, posts garner more responses when accompanied by more symbol sets; and to a certain extent, more textual content is preferred to less. However, it is interesting to note that response behavior displays varying patterns among the three audience engagement dimensions. The audience tends to "like" images but not necessarily hyperlinks. They prefer to comment on posts with more information (visual cues, hyperlinks, and longer posts) and posts containing certain content (e.g., Property/Pets). Although they often share posts with pictures among their friends and networks, they do not always share posts with hyperlinks, and are more likely to "like" shorter posts (i.e., those with less than 50 words).

Second, gratifications of the audience's socialization and assistance needs are positively related to *intimacy* and *interaction* aspects of engagement outcomes. In the third aspect, *influence*, people are inclined to share assistance gratification posts but not those meant for socialization. This supports the expectation based on UGT that different media characteristics appeal to different audience needs, prompting the recipient to respond (or not) appropriately.

Third, compared with routine tasks, time-sensitive messages lead to higher levels of engagement. That is, emergency or other public safety incidents lead to higher response levels on the part of the audience, a finding that aligns well with community-policing doctrine and other emergency management findings (Brooks et al., 2013). However, people tend not to "like" urgent posts concerning unfavorable events such as accidents and traffic. With the introduction of Facebook's newer reaction options (e.g., sad, angry), it will be interesting to dissect whether this "liking" behavior is a function of actual post contents or the favorable implication of the medium's singular reaction choice.

Table 8. Summary of Hypotheses Testing Results.

Hypotheses	Independent variables	Intimacy (like)	Interaction (comment)	Influence (share)
H1a	Image	+	+	+
H1b	Hyperlink	-	+	
H1c	Message length	+	+	
H2a	Needs: Socialization	+	+	
H2b	Needs: Assistance	+	+	+
H2c	Time: Urgent		+	+
H2d	Time: Moderate	+	+	+
H3.1a	Image x Socialization	+		
H3.1b	Image x Assistance seeking	-		+
H3.2a	Hyperlink x Socialization	-		
H3.2b	Hyperlink x Assistance seeking		-	+
H3.3a	Length x Socialization			
H3.3b	Length x Assistance seeking	-	-	-
H3.4	Image x Time sensitiveness	+		+
H3.5	Hyperlink x Time sensitiveness		+	-
H3.6	Length x Time sensitiveness		+	

Note: +: significant positive effect; -: significant negative effect.

We also found that symbol sets and task characteristics do interact with each other, the fit between the two affects the communication outcomes to some extent, providing partial support for the predictions of MST. Interestingly, we found that contrary to the common expectation of the role of image, the audience does not like certain types of contents (e.g., announcement) to include pictures in the posts.

Our interviews with the five police departments supplement our findings from the quantitative analysis. With the increasing demand for community policing, law enforcement agencies have been using social media as an outreach tool to disseminate timely, accurate information to as many people as possible. The Billerica interviewee explained that "the public shouldn't rely on the media; they [the police] want to speak for themselves and to counter misinformation; the media often only report bad news or conflict". More importantly, the police departments hope to leverage social media to build a trusting relationship with the community. The media relations specialist we interviewed from the Peabody Police Department expressed this motivation explicitly in his comment: "Social media is a means to communicate with the community and facilitates their talking back". Therefore, a police department's goal is not merely to attract more followers and friends on social media, but also to make sure the public is watching, listening, and responding.

The metrics of likes, comments, and shares reflect the extent to which the public is engaged in the police-initiated communication. For example, our results show that people often tend to comment on and share urgent or assistance-seeking messages. We extracted a few such posts to find out what people talked about in their comments. One of the posts reported a search for a missing person in a canoe accident in a lake. The post received 25 comments and 63 shares. In addition to offering condolences and prayers for the person and his/her family in the comments, people also discussed how dangerous the lake was and what the city should do to prevent similar accidents from happening in the

future. Interestingly, our data show that police departments also often interacted with the audience by responding to their comments and answering questions.

5.4 Comparing with Other Studies Across Contexts

We drew from the literature a few example studies whose contexts range from law enforcement (Van De Velde et al., 2015), to local government agencies (Bonsón, Royo, & Ratkai, 2015), [6] to nonprofit organizations (Strekalova & Krieger, 2017), to consumer communities (Dessart et al., 2015).

