Preface

Are there more disasters and crises or are we just more aware of those that occur? An interesting question but one whose answer, while important, is not the purpose of this preface. What is important is that more crises or not, we are more aware of them and we expect those with authority to respond well to these crises. 2011 and 2012 saw hurricanes, wild fires, war, mass shootings, floods, draughts, etc. Businesses had to deal with crises such as bad products, bad public relation decisions, communication gaffes, industrial accidents, service outages, etc. Individuals, schools, organizations of all kinds all had to deal with various sorts of crises. So while we suspect there are more crises now than in the past, we definitely are more aware of them; and because we see them play out in real time on television, the Internet, or social media; we are more demanding in and critical of the observed crisis response. 2012 saw the Italian courts convict scientists for giving bad emergency advice showing that we are expecting our experts to give advice that is reasonable and that society will hold the experts accountable. A precedent that may have far reaching consequences as experts become reluctant to advise in uncertain situations. 2012 also saw a public skeptical of the ability of FEMA (Federal Emergency Management Agency) after the debacle of the Hurricane Katrina response; do a better job responding to Hurricane Sandy. Crisis response and our perception of how our leaders responded contributed to the election of the President of the United States when Barack Obama was perceived to be presidential and a good leader in a crisis and continue to influence public perception of government officials.

More access to information is bringing the world’s population closer together. The tsunami in Japan and the crisis at Fukushima were witnessed by viewers around the world. We are also seeing the advent of crowdsourcing crisis response. A crisis occurs, we see the response, and we get involved. Citizens could text in a donation to the Red Cross for Hurricane Sandy victims (as well as other crises) with the result that micro donations are changing the way crisis response is being funded. Technology is enabling this real time observation and participation. Drones with digital cameras bring events to our screens and live data to crisis managers and first responders. More bandwidth is enabling the transmission of more data, information, and knowledge to crisis response managers and even the first responders in the field. Better sensors, models, displays, maps, and communications are being incorporated into crisis response information systems. These improved crisis response information systems are improving our ability to respond and to manage the response. These crisis response information systems are also impacting our ability to make decisions. Managers are starting to display decision paralysis. Decision paralysis occurs when decision makers need more and more data before they can make a decision. The fear is that they will miss something that could cause injury or death to a first responder or a victim. I recently read a criticism of commanders in Afghanistan as it is taking them longer to evacuate personnel than it did in Vietnam. The article blamed lack of leadership and initiative but I believe it is decision paralysis. Commanders in Vietnam had limited data availability, especially when compared to commanders in Afghanistan. I am
a former United States Navy officer, trained in the late 1970s. At that time we were trained to take into account all available data and information and then take action. When data and information are limited you can assimilate it quicker and make quicker decisions. However, as the flood of data, information, and knowledge grows it takes longer to process it and determine appropriate courses of action. Also, managers and commanders are being held liable for the decisions they make using the perception of “what they should have known.” This is where decision paralysis becomes dangerous, the need to always have more or even perfect data, information, and knowledge before a decision can be made. The result is longer decision making times. Additionally, there is great concern that the L’Aquila, Italy convictions of the Italian government’s seismic experts will further reduce the willingness of crisis managers and commanders to make decisions without having all available data, information, and knowledge and leading many of them to wait for more data, information, and knowledge rather than acting on what they have.

We are also becoming so reliant on these crisis response information systems and have embedded them as an imperative aspect of successful decision making practices that when they fail, the repercussions can have devastating effects. Preventative measures cannot fully protect organizations from such mishaps, which is why effective crisis management protocols are critical for businesses’ survival. This is leading to a research agenda with respect to information systems for crisis response that explores questions such as:

- How do we validate that the real time data, information, and knowledge being collected and provided to crisis managers are valid?
- How do we process the large amounts of real time data, information, and knowledge being collected into actionable intelligence?
- How do we prevent decision paralysis and information overload in crisis response?
- What role do social media have in crisis response?
- What technologies can be applied to assist decision making in crisis response?
- What policies and planning should be done to prepare organizations to respond to crises?
- What systems do we need for situational awareness and early warning of crises?
- How do we analyze and use communications data to improve crisis response?
- How do we quickly capture lessons learned and generate best practices from crises, and then disseminate them to the crisis response community?
- How do we prepare individuals, organizations, and communities to be ready and self-sustaining during crises?
- What decision models do we need to use?
- What processes, procedures, and techniques work in crisis response?
- What organizational structures work best for crisis response organizations?

