# Critical Aspects of Early-Phase Response Work and its Consequences for Digital Event-Log Systems

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## ABSTRACT

This paper reports from a study focusing on documentation practice in emergency and crisis response work. Specific focus is put on how information is produced and used in the time-critical setting of a situation room part of a command center at a local fire and rescue services. The study uncovers critical aspects of early-phase response work and its potential consequences for digital event-log systems for supporting documentation and reporting. The findings show that fundamental and important information are produced outside of the formal event-log based documentation systems and not as an embedded and integrated activity of using these systems. The analysis shows existing information technology in use lack important functionality in order to contribute to an event-log based system design as suggested in the DERMIS-framework.

### Keywords

Documentation practice, event-logs, interaction technologies, ethnography, fire and rescue services.

## INTRODUCTION

In the last ten years, professional response organizations have invested heavily in information technology to provide better means to communicate and stay updated in dynamic response work. Robust radio-systems (Balachandran, Budka, Chu, Doumi, Kang, 2006) and mobile systems are in place connecting vehicles and command center environments (Meissner, Luckenbach, Risse, Kirste, Kirchner, 2002) giving the response actors detailed information about locations, buildings, potential risks and available resources.

Advance dispatch and resource management systems have been deployed in order to maintain efficiency and flexibility in complex crises situations. Interactive whiteboards, digital pens (Khalilbeigi, Bradler, Schweizer, Probst, Steimle, 2010) video systems (Bergstrand & Landgren, 2009) and network enabled reporting systems are not uncommon applications in situation rooms in order to stay connected with other agencies and share information across organizational boarders.

This technology driven diffusion of an impressive range of emergency and crisis response systems has been made with the ultimate goal of digitizing almost any aspect of the operational, tactical and strategic management of emergency and crisis response. The digitalization has been driven by an underlying assumption that response actors will have better abilities to maintain a correct perception of reality and be in control if information is stored in computerized systems. During the last few years, Swedish Emergency Management Authorities has made significant investments in building situation rooms and equipping such work settings with advanced information technologies, such as digital whiteboards, video walls, video conference systems. Further, new event-log based applications have been developed in order to support documentation and reporting during ongoing incidents. These initiatives have been characterized by technology-push with little analysis of the actual work and needs of information technology support in situation room contexts.

This paper present findings from a study of how information is produced and used in command center settings and specifically situation rooms. The aim of this paper is make visible the conflict between providing formal event-logging and the use of a range of digital and non-digital artifacts to make sense in early phase response

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work. In early phase response work, core response organizations will all face the problem of mobilizing an immediate response, making sense of what is going on, and formally document their decisions and actions. This paper argues that despite the availability of sophisticated technology for event-logging, in early phase response work people will be more oriented at making sense of the situation rather than documenting the situation in event logs.

## FORMAL DOCUMENTATION AND EVENT-LOGGING

The need for specific systems for formal documentation and event-logging is driven by legal requirements that key actions in response work must be formally documented. In addition, documentation of key activities is also important in order manage complex response work that involves several organizations or response work that will go on for an extensive period of time.

In Sweden, formal documentation and event-logging systems are developed and provided by the Swedish Contingency Agency (aka Swedish Emergency Management Agency). These systems are used by response personnel to document activities have taken place during the response work. These systems are designed for use both during and after an incident.

Such formal systems have strong links to core constructs and design principles presented by Turoff, Chumer, Van de Walle, Yao (2004) in the DERMIS-framework. The DERMIS-framework is informed by insights about emergency and crisis response in United States of America from the 1950s to the aftermath of the 9/11 events in 2001. DERMIS address functionality requirements of software used by people working on planning and executing the emergency response management function. It outlines a set of important design principles for an information system aiming to support local, regional as well as national emergency and crisis response efforts.

A fundamental component in DERMIS is the event-log. An event-log is a computerized construct "a dynamic evolving record of what is happening as the events of the emergency unfold" (Turoff et al, 2004). Each responder should have access to the event-log and use it as an evolving roadmap of the emergency, providing access to all the associated trails being blazed by the resulting actions. Further, by clicking on items in the logs, responders will be able to add or modify the content and by doing so contribute to the list of activities describing the response work. The evolving event-log will become an important resource during response work as well as in post-incident analysis.

## RESEARCH SETTING

This paper focuses on the work in a situation room part of a command center at a local Fire and Rescue Services in Sweden. The incident in focus in this paper required mobilization of additional command centre staff to work in the situation room. Such mobilization is a common procedure when a Fire & Rescue Services faces an incident that has the potential to evolve over several hours. The work setting in the situation room at a command center is to some extent an extreme environment in terms of available information technology. The assembly of artifacts ranges from trivial pen and paper technology, to fixed-line and mobile phones, desktop computers and laptops. The walls are decorated with whiteboards, digital whiteboards and large-scale video walls. In the center of the room is a large conference-table with power-sockets and video-projector connectors. Along the walls are groups of tables arranged as stations for different workgroups. The goal of the work conducted in a situation room is to maintain a good understanding of how the specific incident is developing and how the organizations capability to maintain strategic preparedness is affected. This means that the work in the situation room is oriented towards establishing a balance between the requirements of the specific incident or in some cases multiple incidents while at the same time making sure that the overall response capacity is not severely affected.