The study by van de Velde et al. (2015) analyzed the patterns of retweets of police messages on Twitter. Retweeting can be seen as a type of sharing and influence behavior of audience engagement. Information cues such as URLs, hashtags, and mentions are included as the major explanatory variables. They found that the most frequently retweeted messages are crime and incident reports (informational), followed by small talk (socialization), and "witness wanted" (assistance seeking) messages, and that the inclusion of URLs and hashtags increases the likelihood of message diffusion. These findings are slightly different from ours, which indicate that assistance-seeking posts are most frequently shared, and that posts with hyperlinks are less likely to be shared. Although the study by Van de Velde et al. (2015) is also in the law enforcement domain, its specific research context is quite different than that of our research in terms of platforms (Twitter vs. Facebook), account types (police officers' individual accounts vs. police department's official organization accounts), cultures (Dutch vs. American), and sample sizes. These various contextual factors may have contributed to differences between that study's findings and our findings. More importantly, while that study's focus is only on the prediction of message diffusion (the influence dimension of engagement), our research's objective is to propose an MST-based model that may be used to examine social media communication and additional dimensions of audience engagement (e.g., intimacy and interaction) in the context of community policing, providing additional insights into the relationship between media synchronicity and communication performance.

Bonsón et al. (2015) examined social media practices by local government agencies in European countries. They analyzed information cues including hyperlinks, photos, text, and videos and coded messages into 16 content categories (e.g., environment, public transportation). Most of these posts were informational in nature and not intended for socializing or requesting assistance from citizens—and, generally, promotional and announcement-type posts are unlikely to inspire interaction from users. Nevertheless, this study also found that photos are more successful at engaging citizens than text, URLs, and videos.

Strekalova and Krieger (2015) sought to find the best practices of social media use by public health organizations (e.g., the National Cancer Institute). Given that the main goal of such organizations is to disseminate information through social media, the study focused on how message characteristics affect audience engagement. Similar to our findings, they found that Facebook messages with images received significantly more likes, comments, and shares than videos, hyperlinks, and status updates.

Dessart et al. (2015) examined consumer communities in the commercial context. This study did not analyze the effect of information cues but instead focused on the identification of drivers of consumer engagement in their social media interactions with other consumers. These drivers include information, socialization, entertainment, and monetary incentives. The authors maintain that these drivers have different impacts on the three dimensions of engagement they propose in this study: affective, cognitive, and behavioral.

Table 9 provides a summary of comparison between the findings from our research and from other studies in different contexts. These comparisons show that our study is more inclusive in terms of the variables tested as well as those identified in extant research. Moreover, while several of our findings corroborate previous work, they also reveal some differences that suggest the benefits of using broader, theoretically grounded framing and nuanced data analysis.

[6] We compare our research with studies on other government organizations because law enforcement agencies are different from other government organizations (e.g., Department of Commerce, Food and Drug Administration), as they are empowered to maintain laws and fight crimes using force. Several crises and conflicts that occurred in recent years have caused the police-public relation to deteriorate in many places in the country. As a result, relation-building and public- image management have become more pressing needs for law enforcement agencies than for other governmental organizations.

Table 9. Comparing Our Research with Other Studies in Different Contexts.

		(1) This study	(2) Law enforcement	(3) Local government	(4) Nonprofit organization	(5) Consumer community
Symbol sets	Images	+		+	+	
	Hyperlinks	+/-	+	-	-	
	Text length	+	+			
	Videos			-	-	
Task characteristics	Information	I.D.	I.D.	I.D.	I.D.	I.D.
	Socialization	+	I.D.			I.D.
	Assistance	+	I.D.			
	Entertainment					I.D.
Engagement	Involvement					I.D.
	Intimacy	D.V.		D.V.	D.V.	I.D.
	Interaction	D.V.		D.V.	D.V.	I.D.
	Influence	D.V.	D.V.	D.V.	D.V.	I.D.

Note: + Positive effect; - Negative effect;
I.D.: Identified as a contextual factor but not tested;
D.V.: Used as a dependent variable.
(2): (Van De Velde et al., 2015); (3): (Bonsón et al., 2015); (4): (Strekalova & Krieger, 2017); (5): (Dessart et al., 2015)

6 Discussion

This research focuses on audience engagement in social media communication between police and the public. Based on MST and UGT, we develop a research model regarding the effects of symbol sets (text, hyperlink, and image), audience needs (information, socialization, and assistance), and the fit between these two groups of factors on social media engagement. Our research findings have important implications for both theory and practice. We do want to point out a caveat that all the relationships in the research model are associations rather than causal ones.

