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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 via the online platform 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 studies¹, scholars have identified two dimensions in messages that are critical for increasing the likelihood that individuals who receive a message will take protective action. 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.” While this body of research has grown to include new hazards and new contexts, research on *social media* for alerts, warnings, and imminent threat communication is in its infancy.

HEROIC: Hazards, Emergency Response, and Online Informal Communication²

The HEROIC project 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

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).

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

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 project³ 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 threat. 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.

Comprehensive Testing of Imminent Threat Public Messages for Mobile Devices⁴

A parallel effort that contributes to knowledge on short messaging is the work I contributed to on Wireless Emergency Alerts. In this project, a team of researcher conducted research on the effectiveness of 90-character, 140-character, and 1380-character warning messages for three different hazards (active shooter, tsunami, and radiological device). Using experimental methods to determine perceptual outcomes described previously, the research team determined that 90-character and 140-character messages resulted in reduced message understanding and increased intent to seek additional information; 1380-character messages were more consistently understood, believed, and personalized. Importantly, when investigating the differences between behavioral responses to 140-character messages, it was determined that the hazard itself makes a difference. Perception of risk may lead to different response patterns; warning messages must deliver enough information to overcome preconceived risk perceptions and it is questionable if short messages can do so alone. Additional research is now underway to investigate the effectiveness of “sequenced warning messages” delivered over short messages.

The Risk Perception Project⁵

The Risk Perception Project draws data from the HEROIC data collection site to investigate public risk perceptions relayed in response to four risk signals that were amplified by the media in 2013. We evaluate risk perceptions in public social media by applying the Psychometric Paradigm (identified by Paul Slovic and his colleagues⁶) to code individual messages into nine dimensions of risk that collapse into two underlying risk dimensions, “dread” and “unknown.” We find that risk perceptions are routinely relayed over Twitter messages, that different risk signals result in different frequencies of risk perception messages, and that terrorism messages fall consistently into the dread dimension, more frequently than unknown.

³ Sutton, J., Spiro, E. S., Johnson, B., Fitzhugh, S., Gibson, B., & Butts, C. T. (2014). Warning tweets: serial transmission of messages during the warning phase of a disaster event. *Information, Communication & Society*, 17(6), 765-787.

⁴ Supported by the U.S. Department of Homeland Security through the National Center for the Study of Terrorism and Responses to Terrorism, at the University of Maryland.

⁵ Supported by the U.S. Department of Homeland Security through the National Center for Risk and Economic Analysis of Terrorism Events, at the University of Southern California under award number 2010-ST—061-RE0001.

⁶ Slovic, P., Fischhoff, B., & Lichtenstein, S. (1979). Rating the risks. *Environment: Science and Policy for Sustainable Development*, 21(3), 14-39.