This specific incident engaged four people in the situation room, the chief of staff and three subordinated staff-members.

## METHOD

This paper reports from a study focusing on documentation practice in emergency and crisis response work. The study is based on a qualitative approach (Patton, 1990) inspired by ethnographical field work (Hammersley & Atkinson, 1995) with participant observation and interviews as the primary data collection techniques. The goal has been to get rich and deep descriptions of how documentation is managed as part of response work.

For the incident reported on in this paper, primary data collection techniques included observation, informal interviews and document analysis. The author was alerted of the incident via SMS from the fire and rescue

services and arrived to the command center 12 minutes later. The observations conducted at the command center cover 3 hours of work. Observations and informal interviews with four staff-members and 2 operators were documented as field notes in a paper notebook and these notes were later transcribed. 8 episodes of the work were captured using an ordinary mobile phone. These video sequences (about 60 sec each) covered conversations between the personnel and their interaction with technology. These episodes has been transcribed and analyzed. A selection of documents, artifacts and people were also photographed in order to provide rich material for detailed analysis. Documents and illustrations used and produced by the personnel during the incident have also been collected and formed the basis for an ethnography of the work in the situation room. Follow-up interviews were made with four professionals working as chief of staff regarding their perspective on the role of formal documentation. Collected data was analyzed to build a time-line as well as characterizing themes of the production and use of information in situation room work. The analysis was later transferred into an ethnographic text describing the work at the command center and situation room.

The ethnography was analyzed using procedures of sensemaking (Weick, 1985;1995) as an analytical lens. The analysis focused on how the responders used available information from information systems and how information was produced to manage the evolving situation. The ethnography is not presented in this paper due to limitations of space.

## FINDINGS

The analysis resulted in three important aspects that characterize the work in the situation room. These aspects are; high degree of ephemeral information, visible and collective production of information, and limited use of formal documentation.

### High degree of ephemeral information

A situation room is a communication intensive context where professionals are engaged in a form of ongoing verbal conversations in dyadic or group structures. The conversations serve the purpose to both exchange new insights about specific aspects of the evolving situation, but also as a ground for exploratory interpretations of short-term future directions of the response work. Excerpt from the ethnography:

The ongoing incident at the old TV-house is resource intensive and the staff in the situation room receives only vague reports on how many resources that will be needed onward. Sam, a staff-member working with the logistics scribbles down on a piece of paper, the unit-numbers that are currently assigned to the incident. He transfers this list onto a traditional whiteboard. Over a period of 30 minutes Sam discusses in brief interactions, with other staff-members, how the strategic preparedness is affected and how the re-supply schedule could be formed. A whiteboard is used to sketch a simplified map of all the firehouses in the region in order to structure the re-allocation of available units.

Fragments of the verbal conversations are materialized as paper-notes or simplified representations on whiteboards. The ration between what is verbally expressed and what is captured in paper notes is difficult to determine. However, the study indicates that a large portion of the critical discussions that take place does not result in any formal event-logging concerning what was discussed or any of the related actions of the discussion

### Visible and collective production of information

Interactive whiteboards, traditional non-digital whiteboards, as well as pen and paper were key information infrastructures during the work in the situation room. The use of the whiteboards and the video wall provided an openness and visibility of fundamental incident information. Excerpt from the ethnography:

The chief of staff points at the digital whiteboard and explains to a newly arrived staff member. "- We got the alarm at 19:53, I have been able to plot these topics that we need to deal with." He browses through the topics by using his finger on the touch-screen. The text on

the screen is handwritten and outlines the resources currently assigned and a list of tasks that the staff member now must start to deal with.

This short briefing triggered a set of questions from the staff member. The chief of staff then used the existing notes on a whiteboard to re-iterate and discuss the questions. The whiteboards enabled them to collectively use the fragmented information and formulate starting points for the work of the staff member. Wall size projections seems to provide visibility of available information and enable the personnel to talk, point and interact collectively, interpret the meaning of specific issues and rapidly visualize lines of thought.

#### Limited use of formal documentation.

At various occasions during response work, the chief of staff reminded the group to document their actions in the formal documentation and reporting system. According to the post-incident feedback from the chief of staff, such documentation could have been more extensively done. The following excerpt directed to the author illustrates the conflict between knowing that documentation is important and actually being able to document:

"I am sorry, tonight we did not succeed in documenting as well as we could have."

However, the Chief of staff underlines that this particular task could have been better communicated. This specific incident is not an exception in terms of the ability to provide formal documentation as part of the response work. Based on in interviews with chief's of staff, there is a shared experience that formal documentation is of less focus during the most intense periods of incident response work. Still, the do also express explicit reasons why it is important to produce documentation during response work, such as:

"It is important for us to document so we later on can go back and see what has been done."