6.1 Implications for Theory

6.1.1 Support for and Extensions of Theory

One of the important ways that our study differs from prior work on social media use by police departments is that we used theories to explain and analyze the phenomenon under study. Rather than simply reporting descriptive statistics of various characteristics of police-public social media communication (Huang et al., 2016; Kim et al., 2017; Schneider, 2016; Van De Velde et al., 2015), we employ MST and UGT to develop and contextualize a research model for audience engagement. Our findings offer several insights into media-choice theories as applied within a relatively new form of communication—social media.

First, our findings provide support for MST regarding the roles of symbol sets: the number and variety of information cues contained in a message do have an impact on the communication outcome of audience engagement. In particular, images are associated with significantly more audience engagement in all three engagement dimensions: intimacy, interaction, and influence. Compared with text-only posts, the presence of visual cues in a message increases the amount of information conveyed. Furthermore, as the theory predicts, communication with more information can help clarify ambiguous issues, facilitate understanding in a timely manner, and reduce communication equivocality.

Second, we extend the media synchronicity framework by examining the impact of other factors, such as hyperlinks, and examining both the sender and the recipient's task goals, per UGT. Other than studies focusing on website design (e.g., Palmer and Griffith, 1998), the role of hyperlinks in supporting information conveyance in communications on social media is

understudied. We found that although hyperlinks are associated with more comments, they do not help promote the audience's intimacy and influence behaviors. This is not totally unexpected because although a hyperlink makes additional information available, it usually requires the reader to click on the link to navigate away to an external website. As followers may not necessarily have the time or motivation to read more material, the inclusion of hyperlinks may not necessarily encourage the intended audience engagement.

We investigated the effect of message length, which may impact the time and effort to encode and decode a message, on the communication outcome of audience engagement. Our statistical test results about the relationship between message length and engagement (along the intimacy and interaction dimensions) indicate that the relationship is a curvilinear one. That is, the audience prefers longer messages only to a certain point, beyond which the engagement decreases. In this situation, more is not always better.

Additionally, unlike traditional media choice research which typically uses media type as the unit of analysis, our research delves into the finer level of analysis to examine individual messages. We not only focus on symbol sets but also consider the task's time sensitivity and the purposes of the messages. Our findings provide evidence that task characteristics can impact communication outcomes and suggest that to maximize audience engagement, the message's symbol sets should be aligned with the task's goals and time sensitivity, justifying the addition of UGT to the underlying MST framework.

Third, our research adds new insights to the uses and gratifications literature, separately examining users' informational, socialization, and assistance needs. Based on the 4-I model, we did not treat audience engagement as an atomic construct but unpacked it into several dimensions. We used three of the four outcome categories identified by the 4-I model (intimacy, interaction, and influence) to assess the ability of social media messages to elicit a range of responses. Intimacy (liking) and interaction (commenting) are distinct kinds of engagement: the former mainly engages affect while the latter engages cognition, at least in the sense that it takes longer to compose an appropriate response. Our findings extend this distinction: influence (sharing) patterns are quite different from those of both liking and commenting. Intimacy and interaction are both evident in significant proportions in reaction to socialization and assistance messages. However, influence (i.e., sharing) is not manifested for socialization messages, but is highly significant when the message concerns assistance. This speaks to the need to delve deeper into matching the intent of a message with the audience reaction most likely to achieve the desired engagement. This also suggests that audience engagement should be examined at a finer granularity level where various types of behavioral indicators can provide more insights into the process and outcomes of social media communication.

6.1.2 Contextualization of Theory

Our research contributes to the literature by providing a contextualized model about the factors affecting social media engagement. Our research shows that the design of communication messages is not only dependent on the medium (or message) itself, but also on the expectations of recipients and time sensitivity of tasks; and the audience may engage in the communication in different ways in different situations. The research model allows us to use MST to explain and predict audience engagement behaviors on social media. Additionally, the use of UGT helps identify factors that are relevant in the specific context of community policing. Prior studies on motivations of social media use suggest that social media generally fulfill several user needs, including information, socialization, entertainment, passing time, and mood management (Bumgarner, 2007; Chen, 2011; Johnson, 2014; Quan-Haase & Young, 2010; Shao, 2009). In this research, we contextualize our research model by removing domain irrelevant needs—such as entertainment and mood management—and identifying offering assistance as an additional need in the community-policing context. Furthermore, we used UGT to contextualize the communication tasks so as to derive the effects of symbol sets for different types of tasks (information conveyance vs. meaning convergence).

