

Interoperable Communication: An Analysis of SMS Text-Message Exchange

Elizabeth Avery Gomez

New Jersey Institute of Technology
eag4@njit.edu

Murray Turoff

New Jersey Institute of Technology
turoff@njit.edu

ABSTRACT

Achieving interoperable communication across governmental agencies and jurisdictions remains a challenge and is simply taking time to implement. Initiatives to support agency interoperability continue. However, community responders remain in need of two-way device quick response tactics. SMS text-messaging is one viable interoperable communication technology that provides a bottom-up approach while offering benefits for everyday use. This research in progress studies the use of a web-based SMS text-message training application, designed to simulate two-way SMS text-message exchange. Speech Act Theory and the Theory of Planned Behavior are leveraged to carefully measure SMS text-message exchange. The overarching crisis scenario takes the role of the local community responder. Initial qualitative pilot results are presented and discussed, including next steps for this ongoing research.

Keywords

Crisis management, community responders, SMS text-messaging, interoperable communication, training and simulation.

INTRODUCTION

Effective use of continuously changing mobile technologies, such as a cell phones SMS text-message feature, present challenges for infrequent users, causing them to ignore important features that could save lives. By nature, ubiquitous computing causes users to rely only on features they need. A mobile device user could bypass device features they do not realize are essential in a crisis. Moreover, technology that is not used and practiced on a regular basis will not be used in a crisis (Turoff, Chumer, Van De Walle, Yao, 2004). Community responders, namely volunteers outside of public safety agencies (i.e., police, fire, EMS/medical) at present may not have or use two-way devices on a regular basis for crisis response, increasing the need for mobile device training, protocol adaptiveness and practice time. SMS text-messaging is a low-cost, low-richness communication exchange method, known to be highly reliable in times of chaos (Mehta, 2005), and is portable, extending to both mobile and stationary computer technologies. The unique feature that increases reliability of SMS text-messages is the architecture that has small packets of data travel on a wireless carrier's control channel (McAdams, 2006). "Because SMS text-messages are isolated in the control channel and are often unfazed by heavy traffic or adverse conditions that can overwhelm wireless networks, text messages can get through when most other methods of communication fail. Hence, some government officials are beginning to build SMS use into disaster planning exercises" (McAdams, 2006).

Increased use of one-way outbound alert notifications for crisis, as seen in the Lebanon evacuations (ABC News, 2006) and China 2006 typhoons (Textually.org, 2006) are indicators of message receipt simplicity. FEMA's announcement also supports the movement towards SMS text-messaging as an interoperable communication exchange for crises noting that "anything that can receive a text message will receive the alert, Homeland Security Department spokesman Aaron Walker said (eCorridors, 2006). This new digital system is more secure, it's faster, and it enables us to reach a wide array of citizens and alert them to pending disasters" (eCorridors, 2006).

Citizens and community responders are among the recipients of one-way alert notifications. These users at times find themselves needing a two-way communication protocol for the exchange of essential information in a crisis. SMS text-messaging excels in situations that require the briefest of updates (McAdams, 2006), and where training and practice are needed. A web-based training application, following Nielsen's 10 Web Heuristics (2006) has been developed to study user behavior, response and training effectiveness of communication protocols in the 160 character SMS text-message limit. The training application proposes to increase community responder mobile

device feature awareness and message response readiness, taking a bottom-up approach. Training will be offered to a variety of community responders, including public safety volunteers (police, fire, EMS/medical), community volunteers, community citizens, and students over the age of 18—each group with different information technology skill and usage levels. The survey instruments will capture responder roles, age range, ICT device usage, SMS text-message readiness to respond in addition to learning measures. A database will capture “time on task” and each text-message response.

The web-based training application, currently being field tested, leverages the Theory of Planned Behavior, Constructivist Learning Theory, Searle’s Speech Act Theory, and Ruth and Murphy’s Writing Task Assessment Model, in addition to Habermas’ Theory of Communicative Action to obtain written SMS text-message responses that can be objectively assessed based on the 160 character per text-message exchange limit. This research uses a mixed-factorial design and begins with a crisis scenario, followed by pre-training measures, three repeated measures, and concludes with post-training measures. The crisis scenario stimulus (i.e. text with audio and photo with audio) is the independent variable of this research, comparing “text with audio” training, to the use of “photo with audio” training; both crisis scenario stimuli are introduced through multimedia recordings. The dependent variables include: perceived SMS text-message readiness, perceived learning, and perceived intention to use. The survey constructs have been adapted from empirical research. The training as demonstrated with pilot testing should take between 45 and 60 minutes per study participant. Camtasia screen recording software will be used for some participants to obtain objective behavior and response measures, which is the focus of this paper.