"It is good to have documentation if someone else wants to read what happened."

These rational reasons why documentation is important fits well into the conception that emergency and crisis response is critical and should therefore be documented in such a way that it open up for constructive reviews. However, when we follow up and ask senior commanders if they "go back" and use documentation according to the rational reasons expressed, the answer is in a majority of cases negative. For most of the time, documentation of response work is seldom used for constructive reviews or reflections.

## DISCUSSION

Based on the findings presented in this paper, we argue that there is a conflict between how professionals work in emergency and crisis response situations and the way current information systems support such work. This is specifically the case concerning how information is used and produced in relation to the assumption that event-logging is a key activity in such work.

This study shows that information technology used in a situation room lack important functionality in order to contribute to an event-log based system design as suggested in the DERMIS-framework (Turoff et al, 2004). The personnel working in situation rooms use a range of digital and non-digital artifacts in order to bring forward and re-represent information in a fluid format that make the information possible to work with it. Only limited time is spent on using the formal documentation systems to log decisions or describe what is going on.

The production of information is oriented on materializing important aspects of the situation in order to make it meaningful. The level of uncertainty and the amount of incomplete information form the very actions of the involved personnel to socially construct their view of what they are facing. The information produced and used in this work are manifestations of sensemaking (Weick, 1985). The information objects are socially constructed and their validity is dependent on how well the group of people is able to draw meaning from them.

This means that the validity of these objects must be continuously maintained in order not to degrade into just meaningless notes and poorly made whiteboard drawings. In order to do so, less formalized technology support seems to provide better support for these actions compared to technology support that require the personnel to formulate specific and detailed textual descriptions which too often is the case in event-log based systems.

In such very early stage of response work as presented in this paper, current system support that is based on an event-log construct provide little value in order to address important topics of an escalating situation. The study shows that fundamental and important information are produced outside of the formal documentation systems and not as an embedded and integrated activity of using these systems. This means that even if such systems have excellent support for event-logging, there is a significant risk that only limited amounts of information will be transferred into these systems.

A major reason to this problem is related to the lack of functionality in the various artifacts used for producing information, to add or transfer such information to the event-based logging systems. The range of digital and non-digital artifacts used for producing and using information to make sense in the early-phases of response work restricts the flow of information to the event-log systems. A second reason is that event-log based systems tend to lack support for the openness and flexibility necessary when describing uncertain and dynamic situations.

The study has presented findings of real-world response work that highlights some complex challenges that needs to be addressed in order to fulfill the vision outlined in the DERMIS-framework (Turoff et al, 2004). In general, the use of an event-log construct is favorable when designing system support for emergency and crisis response. However, there are major challenges that must be addressed when it comes to design mechanisms that allow information produced, using a range of different digital and non-digital artifacts, to become available in the event-log. Neglecting the need for such mechanism will result in event-log based systems with limited or no log entries.

## CONCLUSION

This paper has presented ethnographic episodes of early phase response work conducted in a situation room at a local fire and rescue service. The analysis shows that information technology used in a situation room lack important functionality in order to contribute to an event-log based system design as suggested in the DERMIS-framework. The study shows that important information are produced outside of the event-log based formal documentation systems and not as an embedded activity of using these systems. This means that even if such systems have excellent support for event-logging, there is a significant risk that only limited information will be transferred into these systems.

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## REFERENCES

1. Balachandran, K., Budka, K.C., Chu, T.P., Doumi, T.L., Kang, J.H. (2006). Mobile responder communication networks for public safety. Communications Magazine, IEEE 44(1): 56-64.
2. Bergstrand, F & Landgren, J. (2009) Information sharing using live video in emergency response work. Proceedings of the 6th International ISCRAM Conference – Gothenburg, Sweden, May 2009.
3. Hammersley, M., & Atkinson, P. (1995). Ethnography (second ed.). London: Routledge.
4. Khalilbeigi, M., Bradler, D., Schweizer, I., Probst, F., Steimle, J. (2010) Towards Computer Support of Paper Workflows in Emergency Management. Proceedings of the 7th International ISCRAM Conference – Seattle, USA, May 2010
5. Meissner, A., Luckenbach, T., Risse, T., Kirste, T., Kirchneret, H. (2002). Design Challenges for an Integrated Disaster Management Communication and Information System The First IEEE Workshop on Disaster Recovery Networks (DIREN 2002), New York City.
6. Patton, M. Q. (1990). Qualitative Evaluation and Research Methods. London, United Kingdom, SAGE Publications.
7. Turoff, M., Chumer, M,. Van de Walle, B,. Yao, X. (2004). The Design of a Dynamic Emergency Response Management Information Systems (DERMIS). Journal of Information Technology Theory and Application 5(4).
8. Weick, K. (1995) Sensemaking in organisations. Thousand Oaks, SAGE Publications Inc.
9. Weick, K (1985) Cosmos vs. Chaos: Sense and Nonsense in Electronic Contexts. Organizational Dynamics, 14(2), 51-64.