More importantly, the use of the contextualization approach makes it possible to compare findings in social media communication and engagement studies across contexts and domains. Here we demonstrate how the characteristics of the communication tasks and the engagement behaviors may vary, and consequently, how the findings may be different in different situations (see Section 5.6).

6.2 Implications for Practice

Our research has several important implications for practice. The findings suggest that to increase public engagement police departments need to decide not only *what* they write about on social media but also *how* they write about it.

First, our research shows that the public generally welcomes and prefers more information in social media communication. This implies that police departments should continue to use social media as an information dissemination tool. However, the selection of symbol sets needs to be strategic when designing social media messages. For example, like the old saying, "a picture is worth a thousand words", including images can enhance engagement in all three

dimensions in most cases. However, this may not hold true for some types of messages (e.g., announcements). Also, since hyperlinks are less natural, inserting them into a message may not be a good idea—except for to gather comments from the public. Further, if time and resources permit, posting longer messages is generally an effective way of attracting more attention and responses from the public. However, messages longer than 250 words may not necessarily engage the audience. Shorter messages are especially important for assistance-seeking posts. Thus, choice of message content and symbol sets should be based on whether the organization seeks to encourage intimacy, interaction, or influence.

Second, our findings suggest that meaning convergence communication is more effective in engaging the audience in certain conditions. This implies that, in addition to disseminating information, police departments should use social media to offer more opportunities for the public to actively participate in activities and programs related to community policing (e.g., community outreach initiatives, channels for soliciting crime investigation tips, assistance with emergency events, etc.). Moreover, although our analysis cannot provide quantitative evidence for the importance of two-way communication, we believe it is important for police departments to also respond to the comments of the audience, thereby further enhancing engagement and building a trusting relationship with the community.

Third, our results regarding the fit between symbol sets and task characteristics offer specific recommendations for message-design strategies. We suggest that to maximize the outcome of social media communication, police departments ought to take task goals into consideration when using any information cues in their posts. For instance, for posts aiming to enhance the intimacy dimension of engagement used mainly for socialization purposes, we recommend including images, but not hyperlinks. The audience especially welcomes pictures in posts related to certain topics (e.g., lost-and-found and pets). If the goal is to encourage interaction and comments, it is generally beneficial to use images, hyperlinks, and longer text in informational posts. However, hyperlinks and long texts should generally be avoided for assistance-seeking messages. Furthermore, if the police department hopes to reach a broader audience to disseminate information—especially about urgent events—including images will increase the number of shares. Again, URLs are not recommended for this type of message. In terms of content categories, we recommend including URLs and texts, but not images, for announcements to be shared with and reach as many people in the audience as possible. In addition, images are not critical for traffic-related posts, but hyperlinks may encourage more discussion by the audience.

Our findings regarding our control variables offer additional insights into social media use by police departments. Police departments face challenges finding appropriate measures for evaluating the impact of their social media outreach initiatives and practices. Since a common goal of individuals using social media is to build and maintain relationships with their communities, the size of the police department's friend circle would seem to be a ready criterion. However, our findings suggest that having a large number of friends may impede engagement: the frequency of likes and comments actually diminish. This could signify that many of a police department's friends consist of casual observers rather than an actively engaged public: smaller networks may be more effective at promoting engagement or attracting a core of self-selected activists. If the number of friends is the only performance measure police departments track, they could misjudge the impact of their social media outreach activities. A similar caution arises from our finding that frequency of posting is not significantly correlated with likes or comments. Greater message frequency does not lead to greater engagement. This should be good news to departments that are strapped for staff and time to support their social media outreach.

Finally, our results indicate that police departments vary significantly in the degree to which they generate likes and comments, other factors being equal. The reasons will be important to investigate in future research. Given that Billerica's Facebook posts and tweets are redundant, do their audiences overlap—such that Twitter turns out to be the preferred platform on which these readers post their responses? If not, the positive (Peabody, Waltham) and negative (Billerica, Burlington) responsiveness coefficients for the respective departments look more to be a case of "less is more". The findings for these attributes of the police department's engagement (*number of friends* and *post frequency*) stand in contrast to those depicting the media richness of the messages themselves (*images* and *message length*), where more is more.

