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Social media represents a series of online platforms that allow individuals to create and contribute content in both public and private spaces. Since the early 2000's many platforms have come to serve as channels for crisis and risk communication, enabling networked communication among distributed individuals in real time. As the adoption and use of these channels has grown, public officials have joined the online public as likely trusted sources among the many voices that compete for attention. Due to the increased volume of chatter that follows unfolding and unexpected events in hyperlocal contexts, the ability to be recognized as an authoritative source of information, and strategies to affect public behavior has become vital for those who manage emergency public information. Nearly six decades of research on alerts and warnings have paved the way for effective communication in times of disaster, particularly under conditions of threat.

However, the advent of social media has opened doors to new research questions about effective messaging, networked relations, and public behavioral responses online. The answers to these questions are becoming vital as public information officers move to include social media channels to deliver terse warning and alert messages. My work thus aims to address several of these questions, with a focus on short messaging channels such as social networking sites (Twitter) and mobile devices that deliver alerts and warnings.

Theoretical Background

Alerts and warnings are essential for getting people's attention and guiding them to take protective actions. In general, human beings live their lives believing they are safe – warning messages must change that perception so that individuals and groups will act quickly. To date, most warning studies have focused on long-message warnings (those that are at least 1380 characters in length – such as those broadcast via the Emergency Alert System, or unlimited in length). From these studies scholars have identified two dimensions in messages that are critical for increasing the likelihood that individuals who receive a message will take protective action.¹ These include the message style (how a message is written in clear, unambiguous language, with an authoritative voice, using simple, easy to understand words and concepts) and message content (the information relayed in the message itself, including details about the hazard, its expected or potential impact, the population and area at risk of impact, guidance on how to protect oneself and ones loved ones, the time at which the message will expire, and the source or identify of the message sender). Individuals who receive messages must undergo a series of perceptual and behavioral activities before taking action, including understanding, believing, personalizing, and deciding, each of which correspond with information clarification or “milling.” Importantly, much of the empirical record is consistent with the Extended Parallel Process Model, which helps to explain message design features that are necessary for motivating action, either to seek additional information or to protect oneself. While the body of research on warnings has grown to include new hazards and new contexts, research on social media for alerts, warnings, and imminent threat communication is in its infancy. Furthermore, there has been little integration of empirically based research models with communication theory. We aim to address both.

¹ Mileti, D.S., & Sorensen, J.H. (1990). *Communication of emergency public warnings: A social science perspective and state-of-the-art assessment*. (No. ORNL – 6609). Oak Ridge National Lab., TN (USA).

HEROIC: Hazards, Emergency Response, and Online Informal Communication

Now in its second round of NSF-funding, the HEROIC project² conducts research aimed to advance our ability to measure and model the processes governing terse-regime communication in emergency settings, and linking these to the tasks required of emergency management organizations. We do so by addressing a number of questions including: what governs the allocation of attention of the online public to specific organizations and messages during disaster, and how does this affect retransmission of terse messages? What governs the dynamics of organizations' online terse-regime communications and how does their behavior evolve in response to hazard stimuli, public behavior, or their own interactions? To answer these questions, and many others, we have collected a systematic, baseline controlled longitudinal backbone sample of hazard-related communication from Twitter, supplemented by demographic and other information on hazards, online warnings and alerts, and the impacted populations.

One of the key research outcomes of this project has been to identify “why messages get passed on” by focusing on style, content, and network characteristics of messages sent by public officials under conditions of imminent threat³. Looking across a wide range of hazards, including flood, wildfire, hurricane, blizzard, terrorism, and now emergency public health, we have identified the primary predictors that increase, and decrease, the likelihood of retransmission among the public. Factors that increase the likelihood of retransmission include the number of followers, messages that include content on protective action guidance, or details about the hazard impact; and stylistic aspects such as the use of a hashtag. Factors that decrease the likelihood of message retransmission include messages that are directed to a single individual, and the inclusion of a weblink or URL.

Effective Public Tsunami Warnings

A parallel effort that contributes to knowledge on short messaging is a project being conducted on effective public tsunami warnings.⁴ In this project, we have investigated the effectiveness of different types of tsunami warning messages (an original message sent by the National Weather Service, a theoretically enhanced message, a content constrained (140-character) message, and a sequence of content constrained messages. Using experimental methods to determine perceptual outcomes described previously, we found that the enhanced message that increased message and the sequenced message led to better outcomes measured. A second research question focused on risk information seeking and processing. Here, we asked participants about their reasons for seeking additional information from a weblink embedded in a short message. We found that more most, risk perception will influence their decision to click on a URL, however, for some, channel beliefs will override any decision to click. In doing this research, we contribute to knowledge about risk information seeking and channel beliefs that may aid in future message design and dissemination.

² Funded by the National Science Foundation, with Co-PI, Carter T. Butts at the University of California, Irvine.

³ Sutton, Jeannette C. Ben Gibson, Nolan Edward Phillips, Emma S. Spiro, Cedar League, Britta Johnson, Sean M. Fitzhugh, and Carter T. Butts. (2015). “A Cross-Hazard Analysis of Twitter Warning Messages.” *Proceedings of the National Academy of Sciences*. 201508916

⁴ Funded by the National Science Foundation. *Hazards SEES Type 1: End-to-end Development of Time-dependent Geo-targeted Alerts and Warnings Enabled by Dense Observations of the 2011 Tohoku Tsunami*. PIs, Jean-Paul Ampuero and Monica Kohler, CalTech.