

FIRE CREW ENROUTE SENSEMAKING IN EMERGENCY RESPONSE

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Abstract: Reconstruction of major emergencies and crisis as well as observations of large-scale emergency exercises are common approaches for studying and understanding various actors work practice in emergency response. Studies of small-scale emergencies using an ethnographic approach are less common. This paper presents data from a single small-scale emergency as part of an extensive ethnographical field study. A detailed analysis of fire crew enroute sensemaking in a single small-scale emergency is outlined. The theory of sensemaking is applied as an analytical lens aiming to explain the communication between the command centre operator and the fire crew in terms of sensemaking. Further, implications for re-design of existing systems and infrastructure are presented as well as brief reflections of the consequences of such re-design.

1 INTRODUCTION

Studies of sensemaking in the context of emergency response in major accidents and crisis have shown the importance of analysing the organisational and social processes affecting the actions of the involved actors (Weick, 1988, 1993). Major accidents and crisis has been the primary focus for understanding sensemaking in emergency response but little attention has been paid to small emergencies. A small emergency could quickly develop into a major crisis if not dealt with adequately. It is therefore advocated in this paper to focus on the sensemaking process in small-scale emergencies and specifically how enroute sensemaking is affected by limited and ambiguous information, potentially leading to undesirable results. This paper examines the sensemaking process of a fire crew enroute to an incident, using data from one emergency. Implications for re-design of current information systems and technology infrastructure at the fire and rescue services is elaborated.

1. RELATED WORK

Studies of emergency response have a strong tradition to a focus on individual and team decision-

making. Several studies have explored commander decision making in demanding incidents (Klein, Calderwood, Clinto-Cirocco, 1988; Burke, Hendry, 1997) using the critical decision method. The aim has been to understand decision-making in field settings and the method of doing this has been retrospective interviews. Studies of radio talk in large-scale emergency response exercises have focused on the effects by task-specific factors and situation specific factors on the communication pattern between key emergency management team members (Dunn, Lewandowsky, Kirsner, 2002). Studies of commander improvisation in emergency response (Mendoca, Berroggi 2001) have used exercises in field settings to inform the design of decision support systems for field settings. Studies of real everyday work of fire crews and small-scale emergencies have not gained much attention.

2. METHOD

This paper reports from an ongoing extensive field study of every day work at communal fire and rescue services in Sweden. The field study has been conducted using an ethnographical approach (see for instance Hammersley & Atkinson. 1995) where approximately 740 hours of participant observations with fire crews has been conducted. Almost nine hours of video ethnography (Pink, 2002) have also been collected. In this setting the author has gained access and acceptance of the fire crew and

participated on equal terms in the fire crew activities on both day and night shifts. When responding to alarms the author has used the mandatory protective clothing. Studying a group of people has presented some difficulties especially on alarms where the crew during enroute are distributed over two vehicles and the author have had his position on the second ladder vehicle, unable to observing the activities in the first rescue vehicle. In order to capture the work practice in the first rescue vehicle during enroute, a video camera has been mounted on the vehicle dashboard pointing inward in the vehicle. The incident commander has started the video camera directly when he got seated. The accident site is also a challenging setting for participant observations where the fire crew are geographically distributed and the danger and intensity of work to some degree restrict the observer's possibilities to collect data. Field notes has in many cases been written down after the fire crew has left the incident site or back at the fire station.

The combination of transcribed field notes and video recordings have been used to triangulate the analysis. Using video data has provided a rich material otherwise difficult to collect and analyse on a micro-level. Transcribed field notes have provided material to analyse and understand the context.

The incident presented in this paper has been selected from a larger collection of observations and video recordings and is a good representation of the many minor daily incidents that constitute the majority of alarms for fire crews in Sweden. The difficulties confronted in this incident reveal the actor's efforts to make sense of the situation.

