Liquid Communication: An Analysis of the Impact of Mobile Micro-blogging on Communication and Decision-Making

Research-in-Progress

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Abstract

One of the most common forms of using mobile and social media technologies is the use of micro-blogging such as Twitter on mobile devices. The ubiquity of mobile devices combined with the communication via social network service like Twitter can potentially host a number of significant changes in the way people communicate and make decisions in a group setting. Yet, there is no theoretical framework that can effectively predict or interpret the changes. Based on the Bauman's 'liquid modernity,' we develop a new concept, 'communication liquidity' which illustrates the extent to which communication is dynamic. The communication liquidity consists of the three dimensions – temporal, spatial, and conversational. We posit that micro-blogging on a mobile device brings higher levels of the communication liquidity in these three dimensions, which in turn improve the outcomes of communication among the group members.

Keywords: Micro-blogging, mobile devices, communication liquidity, group communication, Twitter

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Introduction

Mobile technology is rapidly changing the landscape of many areas in our society (Treem and Leonardi, 2012; Sorensen, 2011; Dourish and Bell, 2011; Lyytinen and Yoo, 2002). An industry report finds that there are now over one billion smartphone users and estimates suggest there will be two billion users by 2015 (Five star equities, 2012). The sheer volume and the adoption rate are unprecedented.

In particular, it is the developments in social media that fuel the innovations in the mobile sector. Besides the list of well publicized features and applications, social media now commands a major presence in many areas of our society: political revolution (Oh et al, 2013; Wagstaff, 2011; Rhoads, 2011), natural disaster (Hiltz and Gonzalez, 2012; Palen et al, 2007; Majchrzak et al 2007), marketing (Vega 2011; Liang et al, 2011; Elliott, S. 2010; Stephen and Toubia, 2010; Trusov et al, 2009), and more. The easy-to-use, personal, and spontaneous nature of mobile technology draws more people to use social media through their devices.

Noting the rapid proliferation of mobile technology in tandem with social media, many organizations are now implementing a "bring your own device" (BYOD) policy as a way of tapping into the spontaneous and fluid nature of communication that is increasingly common in the personal realm. Organizations are exploring various ways to utilize the combination of mobile and social media technology to support their increasingly mobile and virtual workforces (Olavsrud, 2013).

Grappling with this social phenomenon, scholars across disciplines are investigating and analyzing from different angles and dimensions to understand better the phenomenon and its consequences. For example, existing studies on mobile communication have found that there are significant differences between communication that use mobile devices and those that use traditional, stationed PCs (Virtanene, 2008; Beurer-Zuelling, 2008; Choi et al, 2011; Vlahovic, 2012). However, most of these studies are focused on the outcomes of such communication, such as decision quality and satisfaction (Choi et al., 2011) or they examine other consequences, such as emotion (Vlahovic, 2012) and attitude (Beurer-Zuelling, 2008). So far, little research effort has been expended to examine the communication process. Existing studies suggest that it is expected that the communication process with mobile devices would differ from those of non-mobile desktop environments (Choi et al., 2011). However, past studies did not provide concrete theories or a research framework to explain how communication in a mobile environment is different from that in a stationary computer-mediated communication environment. The purpose of our study is to fill this gap by studying the communication process that occurs when users have access to social media through a mobile device.

Micro-blogging, a popular line of social media, which can be installed on a mobile device, brings an unorthodox approach compared to that of stationary communication. The portability of a mobile device frees a person from a fixed-location while communicating. Being able to communicate asynchronously or synchronously, with one person or with many people, from a location at any time or from anywhere-anytime, or with a desktop PC or a portable device is likely to cause different impact levels on group communication. Such technology allows users to live constantly in the "present" moment of now, breaking down the traditional model of narrative (Rushkoff, 2013). Specifically, we study how the combined use of mobile devices and micro-blogging changes the structure and the actions of small group communications from "solid" to "liquid." While a desktop or a laptop PC can provide some mobility, it is a limited one. For example, a person may tweet using a desktop PC from home, work, or another location. However, in a direct mobility level comparison between a mobile device, such as a smartphone and a fixed-location PC, there is a relatively large difference, which creates palpable effects.

