SimEOC: A Distributed Web-Based Virtual Emergency Operations Center Simulator for Training and Research

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ABSTRACT

Training is an integral part of disaster preparedness. Practice in dealing with crises improves one’s ability to manage emergency situations. As an emergency escalates, more and more agencies get involved. These agencies require training to learn how to manage the crisis and to work together across jurisdictional boundaries. Consequently, training requires participation from many individuals, consumes a great deal of resources in vendor cost for support and staff time, and cannot be conducted often. Moreover, in the current crisis management environment, most training is conducted through discussion-based tabletop and paper-based scenario performance exercises. In this paper, the authors describe a socio-technical training simulator and research tool for upper level emergency managers. This tool is important because it enables emergency managers to train for crises more efficiently and effectively in a virtual environment. It also serves as a research tool for scientists to study emergency management decision-making, infrastructural design, and organizational learning.

Keywords: Disaster Management, Emergency Operations Center, Training Simulator, Virtual Training

INTRODUCTION

A crisis is defined as “any event that threatens to, or actually does, inflict damage to property or people” (IS -1, n. d.). Crises can be small or large in scale. In large scale crises, there usually is a significant probability of extreme danger and highly unpredictable outcomes (Leadership in Crisis, 2011). Small or large scale crises can occur at any time, and the consequences can be enormous. At the height of the H1N1 influenza outbreak between 2009 and 2010, 61 million

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people became infected with this virus. In addition, H1N1 caused an estimated 201,200 respiratory deaths and an additional 83,300 cardiac deaths (Dawood et al., 2012). In 2004, the Indian Ocean earthquake and tsunami affected approximately 5 million people in Indonesia, Sri Lanka, India, and the surrounding areas. Over 280,000 people died, and more than 1 million people were displaced (WHO, n. d.). In the United States, Hurricane Katrina was one of the most expensive and devastating natural disasters in American history (Rabkin, 2005). Over half a million people were affected by the hurricane, and the US energy infrastructure was severely damaged (Rabkin, 2005). In 2012, Hurricane Sandy swept through the Northeastern United States. Seventy-two people died and 8.5 million people lost power. More than 650,000 houses were damaged or destroyed (Blake et al., 2013). These and other crises clearly show the importance of disaster preparedness and response and also demonstrate how much can be improved, especially with respect to training and collaboration among local, state, and federal agencies (Agrait et al., 2004; Auf der Heide, 1989; Dorasamy & Raman, 2011; Holguín-Veras et al., 2007; Rabkin, 2005; Waugh Jr. & Streib, 2006). In our research we have designed and developed a prototype virtual system to improve emergency management training and research within the context of an Emergency Operations Center (EOC). Specifically, we discuss SimEOC – a virtual Emergency Operations Center (SimEOC, n.d.).

The remainder of this paper is structured as follows. We begin by describing some challenge areas and limitations of practices in current emergency management training and research. Next, we outline some of the advantages of using computers, games and simulations to improve training and research. Following this, we describe a virtual Emergency Operations Center we developed in response to contemporary emergency management training and research limitations. We then describe the system in detail, beginning with our research and design methodology and followed by a description of each of the consoles that comprise SimEOC. Finally, we conclude with a description of testing, system evaluation, and future work.

BACKGROUND

Challenge Areas for Training

One key limitation of current crisis management training is the lack of appropriately designed computer-based training (Agrait et al., 2004; Catarci et al., 2011; Nikolai, 2015). Computer-based training can provide critical instructional value to emergency managers (Catarci et al., 2011; Dorasamy & Raman, 2011; Jiri, 2009; Zwass, 2010). This is especially critical because crises often are rare events, and therefore they do not lend themselves to extensive training. Learning in an organizational context is both important and difficult, necessitating specific design approaches to maximize learning effectiveness (Salas et al., 2012). However, during a crisis, EOCs are populated with individuals whose primary responsibilities (and organizational learning) are in other organizations (e.g., schools, health, power companies, transportation). Additionally, in the middle of a crisis, few organizations have the time or resources to train new personnel; their foremost concern is on stabilizing the crisis, not on training individuals (Sniezek et al., 2002; Turoff et al., 2004; Westfall et al., 2009). Another limitation in current training is that individuals physically have to come to the EOC or other locations to gather for exercises (Nikolai, 2015). Since training exercises often involve people from many different organizations and coordinating agencies (Waugh & Streib, 2006; Zwass, 2010), organizations are limited by time, personnel, and budgetary constraints in the number and type of training exercises that they can engage in (Nikolai, 2015; Westfall et al., 2009). For example, the Miami-Dade EOC consists of over 47 organizational liaisons and representation for 35 municipalities, in addition
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