This paper introduces preliminary qualitative findings from the mobile SMS text-message for crisis response training. Examples of SMS text-message responses from the initial study participants are presented to support the direction of this research. At present, minor instrument adjustments and training tasks have been adjusted. The contribution of this research is to quantify written communication responses to determine if training can increase communication readiness. The next steps of this research are to begin data analysis on the message responses with an ultimate goal of creating a rubric. The timeline for this study is Spring 2007.

STUDY BACKGROUND

The background for this study brings together literature on local community grassroots organizations and responders who step in during a crisis once the crisis has exceeded public safety (911 or 112) calls for assistance, and until external resources arrive. The theories discussed below place emphasis on the responder who is in the field and needs to communicate with a low-cost, low-richness device, where two-way quick response tactics are not a part of their everyday routine.

Local Community Organizations and Responder Roles

Community-based organizations are vast in most local areas, but vary depending on the landscape of the area (urban, suburban, cultural diversity, special needs). Each organization is unique, both in regards to their mission, but also to their dynamic staff with the majority being volunteers. Community organizations and their organizational role (Table 1), include, grassroots associations, self-help groups, and other phenomena related to these kinds of groups, such as voluntary associations, all-volunteer groups, small paid-staff nonprofits, faith-based volunteer groups, volunteerism in independent groups, volunteer participation and motivation, social action/advocacy groups, social movement groups, smaller interest groups, and citizen participation groups (Idealist, 2006).

Table 1. Responder Roles in Crisis Management

Service-Based Organization Type	Organizational Role
Public safety (first responder)	Respond to 911 or 112 calls. Resources from police, fire, or EMS/medical are dispatched in tandem. Trained for police, fire, or EMS/medical responsibilities.
Community outreach (mission based)	Extend from public health initiatives and know the needs of the people. Work in local community in a hands-on capacity. Serve populations with special needs, faith-based organizations, culturally diverse groups, special medical needs. Typically volunteers with limited to no paid-staff.
Self-help groups	Skills and personal experiences are relevant to the respective organization. Motivated by passion and the needs of the individuals in the group. Informal structure, flexible nature
Secondary influencers	Promote health awareness, safety and disease prevention.
Specialized response teams	Provide specialized skills associated with a specific incident. Specialized skills.
Humanitarian disaster relief	Specialized and definitive role. Trained for the role and as a team. Provide resources and help manage affected populations.

The diversity of skills, training, and personal experiences make local community responders unique, often wearing many hats within an organization. Turoff et al. (2004) note that “In a crisis it is never certain who will take on which role or which combination of roles. It is expected that people will be trained to be qualified in a number of different roles”. True to the nature of community organizations, roles will vary and cannot be held constant. However, increased mobile device readiness can complement changing roles, causing communication exchange protocols to be the constant variable in a crisis. Extending common exchange protocols (written text) can also benefit agent-based initiatives. Zhu (2006) notes that roles are commonly applied concepts in many fields and for different uses, such as natural organizations, task distribution, and application systems. Roles have always been a key part of any structured group communication process (Turoff 1993; Turoff, Hiltz, Bieber, Whitworth, and Fjermestad 2001). Individual “roles” when responding to a crisis vary based on the nature of the emergency, and the availability of personnel to respond. A “role” is defined as “the actions and activities assigned to or required or expected of a person or group (Encarta, 2005)”. Increased role-based applications show promise in assisting responders to leverage information and communication technologies (ICT) during a crisis. Zhu (2006) discusses opportunities for role-based agents being applicable for many fields.

Supporting Theories

Bringing together Speech Act Theory (Austin, 1962, Searle, 1969), Habermas’ Communicative Action Theory (Te’eni, 2001; Habermas, 1984) and the Theory of Planned Behavior (Fishbein and Ajzen, 1975), the Ruth and Murphy Writing Assessment Model (1988) is adapted for use with SMS text-message protocols. The premise of the writing assessment model is to develop tasks that solicit written responses (SMS text-messages) that can be objectively assessed based on the 160 character per text-message exchange limit.

Beginning with a communicative action, The Theory of Communicative Action encompasses goal-driven behavior (Te’eni, 2001; Habermas, 1984), a dimension present in crisis response, in addition to the communicative speech act exchange, between the sender and receiver. The behavior of the communicator in a crisis is mitigated by the incident taking place and prompts the need for communication or speech acts.

Speech Act Theory introduces two fundamental notions referred to as: 1) performative, which center on the action of doing something, and 2) constative, which is representative of a true/false statement with meaning (Austin, 1962). In a crisis, a statement surrounding the crisis leading up to response efforts could constitute a progression from constative to performative as used by Austin. Direct speech acts as Searle (1969) denotes, align with performative utterances. Performative utterances will be the primary focus of this research in that:

Performative utterances “will be used in a variety of cognate ways and constructions, much as the term ‘imperative’ is. The name is derived, of course, from ‘perform’, the usual verb with the noun ‘action’: it indicates that the issuing of the utterance is the performing of an action – it is not normally thought of as just saying something.” (Austin, 1962).

