Interfaces with Other Disciplines

Rationalising the use of Twitter by official organisations during risk events: Operationalising the Social Amplification of Risk Framework through causal loop diagrams

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ARTICLE INFO

ABSTRACT

Communication of health risk events is a complex and challenging task. The advent of information and communication technology along with the following popularisation and widespread uptake of social media are reshaping the field of risk communication. Guided by key tenets of the Social Amplification of Risk Framework, this study developed a causal loop diagram, capturing the perceptions of professionals in health organisations regarding the role of Twitter during risk events. The aim of this paper is to explore the use of the causal loop diagram and its role with rationalising the use of Twitter in risk communication strategies. A key finding of the model is the central role of trust and its interrelationship with other factors during a risk event. A contribution is made to operational research through the novel use of soft system dynamics in risk communication, to risk communication through the investigation of the new medium Twitter and also to research on the Social Amplification of Risk Framework by providing a means through which to operationalise the framework.

1. Introduction

The internet is recognised as a participatory environment through which various actors communicate about risks (Chung, 2011). Microblogging site Twitter, with its unique capabilities in a risk event, has set in motion an irreversible change in the way in which information is exchanged among stakeholders. Twitter enables its diverse user base – from lay publics to global organisations – with unprecedented means to share information with an unknown but potentially wide indirect audience. Its almost non-existent barriers to interaction provides unparalleled opportunities for direct engagement with other users. The immediacy and ease of information sharing allows live reporting; there are numerous instances where Twitter has been the first to report news.

Potentially, social media may be harnessed as a platform to implement a number of suggested principles of risk communication (Regan, Raats, Shan, Wall, & McConnon, 2016). For example, the above mentioned factors position Twitter better than other social media and social networks to allow the estimation of the public's understanding and perception of a risk (Gaspar et al., 2014) with tweets being easily searched and retrieved; it provides information from the ground and it allows direct engagement with the public. Yet, Twitter has serious disadvantages. Disadvantages include the limited size of the Twitter user base, meaning that messages posted on Twitter by official organisations have a limited reach. Second, the platform is unregulated allowing misinformation to be easily propagated through the network. An aspect that is exacerbated by properties of the site including retweeting. Third, while Twitter is potentially a source of information for official organisations, there are challenges associated with harnessing this information in order to use it effectively during a risk event.

Risk communication is a critical aspect of the risk management of an event. Effective communication of risks by official organisations, such as fire services, police and health bodies who are privileged to scientific expert information, to the public is a challenging task. The advent of newer communication channels such as Twitter is changing risk communication from one-way, unidirectional channels of communication into complex, multidirectional communication networks. Twitter has gained prominence in recent risk events and while it appears a suitable form of communication to

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adopt by emergency organisations, to aid with the overall management of risk events, it is noted that the integration of such forms of communication present challenges for many official emergency service organisations (Latonero & Shklovski, 2011). Although important, limited studies investigate the use of Twitter by official emergency organisations.

This research focuses on the role of Twitter by official health organisations and the integration of Twitter. The research gap addressed in this paper is primarily aligned to the limited research on the use of Twitter by health organisations during risk events. A secondary purpose is to contribute to innovative applications of operational research within the context of risk communication. In this research Social Amplification of Risk Framework (SARF) (Kasperson et al., 1988) which is a comprehensive framework available for the study of risk events is used as the theoretical basis. This framework seeks to explain the way in which risk signals are passed between stations and how they are altered during this process to amplify or attenuate the signal, explaining the social response to risk events. Key tenets of SARF are used to inform the selection of modelling choice, which is causal loop diagrams (CLD) and inform the development of the data collection method, namely semi-structured interviews. The CLD developed from the interviews is used to capture and facilitate understanding of professionals in health organisations of the role of Twitter in risk events.

1.1. Outline of paper

The paper is structured as follows. Section 2 is a review of relevant literature and details the theoretical basis of the research. Section 3 provides the method employed in the study. The findings of the CLD are given in Section 4. Finally, Section 5 presents the discussion and conclusions of the research.

2. Review of relevant literature and theoretical framing

We organise our review of previous studies around three bodies of research. First, we review studies carried out by the field of crisis informatics, a distinct field bringing together social sciences and computer sciences, which has contributed a vast amount of empirical research on the use of Twitter and other social media during crisis events. Second, we review disaster OR, a field that has applied a diverse range of tools and techniques to a vast range of problems related to disaster events but with limited applications to risk communication and Twitter. Third, we review studies related to the multidisciplinary SARF. Individually, these three areas offer distinct contributions but together they offer a comprehensive basis and theoretical framing for the research problem.

