Public Relations Review xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Public Relations Review

journal homepage: www.elsevier.com/locate/pubrev

Is a picture worth a thousand words? The effects of maps and warning messages on how publics respond to disaster information☆

Brooke Fisher Liu[a,*], Michele M. Wood[b], Michael Egnoto[c], Hamilton Bean[d], Jeannette Sutton[e], Dennis Mileti[f], Stephanie Madden[g]

[a] Department of Communication, University of Maryland, United States
[b] Department of Health Science, California State University, Fullerton, United States
[c] START, University of Maryland, United States
[d] Department of Communication, University of Denver, United States
[e] Department of Communication, University of Kentucky, United States
[f] Department of Sociology, University of Colorado, Boulder, United States
[g] Department of Journalism and Strategic Media, University of Memphis, United States

ARTICLE INFO

Keywords:
Crisis
Disaster
Warning
Wireless emergency alert

ABSTRACT

Research examining whether visuals improve publics' crisis and disaster information comprehension is scarce despite the increasing popularity of infographics and visual-based social media in public relations practice. One disaster communication platform that is ideal for testing the potential effects of visuals on helping publics protect themselves during disasters is Wireless Emergency Alerts (WEAs). WEAs are 90-character warnings issued by governments and sent by wireless carriers to individuals (for free) facing an imminent threat such as a tornado or flood. The U.S. government is considering adding maps to future WEAs. Maps are one of the most relied-on tools for people to quickly gain knowledge about spatial tasks such as evacuating during disasters. Consequently, this paper empirically tests how at-risk publics respond to warning messages with and without maps. We do so through two experiments (N_1 = 767, N_2 = 550) of U.S. adults testing three disasters: a tsunami, an active shooter incident, and a radiological disaster.

The popular idiom that a picture is worth a thousand words seems to reflect the rise of image-based social media and mobile messaging applications as prime sources for seeking and sharing information (Duggan, 2015; Hiltin & Holcomb, 2015; Perez, 2016). Yet, research examining whether visuals improve publics' crisis and disaster information comprehension, and subsequent behaviors, remains largely untested (e.g., Casteel & Downing, 2016; Coombs & Holladay, 2011). Furthermore, the majority of crisis communication research has focused on how messages can mitigate organizational crisis responsibility rather than how messages can protect publics' safety (Avery, Lariscy, Kim, & Hocke, 2010; Liu & Fraustino, 2014). Even Coombs (2016), author of the dominant crisis communication theory, recently advocated for moving beyond a "preoccupation with reputation repair strategies," and called for more research on how messages can help publics protect themselves during crises (p. 122).

One disaster communication platform that is ideal for testing the potential effects of visuals on helping publics protect themselves

☆ This research was supported by the Science and Technology Directorate of the U.S. Department of Homeland Security through Contract Number HSHQDC-10-A-BOA36/HSHQDC-12-J-00145 made to the National Consortium for the Study of Terrorism and Responses to Terrorism (START). The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Department of Homeland Security or START.

* Corresponding author.
E-mail address: bfliu@umd.edu (B.F. Liu).

http://dx.doi.org/10.1016/j.pubrev.2017.04.004
Received 13 September 2016; Received in revised form 20 March 2017; Accepted 9 April 2017

is Wireless Emergency Alerts (WEAs). WEAs are 90-character warnings issued by governments and sent by wireless carriers to individuals (for free) facing an imminent threat such as a tornado or flood (FEMA, 2015). Research examining the role of mobile devices in emergency response has just begun to examine how warning information communicated via mobile devices impacts public behaviors during disasters (Bean et al., 2015; Casteel & Downing, 2016). Research is also needed to understand how publics respond to WEAs compared to other warning platforms such as Twitter and the Emergency Alert System (EAS), which can also distribute maps.