In this study, we draw on and critically extend the "Bona Fide Groups theory" that come from the Cybernetic Theory tradition (Littlejohn and Foss, 2008). Cybernetic theory deals with a complex system that is made up of interacting elements influencing one another as well as the entire system. The Bona Fide Group theory deals with the relationship between group members' interactions and permeable group boundaries. However, the extant literature does not address various aspects of communication, such as spatial, temporal, and contextual dimensions.

In order to address this shortcoming in the literature, we develop and empirically test the notion of *communicative liquidity* as a new theoretical framework to understand the combined impact of mobile

and social media technology on communication processes. We draw on the work of philosopher, Zygmunt Bauman and his idea of "Liquid Modernity" (Bauman, 2000; Bauman, 2007). From a structural standpoint, we focus on the liquiditization of temporal and spatial dimensions (Giddens, 1984): from an action standpoint, we focus on the liquiditization of communicative acts.

In this research-in-progress, we examine the combined impact of mobile and micro-blogging technology on three dimensions of liquidity in small group communications – temporal, spatial, and conversational. In particular, we compare a popular micro-blogging tool, Twitter on a mobile device with a stationary communication environment, an online message board with desktop PCs – within a group decision making context. With attention to three dimensional fluidity, we focus on how mobile micro-blogging affect communications patterns, which in turn influence the decision-making outcomes. We ask two major research questions:

- How does the communication environment affect the *liquidity* of small group decision-making?

- How do the three dimensions of communication liquidity – *spatial, temporal, and conversational*– affect small group decision-making outcomes?

Theoretical Framework

In the communication discipline, there are largely seven theory traditions –semiotic, phenomenological, cybernetic, sociopsychological, sociocultural, critical, and rhetorical (Littlejohn and Foss, 2008). With the cybernetic theory tradition, "communication is understood as a system of parts, or variables, that influence one another, shape and control the character of the overall system" (pg. 39). Within the tradition of cybernetic theory, bona fide group theory (BFGT) emphasizes changing boundaries and environment interdependency. According to the theory, "the group's boundaries are permeable, meaning that what is defined as 'in' the group or 'out' of the group is something vague, always fluid, and frequently changing. At the same time, you cannot have a group without some sense of boundary, meaning that the group does have a notion of itself in relation to an environment, but the boundary is always being negotiated" (page 229).

Castells et al (2009) present a notion of "*virtual rendezvousing*" using mobile communication. This is defined as a social nomadic gathering materialized by mobile communication. In the mobile micro-blogging environment, it is common to observe virtual rendezvousing where the group's boundaries are virtual and permeable, externalized through spatial, temporal, and contextual indices. The BFGT explains the dynamic groupings, but it does not go further in explaining certain situations, such as decision-making and outcomes, and it does not extend its concept to spatial, temporal, and conversational dimensions. This is due to the fact that the BFGT existed for face-to-face social group communication, but remained unaware of emerging mobile communication and its dimensions. To address this gap, we develop a new concept we call 'communicative liquidity'.
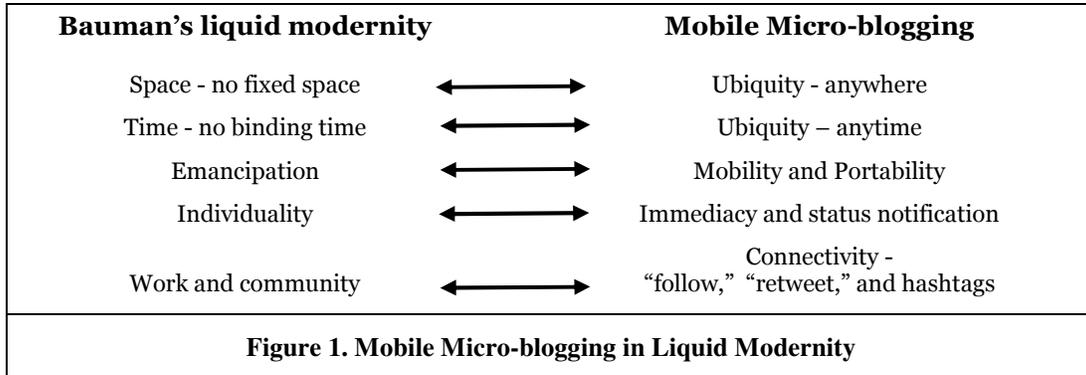
Understanding the concept of liquidity