This book incorporates research that addresses much of the above research agenda. The following chapters provide readers with an inside view of the current discussion of trends in crisis response and disaster recovery methods in a wide variety of situations and industries, including education, healthcare, corporate, and environmental sectors.
John W. Barbrey begins by “Evaluating Campus Safety Messages at 99 Public Universities in 2010.” In 2009, the U.S. Department of Education published an Action Guide for Emergency Management at Institutions of Higher Education (U.S. Department of Education, 2009). In 2006, the Virginia State Crime Commission issued a prescient “Final Report: Study on Campus Safety (HJR 122)” regarding Virginia’s colleges and universities (Virginia State Crime Commission, 2006). Gray (2009) provided results from a “Columbine 10-Year Anniversary Survey,” which reviewed recent campus safety improvements of 435 K-12 and university respondents. From the three documents, prescribed campus safety activities were identified that could be consistently found in the stated programs and policies on university websites. Of these activities, 18 separate criteria upon which a university’s online emergency preparedness/safety/security messages could be evaluated through content analysis were conceptualized (coding: 1= school has criterion, 0= does not), to estimate the quality of the overall preparedness message of each institution in the small sample (n = 99) of universities, representing all 50 states in 2010.

“Equipment Distribution for Structural Stabilization and Civilian Rescue” by Albert Y. Chen et al. investigates how the efficiency of Urban Search and Rescue operations depends on the supply of appropriate equipment and resources, and an efficient damage assessment facilitates deployment of these resources. This chapter presents an Information Technology (IT) supported system for on-site data collection to communicate structural condition, track search and rescue status, and request and allocate appropriate resources. The system provides a unified interface for efficient gathering, storing, and sharing of building assessment information. Visualization and access of such information enable rescuers to respond to the disaster more efficiently with better situational awareness. The IT system also provides an interface for electronic resource requests to a geospatial resource repository service that enables a spatial disaster management environment for resource allocation. Request and deployment of critical resources through this system enables lifesaving efforts, with the appropriate equipment, operator, and materials, to become more efficient and effective. A system development at the Illinois Fire Service Institute has shown promising results.

Next, Tiziana Catarci et al. describe “WORKPAD: Process Management and Geo-Collaboration Help Disaster Response.” In complex emergency/disaster scenarios, persons from teams from various emergency-response organizations collaborate to achieve a common goal. In these scenarios, the use of smart mobile devices and applications can improve the collaboration dynamically. The lack of basic interaction principles can be dangerous, as it could increase the level of disaster or can make the efforts ineffective. This chapter examines the main results of the project WORKPAD, finished in December 2009. WORKPAD worked on a two-level architecture to support rescue operators during emergency management. The use of a user-centered design methodology during the entire development cycle has guaranteed that the architecture and resulting system meet end-user requirements. The feasibility of its use in real emergencies is also proven by a demonstration showcased with real operators. The chapter includes qualitative and quantitative results and presents guidelines that can be useful in developing emergency-management systems.

The events of September 11, 2001, the Indian Ocean tsunami in 2004, and Hurricane Katrina in 2005 awakened American policymakers to the importance of the need for emergency management. “Experience Report: Using a Cloud Computing Environment during Haiti and Exercise24” by Brianna Terese Hertzler et al. explains how a cloud computing environment can support social networks and logistical coordination on a global scale during crises. Basic cloud computing functionality is covered to show how social networks can connect seamlessly to work together with profound interoperability. Lastly,
the benefits of a cloud computing solution is presented as the most cost-effective, efficient, and secure method of communication during a disaster response, with the unique capability of being able to support a global community through its massive scalability.

Chapter 5, “Multi-Layers of Information Security in Emergency Response” by Dan Harnesk and Heidi Hartikainen, draws on the socio-technical research tradition in information systems to re-conceptualize the information security in emergency response. A conceptual basis encompassing the three layers—technical, cognitive, and organizational—is developed by synthesizing Actor Network Theory and Theory of Organizational Routines. This chapter makes the assumption that the emergency response context is built on the relationship between association and connectivity, which continuously shapes the emergency action network and its routines. Empirically, the analysis is based on a single case study conducted across three emergency departments. The data thus collected on information security, emergency department routines, and emergency actions is used to theorize specifically on the association/connectivity relationship. The resultant findings point to the fact that information security layers have a meaning in emergency response that is different from mainstream definitions of information security.