Maps are one of the most relied-on tools for people to quickly gain knowledge about spatial tasks such as evacuating during disasters if people are able to read them (Burigat & Chittaro, 2016). The U.S. government purposefully excluded graphics from WEAs when they were first issued in 2011 to decrease the possibility that message recipients would search for additional information online and overwhelm cell networks (Federal Communications Commission, 2008). As Casteel and Downing (2016) noted, this is a flawed strategy given the large body of research showing that publics seek and share information before deciding what to do during disasters (e.g., Jin, Liu, & Austin, 2014; Liu, Fraustino & Jin, 2015; Mileti & Sorenson, 1990). In updating WEAs in 2016, the Federal Communications Commission required future WEAs to support embedded URLs, including the possibility of linking maps to future messages (Federal Communications Commission, 2016).

Consequently, this paper empirically tests how at-risk publics respond to warning messages with and without maps. We test three message types: WEAs, tweets, and long-form messages. As already noted, WEAs are the newest tool in the U.S. government's warning toolkit, but tweets (140 character messages) are a prominent government warning platform (Bean et al., 2015). Long-form messages (1380 characters) are also investigated since messages of this length are possible today in the description and instruction fields of the Emergency Alert System (EAS), which distributes warnings via broadcast television, cable television systems, wireless cable systems, and satellite digital audio radio service (Federal Communications Commission, n.d.). We test how at-risk publics respond to these three message types through two experiments ($N_1 = 767, N_2 = 550$) of U.S. adults testing three disasters: a tsunami, an active shooter incident, and a radiological disaster.

1. Literature review

This section synthesizes research on maps, disaster communication, and how people respond to warnings. But first, we present key definitions relevant to this study.

1.1. Key definitions

1.1.1. Crisis, disaster, and warnings

A crisis is a "significant threat to operations that can have negative consequences if not handled properly" (Coombs, 2007, para. 2). Crises typically are unanticipated, though there usually are warning signs. Because of the surprise factor associated with most crises, these events tend to evoke "uncertainty, psychological discomfort and stress" among stakeholders (Sellnow & Seeger 2013, p. 6). A disaster is a "serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which [sic] exceed the ability of the affected community or society to cope using its own resources" (National Science and Technology Council, 2005, p. 21). Crisis and disaster are sometimes used interchangeably in the literature. For simplicity, this study uses disaster, which tends to have less of a focus on organizational reputation repair and more of a focus on public safety. Warnings are a form of disaster communication that attempt to inform people about emerging risks and persuade them to take protective actions to mitigate loss of life and property (De Vocht, Claeys, Cauberghe, Uyttendaele, & Sas, 2014).

1.1.2. Hazard maps

Hazard maps explain and display hazard distributions and risk levels of areas likely to be affected by hazards. They also may display areas that may not be accessible during disasters (Haynes, Barclay, & Pidgeon, 2007).

1.2. Maps and disaster communication

Mapping evacuation routes has long been a best practice in pre-disaster planning for severe hazards such as floods (Perry, 1979). Maps also are essential for local hazard assessment and public education (Hagemeier-Klose & Wagner, 2009). Despite this well recognized importance of maps in disaster management, relatively limited prior research examines how maps affect people's decision-making processes during disasters (e.g., Burnsdie, Miller & Rivera, 2007; Casteel & Downing, 2016; MacEachren & Cai, 2006). Furthermore, the existing research provides conflicting conclusions about how maps and other visuals affect publics' disaster responses. Some research points to problems that can arise in interpreting maps when the user is under time pressure, such as during emergency situations (Akella, 2009; Dymon & Winter, 1991; Haynes et al., 2007; Handmer, 1985; Roder, 1961). For example, past research shows that members of the public can struggle with interpreting uncertainty levels and geographic risk areas in hurricane forecasting graphics (e.g., Broad, Leiserowitz, Weinkle, & Steketee, 2007; Zhang, Prater, & Lindell, 2004). Indeed, Zhang et al. (2004) found that one third of their survey respondents incorrectly interpreted their risk area, and slightly more than half of these respondents over-estimated their hurricane risk.

Yet, visuals can also support public protective action decision-making. For example, Burnsdie et al. (2007) found in a survey examining hypothetical evacuation behavior that viewing images of hurricane damage increased the likelihood of evacuation. Indeed, maps can objectively communicate hazard risk information through improving risk perception, supporting personal risk