Mobile device usage, especially with functions unfamiliar to the user takes practice. Increasing readiness of communication protocols for SMS text-messaging, independent of the device allows the user to focus on the message form without the usability issues associated with the device. Individual behavior for any community responder whether from a public safety agency, community health agency, private sector, or humanitarian relief organization brings individual beliefs, and values that fall outside of the responding team and incident circumstances. The Theory of Planned Behavior (Fishbein and Ajzen, 1975) aims to predict and understand motivational influences on behavior that are not always under an individual’s volitional control. Targeting strategies for behavior change, as seen in the Theory of Planned Behavior (TPB), are introduced in this research with repeated measure tasks that place emphasis on the SMS text-message response.

WHY SIMULATE SMS TEXT-MESSAGING

The interim report of the Strong Angel III Integrated Disaster Response Demonstration that took place in San Diego California in August, 2006 highlighted numerous findings and needs for communication, training, and practice for interoperability and integration of communities into emergency response efforts. One intriguing finding that supports this research is the need to “Establish and train users on effective trans-boundary communications (#8)” where the need for “VOIP voice, radio voice, and *text chat* both locally in the room and outside to sites beyond either ad hoc or conventional access point range. Being able to distribute a *different word* of the day over each mode and *confirm receipt*” were also noted (SA, 2006).

One might ask, why simulate SMS text-messaging when mobile devices (cell phone, PDA, blackberry) are readily available. After careful review of the literature and in following real-world events, the ubiquitous nature of mobile devices makes it difficult to hold constant the functions per manufacturer model of a mobile device. Users take time to adjust to a mobile device which introduces usability dimensions, such as the differences between the study device and the study participant’s knowledge of their own device. Providing training and techniques related to message form allows the user to apply their learning to their own specific device.

Another benefit to simulation is the integration of multimedia technologies that record screen behavior and ability to capture learning measures. As observed when reviewing the Camtasia screen recordings, pausing and backspacing are measures that would not otherwise be captured if a mobile device were used to measure behavior for SMS text-message communication exchange. Other task performance measures include mouse movements around the screen during the training, the ability to replay the scenario and review the task instructions in one central location. Moreover, this research places emphasis on the SMS text-message response and not on the actual use of the device itself.

When using a mobile device and SMS text-messaging, the 160 character limit is an important dimension. The readability and message exchange sequence cause a message over the 160 character limit to be divided. For example, a message of 180 characters would be divided at exactly 160 characters regardless. Do we know if there was a space at 160 characters, or were we at the end of a sentence or important thought? Will the two messages arrive in sequence (i.e. first 160 characters, followed by the last 20 characters). On a small device, swapping between two messages for critical information can extend timeliness and more importantly effective response.

Another qualitative focus for this research is the uncertainty and ambiguity of the speech act presented in the response. Table 2 displays two responses from the pilot study to reflect the difference in frequency of usage, both to text-messaging and cell phone usage, but also with extended Internet features, such as alert messaging and listservs.

Table 2. Study Participant SMS Text-Message Examples

Task	Study Participant 1	Study Participant 2
1	thanks	JOe, received directions. Should be there in 20 minutes. (Subject 4)
2	have arrived in Wayne. streets are flooded and not drivable. we need public safety vehicles able to negotiate high water	JOe, proceeding on foot from Grey Rock and Island. Water rising, may need boats to move people through to safety. Will confirm, (Subject 4)

Task 2, asks the study participant, who is acting in the role of a responder to confirm receipt of directions. The responder is traveling to the location of the incident and needs alternate directions. Study participant 1, the more experienced text-message user, confirms receipt with a single word. Study participant 2, provides a greeting and closing, confirms receipt, and also provides information on arrival time. Given the text-message with directions was provided by the sender, the arrival time could be estimated by the sender. This information could be considered redundant or should be supplemented with additional criteria that would cause the estimate of the sender to differ from the responder. For example, if the responder was sitting in very heavy traffic and could see ahead the road was not moving, this would extend the driving time that the sender would estimate.

Task 2, asks the study participant to confirm arrival at a cross-street two blocks from the assigned incident. The responder encounters heavy flooding and cannot drive the last two blocks. The sidewalks are passable, allowing the responder to walk safely. Study participant 1, confirms arrival to the general area, provides details on the condition of the location, and also clearly states the needs at that location. Study participant 2, confirms next steps and also includes the starting location at the time the text-message was created. Additionally, provides conditions of the area in less detail and more importantly articulates in a manner of uncertainty, increasing the ambiguity of the conditions at the location. Words such as “may need” and “will confirm” raise additional questions at the incident location.