Many proposed technological solutions to emergency response during disasters involve the use of cellular telephone technology. However, cell phone networks quickly become saturated during and/or immediately after a disaster and remain saturated for critical periods. In “Cell Phone Use with Social Ties During Crises: The Case of the Virginia Tech Tragedy,” Andrea Kavanaugh et al. investigated cell phone use by Virginia Tech students, faculty, and staff during the shootings on April 16, 2007 to identify patterns of communication with social network ties. An online survey was administered to a random sample pool to capture communications behavior with social ties during the day of these tragic events. The results show that cell phones were the most heavily used communication technology by a majority of respondents (both voice and text messaging). While text messaging makes more efficient use of bandwidth than voice, most communication on 4/16 was with parents, since the majority of the sample is students, who are less likely to use text messaging. These findings should help in understanding how cell phone technologies may be utilized or modified for emergency situations in similar communities.

Next, Suradej Intagorn and Kristina Lerman explore “Mining Geospatial Knowledge on the Social Web.” Up-to-date geospatial information can help the crisis management community to coordinate its response. In addition to data that is created and curated by experts, there is an abundance of user-generated, user-curated data on Social Web sites such as Flickr, Twitter, and Google Earth. User-generated data and metadata can be used to harvest knowledge, including geospatial knowledge that will help solve real-world problems including information discovery, geospatial information integration, and data management. This chapter proposes a method for acquiring geospatial knowledge in the form of places and relations between them from the user-generated data and metadata on the Social Web. The key to acquiring geospatial knowledge from social metadata is the ability to accurately represent places. The authors describe a simple, efficient algorithm for finding a non-convex boundary of a region from a sample of points from that region. Used within a procedure that learns part-of relations between places from real-world data extracted from the social photo-sharing site Flickr, the proposed algorithm leads to more precise relations than the earlier method and helps uncover knowledge not contained in expert-curated geospatial knowledge bases.

The interaction design for web emergency management information systems (WEMIS) is an important aspect to keep in mind due to the criticality of the domain: decision making, updating available resources, defining a task list, and trusting in proposed information. A common interaction design strategy for WEMIS seems to be needed, but currently there are few references in literature. The aim of the chapter
by Teresa Onorati et al., “Interaction Design Principles for Web Emergency Management Information Systems,” is to contribute to this lack with a set of interactive principles for WEMIS. From the emergency point of view, existing WEMIS have been analyzed to extract common features and to design interactive principles for emergency. Furthermore, the authors studied design principles extracted from a well-known (DERMIS) model relating them to emergency phases and features. The result proposed here is a set of design principles for supporting interactive properties for WEMIS. Finally, two case studies have been considered as applications of proposed design principles.

In Chapter 9, “RimSim Response Hospital Evacuation: Improving Situation Awareness and Insight through Serious Games Play and Analysis,” Bruce Campbell and Chris Weaver describe how, to aid emergency response teams in training and planning for potential community-wide emergency crises, two coordinated research teams centered in King County, Washington have developed software-based tools to provide cognitive aids for improved planning and training for emergency response scenarios. After reporting the results previously of using the tools in pilot studies of increasing complexity, the implementation teams have been searching out community-wide emergency response teams working on emergency response plans that might benefit from use of the tools. In this chapter, the authors describe the tools, the application of them to a countywide hospital evacuation scenario, and the evaluation of their value to emergency responders for improving situation awareness and insight generation.

“Knowledge-Based Issues for Aid Agencies in Crisis Scenarios: Evolving from Impediments to Trust” by Rajeev K. Bali investigates crisis management from an international perspective. As part of its expanding role, particularly as an agent of peace building, the United Nations (UN) actively participates in the implementation of measures to prevent and manage crisis/disaster situations. The purpose of such an approach is to empower the victims, protect the environment, rebuild communities, and create employment. However, real world crisis management situations are complex given the multiple interrelated interests, actors, relations, and objectives. Recent studies in healthcare contexts, which also have dynamic and complex operations, have shown the merit and benefits of employing various tools and techniques from the domain of knowledge management (KM). Hence, this chapter investigates three distinct natural crisis situations (the 2010 Haiti Earthquake, the 2004 Boxing Day Asian Tsunami, and the 2001 Gujarat Earthquake) with which the United Nations and international aid agencies have been and are currently involved, to identify recurring issues which continue to provide knowledge-based impediments. Major findings from each case study are analyzed according to the estimated impact of identified impediments. The severity of the enumerated knowledge-based issues is quantified and compared by means of an assigned qualitative to identify the most significant attribute.