2.1. Crisis informatics

Crisis informatics has conducted significant empirical research investigating Twitter during crisis events, particularly natural disasters. Investigation into the use of Twitter by the public, including victims, show that Twitter has multiple purposes being used to coordinate humanitarian responses; enable remote individuals to help in disaster responses; locate individuals; seek information; provide information from the ground and share information (see, for example Hughes & Palen, 2009; Paul, Dredze, & Broniatowski, 2014; Starbird & Palen, 2011; Vieweg, Hughes, Starbird, & Palen, 2010). The public have shown to be resourceful and innovative in their use of Twitter during an event. Studies further highlight that depending on the type of crisis event, whether it is a natural or man-made crisis, then the social response to that event on Twitter differs. Limited studies address the use of social media by official emergency organisations (see, for example Hughes & Palen, 2012;

Hughes, St. Denis, Palen, & Anderson, 2014; Latonero & Shklovski, 2011; St. Denis, Palen, & Anderson, 2014). These studies find individuals drive the use of Twitter but organisational factors prevent it being institutionalised. Organisations are slow to adopt social media but recognise that it may be an opportunity. Other studies have shown the benefits of Twitter for the surveillance and prediction of events, with Twitter users being used as sensors in events such as earthquakes and also monitoring disease outbreaks (Achrekar, Gandhe, Lazarus, Yu, & Liu, 2011; Lampos & Cristianini, 2010; Sakaki, Okazaki, & Matsuo, 2010). Several specific applications are shown to be highly effective; showing how tweets can be mined for information.

2.2. Disaster and emergency OR

A review of disaster and emergency OR literature demonstrates a diverse and extensive application of OR to a variety of problems (see Altay and Green, 2006; Galindo and Batta, 2013; Simpson and Hancock, 2009, for detailed reviews). With respect to risk communication, there are few studies. Preece, Shaw, and Hayashi (2015) adopt a soft OR approach, applying a Viable System Model (VSM) to investigate challenges of risk communication in dynamic disaster events and Eiselt and Marianov (2012) formulate the problem of loss of cell phone towers as a mixed-integer linear programming problem to provide a model to minimise loss of communication. Fry and Binner (2016) recently addressed the evaluation of information gained from Twitter and developed a model for utilisation of Twitter for the improved management of evacuations.

Within the context of social responses to risk, a system dynamics (SD) approach was utilised by Busby and Onggo (2013) to model the responses of the public to zoonotic disease outbreaks; Busby, Onggo, and Liu (2016) use agent-based modelling to model social risk beliefs and Kandiah, Binder, and Berglund (2017) use agent-based modelling to investigate public adoption of water reuse.

Preece et al. (2015, p. 313) evaluate that most existing disaster OR literature featured the 'application of reductionist approaches', cautioning that these types of approaches can fail to consider the 'need for holism in risk communication and analysis'. With the unstructured, dynamic nature of emergency events, the tools and techniques of soft OR are naturally more suitable, first in the problem structuring with the ability to involve decision-makers in the modelling process and also their ability to deal with complex, ill-structured problems (Simpson & Hancock, 2009).

2.3. Social Amplification of Risk Framework (SARF)

SARF is a comprehensive, multidisciplinary framework positioned to support the study of risk communication; it remains one of the only frameworks to integrate the work of previous studies on risk communication and risk perception (Kasperson, Kasperson, Pidgeon, & Slovic, 2003; Pidgeon & Henwood, 2010). It is proposed that SARF could be used to advance knowledge of risk communication and ultimately lead to better execution of communication during health risk events (Pidgeon & Henwood, 2010).

There are two main parts of the framework. The first part distinguishes social and individual stations through which risk signals pass as transmitted from source to end receiver. The framework draws upon classical communications theory to explain amplification and attenuation of risks (Bakir, 2005; Duckett & Busby, 2013); SARF states that when a signal is received by a station it is decoded and then encoded as it is passed to the next station or the final end receiver (Kasperson et al., 1988). The central tenet of the framework is that risk signals pass between stations and these include the media, scientific representatives and individuals, and as