SUMMARY AND CURRENT RESEARCH

The pilot study provided feedback for instrument adjustments. The findings suggested a very realistic environment with respect to cell phone material in an ongoing crisis scenario. The study participants were able to follow the crisis scenario and respond to each of the five task prompts for SMS text-message response. The speech acts were adjusted to focus on the illocutionary speech act-essential rule in lieu of different illocutionary speech act rules.

Data for the field study will compare “photo with audio” and “text with audio” in lieu of “training” and “no training” as proposed in the pilot study. The “training” and “no training” comparison presented limitations. The limitation with “no training” was not having a baseline measure for cell-phone and text-message usage for the “no training” participants. As a result, many “training with audio” features to be presented in the “training with audio” version had to also be covered in the “no training” version. Aside from demographic information, pre-training preparedness beliefs, ICT usage, and behavioral dimensions in addition to the learning measures were also adjusted. Length of time for the participant was also evaluated and reduced by about 10 minutes by using speech act and plain language techniques for the training materials. The surveys can take additional time for some participants and the reason the overall length for participants was reduced.

The contribution of this research is to quantify written communication responses to determine if training can increase SMS text-message communication readiness. The next steps of this research are to begin data analysis on the message responses collected from the five tasks per participant, with an ultimate goal of creating a rubric and next steps for training and practice. The timeline for this study is Spring 2007.

REFERENCES

1. ABC news. (2006). China Text-Messages Millions On Typhoon: Need to reach millions of people to warn them of typhoon, China turns to text-messaging. <http://abcnews.go.com/Technology/wireStory?id=2243099&CMPOTC-RSSFeeds0312>, July 27, 2006.
2. Austin, J.L. (1962). How to do things with words. J.O.Urmson and Marina Sbiba, Editors. Harvard University Press, Cambridge Massachusetts.
3. eCorridors. (2006). Taken from CNN: Wireless Devices to get Emergency Alerts. http://www.ecorridors.vt.edu/news/topic/?article_id=209&cat_type=topic&cat_id=20, July 12, 2006.
4. Encarta. (2005). http://encarta.msn.com/dictionary_/outreach.html
5. Foundations for Recovery. (2006). Need for FEMA and Red Cross to Coordinate more effectively with Local and Faith-Based Organizations Identified. [<http://www.foundationsforrecovery.org/> Jun 19, 2006.
6. Habermas, J. (1984). The Theory of Communicative Action: Reason and Rationalization of Society, Volume 1, Beacon Press, Boston, 1984.
7. Idealist. (2006). "What is a grassroots organization?" <http://idealist.org>, September 2006.
8. McAdams, J. (2006) SMS for SOS: Short Message Service earns valued role as a link of last resort for crisis communications. <http://www.fcw.com/article92790-04-03-06-Print> April 3, 2006.
9. Mehta, Nihal. (2005). Op Ed : An S.O.S. for SMS. <http://www.imediaconnection.com/content/7088.asp> November 1, 2005.
10. Ruth, L. and Murphy, S. (1988). Designing Writing Tasks for the Assessment of Writing. Ablex Publishing Corporation. Norwood, New Jersey.
11. Searle, J.R. (1969). Speech acts: An Essay in the philosophy of language. Cambridge University Press.
12. Strong Angel III (2006). Integrated Disaster Response Demonstration. http://www.strongangel3.net/files/SAIII_working_report_20061106.pdf October 1, 2006.
13. Te'eni, D. (2001). Review: A Cognitive Effective Model of Organizational Communication for Designing IT" MIS Quarterly, (25)2, p. 251, June 2001.
14. Textually.org (2006). Mobile Technology Aids Swedish Evacuation. <http://www.textually.org/textually/archives/2006/07/012985.htm>, July 20, 2006.
15. Turoff, M., Chumer, M., Van De Walle, B., Yao, X., (2004). The Design of a Dynamic Emergency Response Management Information System (DERMIS), Journal of Information Technology Theory and Application (JITTA), (5)4, 2004, pp. 1-35.
16. Web Creators. (2001). Jacob Nielsen's 10 Web Heuristics. <http://www.stanford.edu/group/web-creators/heuristics>, June 8, 2001.
17. Zhu, H. (2006). Separating Design from Implementations: Role-Based Software Development, Proc. of the 5th IEEE International Conference on Cognitive Informatics, Beijing, China, July 17-19, 2006, pp. 141-148.
18. Zhu, H. and Zhou, M.C. (2006). Role-Based Collaboration and its Kernel Mechanisms, IEEE Trans. on Systems, Man and Cybernetics, Part C, vol. 36, no. 4, July 2006, pp. 578-589.