In “Supporting the Allocation of Traumatized Patients with a Decision Support System,” Tim A. Majchrzak et al. present a business rules-based decision support system for the allocation of traumatized patients. The assignment of patients to vehicles and hospitals is a task that requires detailed up-to-date information. At the same time, it has to be carried out quickly. The authors propose supporting medical staff with an IT system. The proposed system could be used in cases of mass incidents, as it is problematic, but essential, to provide all injured with adequate healthcare as fast as possible. The contribution is a system based on business rules, which is a novel approach in this context. Its feasibility is proven by prototypic implementation. In this chapter, the authors describe the development project’s background as well as the system’s requirements and implementation details. The authors present an exemplary scenario to show the strengths of the proposed approach.

Having the right information at the right time is crucial to make decisions during emergency response. To fulfill this requirement, emergency management systems must provide emergency managers with
knowledge management and visualization tools. In “Visualizing Composite Knowledge in Emergency Responses using Spatial Hypertext,” José H. Canós describe this goal as twofold: on one hand, to organize knowledge coming from different sources, mainly the emergency response plans (the formal knowledge) and the information extracted from the emergency development (the contextual knowledge), and on the other hand, to enable effective access to information. Formal and contextual knowledge sets are mostly disjoint; however, there are cases in which a formal knowledge piece may be updated with some contextual information, constituting composite knowledge. In this chapter, the authors extend a knowledge framework with the notion of composite knowledge, and use spatial hypertext to visualize this type of knowledge. The authors illustrate the proposal with a case study on accessing to information during an emergency response in an underground transportation system.

“Emergency Management, Twitter, and Social Media Evangelism” by Mark Latonero and Irina Shkolovski considers how emergency response organizations utilize available social media technologies to communicate with the public in emergencies and to potentially collect valuable information using the public as sources of information on the ground. The authors discuss the use of public social media tools from the emergency management professional’s viewpoint with a particular focus on the use of Twitter. Limited research has investigated Twitter usage in crisis situations from an organizational perspective. This chapter contributes to the understanding of organizational innovation, risk communication, and technology adoption by emergency management. An in-depth longitudinal case study of Public Information Officers (PIO) of the Los Angeles Fire Department highlights the importance of the information evangelist within emergency management organizations and details the challenges those organizations face engaging with social media and Twitter. This chapter provides insights into practices and challenges of new media implementation for crisis and risk management organizations.

Decision-making in emergency management is a challenging task as the consequences of decisions are considerable, the threatened systems are complex, and information is often uncertain. “A Distributed Scenario-Based Decision Support System for Robust Decision-Making in Complex Situations” by Tina Comes presents a distributed system facilitating better-informed decision-making in strategic emergency management. The construction of scenarios provides a rationale for collecting, organizing, and processing information. The set of scenarios captures the uncertainty of the situation and its developments. The relevance of scenarios is ensured by gearing the scenario construction to assessing alternatives, thus avoiding time-consuming processing of irrelevant information. The scenarios are constructed in a distributed setting, allowing for a flexible adaptation of reasoning (principles and processes) to both the problem at hand and the information available. This approach ensures that each decision can be founded on a coherent set of scenarios. The theoretical framework is demonstrated in a distributed decision support system by orchestrating experts into workflows tailored to each specific decision.

In “Exercise24: Using Social Media for Crisis Response,” Austin W. Howe et al. ask, “Can populations self organize a crisis response?” This chapter is a field report on the first two efforts in a continuing series of exercises termed “Exercise24 or X24.” The first Exercise24 focused on Southern California, while the second (24 Europe) focused on the Balkan area of Eastern Europe. These exercises attempted to demonstrate that self-organizing groups can form and respond to a crisis using low-cost social media and other emerging web technologies. Over 10,000 people participated in X24, while X24 Europe had over 49,000 participants. X24 involved people from 79 nations while X24 Europe officially included participants from at least 92 countries. Exercise24 was organized by a team of workers centered at the SDSU Viz Center, including significant support from the US Navy as well as other military and Federal organizations. Dr. George Bressler, Adjunct Faculty member at the Viz Center led both efforts. Major
efforts from senior professionals EUCOM and NORTHCOM contributed significantly to the preparation for and success of both X24 and especially X24 Europe. This chapter presents lessons learned and other experiences gained through the coordination and performance of Exercise24.

Ubiquitous computing opens new possibilities in various aspects of human activities. The last chapter, “Ubiquitous Computing for Personalized Decision Support in Emergency” by Alexander Smirnov, proposes an approach to emergency situation response that benefits from the ubiquitous computing. The approach is based on utilizing profiles to facilitate the coordination of the activities of the emergency response operation members. The major approach underlying idea is to represent the operation members jointly with information sources as a network of services that can be configured via negotiation of participating parties. Such elements as profile structure, role-based emergency response, negotiation scenarios, and negotiation protocols are described in detail.