6.3 Limitations and Future Research

Taken together, our findings and the limitations of this study raise several questions that require further investigation. Our data set encompasses the police social media activity across one platform, Facebook, for five relatively small communities in a single US state over a period of just three months. More and larger samples are needed to generalize from our findings to the population of law enforcement agencies and to other kinds of government agencies that would allow additional comparison with private-sector media choice research.

Our engagement measures are limited to likes, comments and shares; it would be useful to extend

these to Facebook's newer reaction options or, in the case of Twitter, retweets. Since Facebook extended the "like" feature with more expressive reaction options (e.g., love, sad, angry) after the sample was collected, a comparative study using a more recent sample would be able to generate finer results on how people's responses vary with communication contents and contexts.

Unfortunately, since the count of views and reading time was not directly accessible from the Facebook's API (in contrast to the number of likes, comments and shares, which were accessible) at the time of our data collection, we could not test the impact of our independent variables on the *involvement* aspect of engagement. Analysis of involvement data would widen the scope of understanding to those who read but do not react to posts and could also indicate which posts receive the most attention.

Another limitation of the current study is that we did not perform content analysis on the large number of comments made by the audience. More details and insights could be discovered about this dimension of engagement if comments were analyzed not only at the message level but also at the event level (e.g., a crime investigation that lasts for several weeks or months).

Just as likes, comments, and shares are influenced by gratification and content category, police evaluation of the success of their social media posts and outreach more generally may depend on the purpose. Does a message seek to prevent or solve a crime, to better protect people and property, to encourage support or event attendance? Comments are more relevant to the first two areas, likes to the next, and shares to the last. Attempting to directly tie social media activity to a policing outcome such as crime resolution is a very complex challenge that falls well beyond the scope of this type of analysis.

Our future research will pursue several directions. As mentioned earlier, because we find that message context matters, further content analysis of the messages themselves could be fruitful. Other dimensions of message content may also affect communication outcomes. For example, messages with different sentiments (e.g., happy vs. sad) and in different styles (e.g., humorous vs. monotonic) may very likely lead to drastically different reactions. Similarly, it would be interesting to study the patterns of responses. Are readers' posts merely affective (sentiment) or substantive, in the sense of providing new and or useful information?

It would also be interesting to distinguish between different types of audience (e.g., individual vs. organizational, local vs. distant) and to examine if organizational followers and fans of a police department respond differently than individuals to the social media communication by the agency.

Facebook has evolved, and its uses have also matured. Our symbol set indicators, pictures, hyperlinks, and message length should be extended to include sound, video and live video. We also need to determine whether the social media platform matters and if media synchronicity has a different meaning in this environment, as compared to the traditional media context in which the theory developed. Finally, we seek to examine secondary impacts that occur when the public reshares or initiates posts about policing activity and public safety events. These are likely to trigger a different pattern of recipient reaction and gratification-seeking outcomes.

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Appendix

Table A1. Summary of Studies Based on MST.

Study	Subjects	Context	Major findings
(Dennis et al. 1999)	100 college students	Group decision-making	Communication effectiveness is influenced by matching the media capabilities to the requirements of the fundamental communication processes, not aggregate collections of these processes (i.e., tasks).
(Niinimäki et al., 2012)	79 software engineers	Global software development	To achieve intended communication outcomes, the symbol sets selected (e.g., text instead of verbal cues) must match the task requirements (e.g., conveyance of program source code).
(Tang, Wang, & Norman, 2013)	274 college students	Virtual meeting for group communication	Certain media capabilities and extraversion have a positive impact on whether individuals feel connected to others in online communities.
(Mano, 2014)	1406 Internet users	Online health information services	Among all social media only those that offer consulting have a significant effect on the likelihood of using online health services.
(Herijgers & Maat, 2015)	N/A	Multichannel communication for mortgage information	When applied to a mortgage communication package for consumers, the evaluation reveals significant problems concerning the contents and timing of mortgage information and the channels chosen to convey it.
(Shen, Lyytinen, & Yoo, 2015)	N/A	Teams	The research provides a comprehensive review of what is known about time in IT-mediated teams.
(M. J. Park, Chio, & Rho, 2016)	491 Korean citizens	e-Government services	This study emphasizes the importance of appropriate understanding of the media characteristics of social media in order to increase citizen satisfaction with government social media services.
(Wang, Pauleen, & Zhang, 2016)	5 senior managers of SMEs	B2B communication	The findings confirm the media capabilities of social media apps as explained by MST.