About a decade ago, Bauman (2000/2007) introduced the concept of *liquid modernity* to explicate how our society has become busier and more fragmented. He used the word "solid" to symbolize post-modernity, to indicate "solid" concepts, such as traditional values, customary rights, civic obligations, and individual family duties. Societal collective systems and organizations were well-structured, centralized, and preserved a functional top-to-bottom hierarchy. The notion of time and space were clearly identified and the context was clearly mapped.

Just as the natural transgression from solid to liquid occurs with higher temperature, the solid forms of our social fabric and sectors have gradually transformed or *liquidized* into more fluid ones, taking us from post-modernity to so-called liquid modernity. The melting process is the underlying impetus of our society, which intuitively evolves to seek a higher order. Using fluidity as a metaphor, Bauman supports his liquid concept by stating that "*fluids … liquids, unlike solids, cannot easily hold their shape. Fluids, so to speak, neither fix space nor bind time. While solids have clear spatial dimensions … fluids do not keep to any shape for long and are constantly ready … it is the flow of time that counts, more than the space they happen to occupy: that space, after all, they fill but 'for a moment'*" (page. 2). Bauman takes up the length of his entire book (2000) to illustrate this liquid concept through five social topics – emancipation, individuality, time/space, work, and community. With those five topics, he states that there are no more

set-rules, requirements, codes of conducts, customary references, or guidelines. A societal member may determine his or her own path, but simultaneously may be presented with many conflicting life-choices. For the time-space topic, they have become more unstructured and their contexts are hard to define and to discern. In corollary, the fragmentation and isolation phenomenon in our society is expected to continue.

Given today's fragmented-yet-connected society, mobile micro-blogging consummately exemplifies Bauman's concept of liquid modernity and the behavior of contemporary individuals. Bauman's liquid modernity fits well with the experience of mobile micro-blogging communication. This communication type may symbolically represent liquid modernity, as outlined by Bauman.

Bauman's liquid modernity		**Mobile Micro-blogging**
Space - no fixed space	⟷	Ubiquity - anywhere
Time - no binding time	⟷	Ubiquity – anytime
Emancipation	⟷	Mobility and Portability
Individuality	⟷	Immediacy and status notification
Work and community	⟷	Connectivity - "follow," "retweet," and hashtags

Figure 1. Mobile Micro-blogging in Liquid Modernity

In this study, we focus on three dimensions of liquidity – *temporal, spatial*, and *conversational. Temporal liquidity*: With the availability of asynchronous and synchronous communication, a person may choose to read selectively, while also responding in another mode, shaping the course of conversation to reflect that individual's best interest. The timestamp on each transaction would reveal more information about why certain tweets are held back as a late response. *Spatial liquidity*: Twitter on a mobile device and Twitter via a desktop PC are compared for location-specific differences. Twitter on a mobile device setup allows a person to tweet spontaneously while in transit – walking, or riding in a bus or a train – to the next location. *Conversational liquidity*: Twitter on a mobile device communication is expected to be dynamically different from the more conventional computer-mediated communication. The underlying conversation patterns, initiatives, nuanced saliencies, and developments would be externalized through conversational fluidity.

Past Studies on Mobile Micro-blogging

The scholarly work of mobile micro-blogging and its communication process is still a nascent area. Treem and Leonardi (2012) present four affordances – visibility, persistence, editability, and association – that influence organizational communication processes. Visibility is the capacity to make information about and knowledge of people known through social mediums. Persistence is the capacity to make contents viewable after the originator has logged out from the social medium. Editability is the capacity to modify the communication before and after the contents are distributed to others. Finally, association is the capacity to make connections between people, including, between a person and another individual, or between a person and a particular content. Micro-blogging encompasses these four affordances: it is high-visibility, high-persistence, high-editability, and high-association.

