
Introduction to the special issue

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1 Overview

By examining human response to crises, we improve our understanding of the potential and limits of human and technological capabilities, thereby improving society's ability to plan for and respond to future events. Yet the uniqueness, severity, spontaneity, complexity, and possible sensitivity of crises pose considerable challenges for conducting methodologically rigorous investigations into crisis decision-making, communication and supporting technologies.

This special issue of the *International Journal of Emergency Management* demonstrates recent advances in research methods and tools to advance scientific understanding of emergency management. In essence, this means developing a body of instrumentation and knowledge that can better explain the behaviour of combined human, technological and natural systems that may be exposed to highly disruptive events. Methodological advances in these areas provide a sound mechanism not only for

generating results, but also for informing discourse on policy-oriented questions of how to manage disaster, as well as stimulating progress in the development of tools to support work processes.

Prior approaches to the study of emergency management have encompassed field and laboratory studies, as well as less conventional techniques such as computer simulation. In many cases, there has been a strong reliance on one-shot case studies, leading to questions about the generalisability or transferability of results. Substantial challenges therefore remain for developing sound theory about human decision-making and the role of supporting tools in emergency management.

Most of the contributions in this issue expand upon methodologically innovative or focused papers from the 2007 Information Systems for Crisis Response and Management Conference (ISCRAM). This introduction presents an organising framework which is then used to summarise the contributions of these papers and to outline directions for future research.

2 An organising framework

As pointed out by Weick (1985) and others (Stallings, 2002), there are considerable challenges involved in investigating complex socio-technical systems – including those which are called emergencies. A fundamental tension is between the established scientific paradigm of reproducibility of results and the view that all disasters are unique. The tension is manifested in the preponderance of studies that are either interpretive or positivist, but not both. In this section, we consider the role of interpretive and positivist perspectives in shaping theory building through measurement and choice of methodology, and argue for a range of perspectives and methods that reflects the richness and complexity of salient phenomena in the domain of emergency management.

2.1 Interpretive versus positivist perspectives

A study may be said to be interpretive “if it is assumed that our knowledge of reality is gained only through social constructions such as language, consciousness, shared meanings, documents, tools and other artifacts” (Klein and Myers, 1999). The types of generalisations that may be drawn from interpretive case studies are the development of concepts, the generation of theory, drawing of specific implications and the contribution of rich insights (Walsham, 1995).

In contrast, a study may be said to be positivist “if there is evidence of formal propositions, quantifiable measures of variables, hypothesis testing, and the drawing of inferences about a phenomenon from a representative sample to a stated population” (Orlikowski and Baroudi, 1991). There are some obvious challenges associating with a positivist approach to conducting research in emergency management, perhaps foremost among them the difficulties involved in obtaining samples of any other size but one (Killian, 2002).

In reality, both interpretive and positivist perspectives figure into the development of sound theory (Lee, 1991; Trauth and Jessup, 2000). Studies that combine interpretive and positivist approaches in the domain of emergency management are rare (but see (Roberts *et al.*, 1994) for an exception). One approach to effecting this combination is triangulation, which may be defined as “the combination of methodologies in the study of

the same phenomenon” (Denzin, 1978). Triangulation can provide “a more complete, holistic, and contextual portrayal of the units under study”, though it is important to keep in mind that “effectiveness of triangulation rests on the premise that the weaknesses in each single method will be compensated by the counter-balancing strengths of another” (Jick, 1979).

2.2 *Measurement, level of analysis and data sources*

In studies involving field data, it is appropriate to address concerns of validity, particularly in regard to sampling and measurement (Stallings, 2002). Broadly speaking, measurement may be defined as the “process of linking abstract concepts to empirical indicants” (Carmines and Zeller, 1979). It is worth emphasising that this definition does not presuppose that measures are quantitative, merely that the linkage between abstract concepts and their instantiation in the real world be provided empirically.

The need for discussions of instrument development is particularly great when the phenomena is not clearly understood. Yet with a few prominent exceptions such as survey instruments (Goodhue, 1998), the path to instrument development is seldom discussed, and the instruments themselves – such as those measuring actual or perceived user performance or satisfaction – are woefully under-discussed. Without adequate detail on instrument development and validation, resulting claims the resulting theory may become too narrow (or too diffuse) too quickly, leading either to an unnecessarily narrow view or to a hopelessly broad one.

The level of analysis specifies the elements that will be measured in order to answer the research questions (Klein *et al.*, 1994). Examples include the individual, group, team, organisation or even society. Data may be produced by applying research instruments to the unit of analysis before, during or after the real or simulated event. Studies that rely mainly on data collected during the actual event (*i.e.*, communication logs) or soon after (*i.e.*, debriefings with response personnel) may be less susceptible to retrospective or hindsight biases on the part of informants. There are numerous examples of the latter, but few of the former (for an exception see the paper by Lind *et al.* in this issue).