Table A2. Summary of Social Media Studies Based on UGT.

Study	Subjects	Platforms	Major Findings
(Bumgarner, 2007)	1049 college students	Facebook	Social media is used by college students primarily as a social activity. Facebook appears to operate as a tool for the facilitation of gossip.
(Joinson, 2008)	378 college students	Facebook	The different uses and gratifications relate differently to patterns of usage. Social connection gratifications lead to increased frequency of use; content gratifications increase time spent on the site.
(Raacke & Bonds-Raacke, 2008)	116 college students	Facebook & MySpace	Major motives of college students to use social media are keeping in touch with friends, information-seeking and sharing.
(Johnson & Yang, 2009)	242 Internet users	Twitter	Users seek both information and socialization, but Twitter's facilitation of communication and connections provide the most satisfaction. Only information needs predict frequency of use.
(N. Park, Kee, & Valenzuela, 2009)	1715 college students	Facebook	Four primary needs for participating in Facebook Groups are socializing, entertainment, self-status seeking, and information. Informational uses are correlate with users' civic and political participation.
(Urista, Dong, & Day, 2009)	50 college students	Facebook & MySpace	Young adults use social networking sites to fulfill their needs and wants, including efficient and convenient communication, curiosity about others, popularity, and relationship formation and reinforcement.
(Vorvoreanu, 2009)	88 college students	Facebook	Facebook used by college students is mainly for socialization/affection seeking. Business presence is not welcomed unless relationship cultivation strategies and dialogue gratify students' wants and needs.

Table A2. Summary of Social Media Studies Based on UGT.

(Quan-Haase & Young, 2010)	98 college students	Facebook & instant message (IM)	Key motivations for joining Facebook are peer pressure, social connectivity, and curiosity. Use of Facebook gratifies entertainment and social information, while use of IM gratifies intimacy and the development of close ties.
(Chen, 2011)	317 users	Twitter	Active engagement and high frequency of Twitter use gratifies users' connection need.
(Cheung et al., 2011)	182 college students	Facebook	Social connection, approval and entertainment motivate use.
(Smock et al., 2011)	267 college students	Facebook	Motives for general use differ from those motivating features use.
(Ku, Chu, & Tseng, 2013)	449 Internet users	Social network site (SNS), IM & email	Four gratifications are common to all ICT technology use (relationship maintenance, information-seeking, amusement, and style), but other motivators are platform specific.
(Pai & Arnott 2013)	24 users (20-40 years old)	Facebook, bulletin boards & blogs	Belonging, hedonism, self-esteem, and reciprocity are users' four main motivators for SNS adoption.
(Whiting & Williams 2013)	25 Internet users	SNS	Ten uses and gratifications for using social media are: social interaction, information-seeking, pass time, entertainment, relaxation, communicatory utility, convenience utility, expression of opinion, information sharing, and surveillance/knowledge about others.
(Kim, 2014)	541 college students	SNS	Expression, information, socialization, and entertainment motivate the use of social recommendations (e.g., "like" on Facebook) features..
(Mäntymäki & Riemer, 2014)	842 students (13-18 years old)	Social virtual worlds (SVW)	The intentions to continue SVW use are predominantly hedonically motivated, and inside the platform, users' engagement in social activities are associated with the hedonic experience.

Table A2. Summary of Social Media Studies Based on UGT.

(Zolkepli & Kamarulzaman, 2015)	476 Internet users	SNS	Motivation to adopt social media adoption is driven by three types of need category: personal (enjoyment and entertainment), social (social influence and interaction) and tension release (belongingness, companionship, playfulness).
(Choi et al., 2016)	357 hotel site users	Facebook	Three gratifications of information, convenience and self-expression significantly affect user satisfaction with the hotel's Facebook page, which is positively related to their intention to stay at the hotel in the future.
(Ifinedo, 2016)	College students	SNS	Self-discovery, entertainment, social and connection needs motivate SNS use.

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