A few studies have discussed the spatial, temporal, and contextual dimensions of mobility (Sorensen, 2011). Humphreys (2007) discusses how a location-specific information-sending social application can significantly augment and strengthen close social ties between "core circle" friends. As the friends meet on a regular basis, the location-specific information invites the friends for further social gatherings. Pascoe et al (2000) emphasize the user interface for contextual mobility. Mobility does not present ample time for a user to configure and adjust the parameters of a mobile device. The minimal attention user interface of mobile devices seeks to minimize the user's attention in order to maintain mobility. Fallman (2005)

emphasizes the possibilities of changing contexts. The study argues that HCI mobility needs to pay more attention to the contextual dimension over the other two – spatial and temporal – dimensions. Jackson (2007) proposes the concept of information fluidity, noting that with mobile technology, there is no clear account of where the information is coming from. The information conduit is ever changing between media and among users with repeated "connect-disconnect-and-connect-again" behaviors at various different intervals and/or conjunction points.

A few studies looked at user behavior during mobile communication and group communication. Vlahovic et al (2012) explored how the duration of interaction and the form of laughter influenced happiness in different communication modes – face-to-face, Skype, mobile phone, IM, texting, and email. The result revealed that only face-to-face communication had a positive outcome for the duration of the interaction. Virtanen, et al (2008) showed the interaction effect between the group communication application and the group's attributes – background, closeness, trust, and prior experience with the application. A recent blog from the Twitter company (Schreiner, 2013) reports on current trends with Twitter mobile user behaviors. Among the major findings, the noticeable ones are: 1) mobile users are on Twitter more than the average Twitter users. They are 79% more likely to be on Twitter several times a day than the average Twitter user. 2) Mobile users engage with Twitter throughout the day. Non-mobile users only access Twitter when they *need to use* Twitter, but mobile users are more likely to use Twitter during all of their active hours – during commutes to work or school, shopping, and social time. 3) 57% of mobile users communicate with people near them via Twitter. This indicates that Twitter on a mobile device is favorably used for a small group's social maintenance. 4) Mobile users engage more with content. They are more likely to compose original Tweets than the average Twitter user; they are more likely to click on links, as well as more likely to retweet and to favorite a Tweet. 5) 60% of 200 million active Twitter users log in via a mobile device at least once every month.

Hypotheses Development

A typical communication session of mobile micro-blogging is a series of fragmented transactions in continually changing temporal and spatial contexts. People wield their smartphone prodigiously while tweeting as they relocate from one place to another. Therefore, by using mobile micro-blogging communication, groups can communicate without being tied to a particular location. Similarly, individuals in a group can send and receive messages whenever it is convenient for them. Furthermore, the "always-on" feature of mobile phone alerts group members whenever there is a new message. Therefore, with mobile micro-blogging, individuals are more likely to communicate without being tied to a particular temporal context. Finally, with Twitter's 140-character limit, group members are forced to make only one point at a time. Together with the constantly changing temporal and spatial contexts, group members are likely to experience staccato-like communication patterns with bursts of ideas and parallel exchange of ideas, rather than a linear form of communication that focuses on a single issue at a time. Therefore, we hypothesize:

H1: Compared to the limited-mobile micro-blogging environment, mobile micro-blogging environment is likely to exhibit:

   H1a: Higher spatial liquidity (frequent exposure to different scenes & locations)

   H1b: Higher temporal liquidity (Ubiquity)

   H1c: Higher conversational liquidity (more frequent switches of and parallelism of topics during communication).

Using mobile micro-blogging allows a group to engage in simultaneous virtual rendezvousing that transcends spatial and temporal barriers and associates the group with a given contextual actor or function (Jackson, 2007; Fallman, 2005); and those multiple virtual presences may significantly gratify the users and opportunely allow the users to work towards a higher level of output quality. Furthermore, the "connect-disconnect-and-connect-again" communication behavior (Jackson, 2007) enables several potentially positive behaviors due to constant changes in spatial and temporal contexts. First, it allows groups to enact the four affordances: visibility, persistence, editability, and association (Treem and Leonardi, 2012). For example, the temporal gap of "connect-disconnect-and-connect-again" grants more moments of cognitive laxity where one may enact editability. Second, this phenomenon may also influence a person's cognitive ability to deal with a message's complexity. Using mobile micro-blogging, a

person may quickly reassess and readdress a message during the "on-and-off" communication session (Dennis et al, 2008; Goodyear, 2007) which may increase the message's value and content. Third, with increasing conversational fluidity, group members can express contrarian views, without worrying about disrupting the flow of group dynamics. This helps the group consider multiple views simultaneously. Taken together, increased communication liquidity is likely to enhance group decision outcomes measured in decision-making quality and satisfaction.