2.3 *Methods*

For quite some time, a number of researchers have argued for increasing the portfolio of methods used in social science – a point that may be expanded to the domain of emergency management. The interpretive and positivist perspectives are sometimes associated with qualitative and quantitative methods, respectively, yet one does not necessarily imply the other. As discussed below, various combinations of perspectives and methods may be seen in the papers of this special issue.

3 **Papers in the special issue**

The papers in this special issue represent both positivist and interpretive perspectives: they utilise or propose methods that should stimulate discussion and action concerning how research in the emergency management domain may be conducted.

Bertsch and Geldermann use Multi-Criteria Decision Analysis (MCDA) software in a particular risk and emergency management scenario to model and simulate the preferences of decision-makers involved. MCDA is based on multi-attribute value theory, and therefore prescriptive and positivist in nature. However, as the authors emphasise, they make use of the MCDA software's modelling and visualisation capabilities to facilitate the decision-making process and improve the transparency and traceability of the decisions taken. As such, the authors' approach has a complementary interpretive perspective, aiding decision-makers in gaining knowledge of the context of their decisions.

Kruchten *et al.* represent a shared meaning of the many disaster management languages, and build a comprehensive meta-ontology unifying the patchwork of partial ontologies that currently prevail in the disaster management domain. This interpretive perspective provides the rationale for the argument that this meta-ontology can be used to build better informed critical infrastructure disaster simulations, and can serve as a basis on which to develop information systems that help analyse infrastructure weaknesses and aid in the response to incidents.

Gouman *et al.* report on the use of various instruments to learn from an experimental emergency management exercise in a small community surrounded by important industrial activity and threatened by flooding. In their interpretive study, the authors develop their understanding of communication and information exchange during the exercise via quantitative and qualitative methods including on-site observations, analysis of communication logs, and questionnaire-based feedback. In addition, the authors also describe the challenges of conducting empirical research during a 'real' crisis event.

Lind *et al.* use formal network analytic methods to assess the extent to which various officials and their organisations performed as communication brokers (or intermediaries) following the Hurricane Katrina disaster – a situation characterised by the absence of traditional, working communications channels, and a reliance on emergent multi-organisational communication networks. Their findings suggest that a greater understanding of the role of social networks and the diverse brokering functions formal officials and informal community leaders perform following a disaster may benefit local emergency management planners.

Franco *et al.* reflect on the research methods used in the international ISCRAM community. The authors find that the case studies found in ISCRAM scholarship often appeal to inferential generalisation techniques. The proposed alternative is to employ techniques associated more often with interpretive research. In addition, the authors find that analytic generalisation from findings of multiple case studies to a broader, overarching theory of disaster management remains largely absent from the discussion. Given the multidisciplinary nature of ISCRAM research, a trans-theoretical and trans-methodological approach may offer greater explanatory and predictive power than mono-theoretical and – methodological approaches.

Fitrianie and Rothkrantz present their ongoing research on the design and use of a automated dialogue system serving as a crisis hotline dispatcher receiving (textual) messages from people in a crisis situation. The dialogue system can engage in dialogue with the caller and recognise the emotional status of the message. The research neatly illustrates an interpretive perspective employing both qualitative methods (in understanding the work of human dispatchers) and quantitative ones (in interpreting the messages received by callers to these dispatchers).

Büscher *et al.* make use of a novel participatory design method to introduce functional prototypes into enactments of real work (in this case, the use of ubiquitous computing devices in a major incident situation). Through an elaborate analysis of a sequence of incident management events, the authors' findings indicate this new approach leads to insights and knowledge that could not have been obtained through table-top discussions and exercises. The paper brings in a perspective that is well established in the field of human-computer interaction (*i.e.*, strongly interpretive, culminating in a designed artefact), in this case driven by data collected in a quasi-realistic emergency environment.

Bosse *et al.* apply in their work a number of techniques and tools from the fields of Artificial Intelligence and Cognitive Science to investigate and model the reasoning of humans in stressful conditions (the test case is an airplane crash in the Netherlands). Assessing reasoning schemes that are both simulated (*i.e.*, deduced from the authors' formal approach) and empirical (*i.e.*, actual descriptions in the incident report), the authors conclude that their approach can be used to enable automated detection of interpretation errors in incident management. A defining characteristic of the theory is that it is computable, thus enabling very fine-grained analysis of model processes and its comparison with observed human cognitive and behavioural processes.

4 Conclusions

The papers in this special issue highlight a number of methodological advances, and are particularly valuable in showing how these methods may be employed to uncover salient but under-researched phenomena in the domain of emergency management. We thank the authors for their contributions and look forward to future research that both builds upon and diversifies this work.

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