H2: A higher level of communication liquidity (temporal, spatial, and conversational) is associated with a higher group decision-making quality.

H2a: A higher level of communicative liquidity would yield a significantly higher level of solution quality

H2b: A higher level of communicative liquidity would yield a significantly higher level of satisfaction
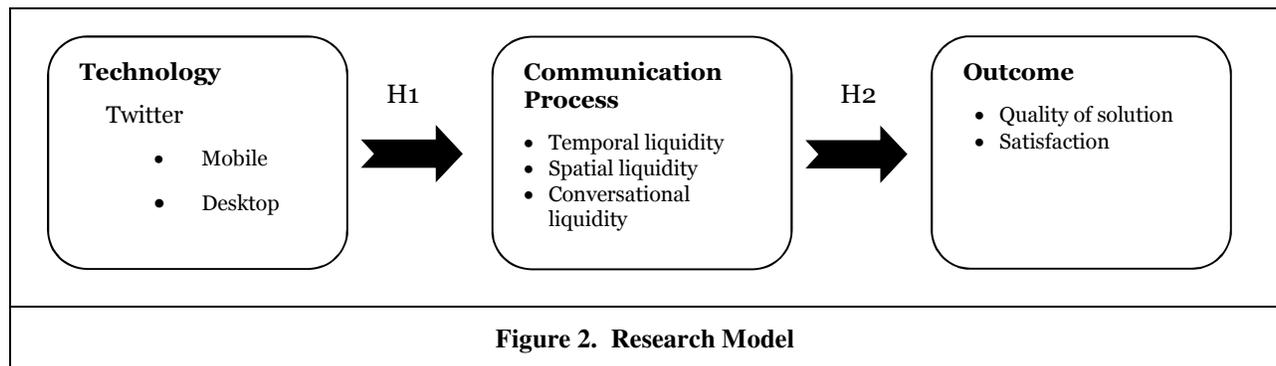

Figure 2. Research Model

Empirical Study

Experiment design

We tested our hypotheses in a controlled experiment that involved the manipulation of the micro-blogging environment (mobile vs. desktop). We randomly assigned students to one of these two conditions. Each group consisted of four members. Groups in each condition were restricted to the assigned technology. The experimental task posed a situational business problem. The problem description was about a group of management faced with the decision to downsize their workforce; they must rank each employee based on work performance and individual merits. In the experiment, each group functioned as the management team.

Experiment procedure

We recruited participants from a pool of university students. We offered course credit for participation in the experiment. Prior to the beginning of the experiment, we asked participants to create a new Twitter ID so that we could collect the entire communication contents without violating their privacy. At the beginning of the experiment, we asked group members to exchange their Twitter ID. For participants in the mobile micro-blogging environment, we gave detailed instructions on how to turn on a location-based service feature so that we could capture where they did the tweeting. We asked the participants in the desktop environment to record in each message the location where each message was posted (e.g. 'home', 'school', 'work', 'play', etc.). The groups began their session with a brief socialization exercise. After introductions, the groups had 10 days to complete the task. Once a group reached a consensus, they submitted a report describing the group's resolution and their rationale. All tweets and replies were to be downloaded and collected using a Twitter application programming interface (API). After they submitted the report, we asked participants to respond to the post-experiment questionnaire for satisfaction on process and outcome.

Measurement

We measured the three dimensions of communication liquidity through a combination of system log data and content coding. For temporal and spatial liquidity, we used the information that we extracted from the tweets. Specifically, we gauged the temporal liquidity category by using the time stamp of each message. We calculated the average interval between messages per each group. A short interval indicates a high degree of temporal liquidity, showing a staccato-like communication pattern with rapid exchange of messages. For spatial liquidity, we used the location tag from the Global Positioning Systems (GPS) for each message from the mobile communication users. Using the location tag, we calculated the number of locations and the average distance that one travels while exchanging messages for each group. For the desktop users, we counted the number of locations the participants recorded in the messages.

To measure conversational liquidity, we conducted a content coding of messages using a coding scheme we had developed. Specifically, we identified three formative indicators of communication fluidity through content coding. First, we measured how fragmented each message was. Using the Integrity Complexity coding scheme (Baker-Brown et al, 1990), we identified how many different ideas were included in each message and how well multiple ideas were integrated each message. A lower integrative complexity score indicates a highly fragmented communication content. We also counted how many different threads of messages were being exchanged at any given point in time. We marked each message based on the nature of the moves (Poole and Roth 1989; DeSanctis and Poole 1994): bit, opposition, affirmation, tabling, and open discussion. Based on these moves as indicated by each message, we were able to identify if the group was opening up a new thread of discussion, keeping an existing thread, switching to another open thread, or closing an active thread. This allowed us to calculate the average number of parallel threads. Third, using the coding of the moves, we calculated how frequently they switched between different threads.

An initial coding scheme was developed from several rounds of brainstorming sessions. Upon developing the initial coding scheme, three pilot coding sessions were administered to ensure the comprehensiveness and adequacy of the coding scheme. After each pilot coding session, any marked differences were thoroughly discussed and reconciled for modification. The final initial coding scheme is shown in Table 1.

Table 1. Measurements		
Variables	**Measures**	**Comments**
Integrative complexity (IC)	Baker-Brown et al.'s coding scale	Differentiation and integration of the tweet Average of individual tweet's IC measures
Parallelism	Total number of threads discussed	Count the number of all discussed subjects
Conversational dynamism	Number of the moves among subjects	Count the number of subject change

We measured the decision-making outcomes based on the quality of outcomes and perceived satisfaction. To measure the quality of decisions, we will hire expert judges to assess the group reports according to two categories: clarity of presentation and quality of solution (Ocker, 1996/1998; Campbell, 2005). The clarity of presentation relates to whether the report clearly presents a group's solution and the rationale behind it; and the quality of solution is whether the solution provided by a group is of high quality - comprehensive, creative, and feasible. Finally, to measure perceived satisfaction for process and outcomes, we used the measure developed by (Green, 1980).

Analysis method

We will hire coders to conduct content coding with messages collected from the study. They will be trained until they reach an acceptable level of agreement (70%) with sample messages. All analysis will be done at the group level. Given that most of the data is collected at the individual level, we will use a hierarchical multiple regression model in analyzing our data.

Expected Contributions and Future Research

Our research presents a new mobile communication theory, *'liquid communication'* which is based on Bauman's liquidity concept applied to micro-blogging on a mobile communication device. This concept explicitly addresses three major mobile dimensional fluidities – temporal, spatial, and conversational. Compared to a limited-mobile fixed-location PC, this study aims to reveal any significant usage differences and experiences for users in respect to three dimensional fluidity. Another major contribution is the new micro-blogging coding scheme that is germane to micro-blogging on a mobile device. The coding scheme specifically addresses and accounts for those three categories of dimensional fluidity. The success and validation of this new mobile-microblogging coding scheme would provide a basis for future studies. The study is scheduled to initiate a few rounds of pilot sessions to continue to enhance and fine-tune the procedures and the instruments. The main experiment is also expected to have a few rounds of sessions to ensure sound data collection. As this is a research-in-progress study, it is too early to draw any definitive conclusions in regards to the validity of the theoretical framework and its relevancies. A future consideration for this study is the inclusion of discussion of a relevant and value-added group dynamic variable, such as task type, a contextual or contingency issue, for better illumination of pertinent issues and for added contribution. We anticipate that this could be a timely and pioneering study. For practitioners, this study's findings are expected to provide new insights into this form of communication as well as to help leverage their business communication enterprise.

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