3. THEORY

The theory of sensemaking has here been applied as an analytical lens. The objective is not to contribute to the sensemaking domain but to use the theory to explain aspects of the fire crew work practice. Sensemaking is defined as; "reality is an on-going accomplishment that emerge from efforts to create order and make retrospective sense of what occurs" (Weick, 2001, p.11). Further "Sensemaking is focused on those actions around which the strongest commitment forms" (Ibid, p.26). Sensemaking can be seen as a process of committed interpretation, where commitment binds the individual to his behavior and influences the individual's further sensemaking. Committed action determines the scope of interpretation by focusing on those cues that suggest potential justification of that committed action. Commitment is an additive process resulting in a situation where new

justifications and meanings slowly emerge due to their ground in old meanings that are to some degree persistent even if they are outdated. This means that to make sense, people as actors in a social context will interact and make committed actions based on a cues that help them to justify their actions in that particular social context.

Focus of the analysis is the conversation between the operator, incident commander and the fire crew where commitment, cues and justification affect the behaviour of the fire crew.

4. RESULT

The setting reported from in this paper is a fire crew in a suburban district in a major city in Sweden. The fire crew consist of six firemen, two commanders, one fire crew foreman and one incident commander (IC), making a total of seven people. In the incident examined here, the fire crew is dispatched by the command centre operator (CCO) and use the rescue vehicle (411) and the ladder vehicle (413).

The incident starts when a person have called the national emergency organisation and reported a fire in what is understood as an electrical power station. The command centre operator who received the call dispatches the fire crew.

Due to the vague location description by the caller, the CCO and IC face problems to determine the location. The CCO contacts the energy company. Information from the energy company influences the fire crew's actions and understanding of the incident. Further and not part of the scope of this paper, the fire crew arrives to the perceived location. The fire crew is unable to use the desired approach route forcing the IC to walk to the object and the driver to choose an alternative approach route. In retrospect it was shown that this incident did not involve a fire in a electrical power station, but a person having started a fire in his fire stove in a garage. The fire crew where not at the location of the electrical power station.

Two broad themes of the sense-making process have been identified: Sensemaking regarding location and type of incident, and Sensemaking regarding scale of accident. In this paper only the first theme will be further elaborated.

The recorded video data outlines the communication between the command centre operator (CCO), the incident commander, the fire crew foreman and the remaining firemen. The fire

crew is divided in two vehicles, rescue vehicle (411) and the ladder vehicle (413) with two firemen. The observations have been divided in two parts with subsequent detailed analysis.

4.1 Sequence A

This sequence shows how the involved actors are trying to understand and define the location of the incident and type of incident. The sequence starts when the fire crew just have left the fire station and the IC establishes contact with the command centre.

#	Time	Actor	Conversation ¹
01	0.00	IC:	<i>Four-eleven (411), one-one-three, we are heading for Nuevo-hotel</i>
02	0.05	CCO:	<i>Okay, four-eleven (411), behind Nuevo-hotel along the cycle way there is an electricity-house, says the caller, and there is smoke. You will have eighty-six adam. Over eighty-six adam...what company or address did you say?</i>
04	0.20	IC:	<i>you have to decide yourself, John</i>
03	0.31	Fireman:	<i>no...along the cycle way behind Nuevo-hotel, there is some...a large...an electricity-house...with smoke coming out...contact the energy-company to hear if they have something there</i>
06	0.32	CCO:	<i>drive to the backside,when you pass the OceanStore</i>
05	0.36	Foreman:	<i>Okay</i>
07	0.41	Driver (John)	<i>Sounds good...and you take contact with the</i>
08	0.50	IC:	

09	0.54	CCO:	<i>energy company I'll do that, Andrew</i>
10	1.03	IC:	<i>I do not understand what company he is talking about...but...</i>
11	1.07	Foreman:	<i>But we should drive behind the apartments...on the backside</i>
12	1.20	IC:	<i>Yeah, there is that...that entrance gate</i>
13	1.28	IC:	<i>It will be goblin steps</i>
14	1.30	Fireman:	<i>Yes</i>
15	1.38	IC:	<i>If there is ground current you should not take any big steps [laugh]</i>

4.1.1 Defining the location using reference points

The location of the incident is by the caller described vaguely making it difficult for the CCO to provide a distinct location to the IC. In parallel to the CCO and IC conversation, the foreman gives route directions to the driver based on very limited information. The ambiguity of the provided information by the CCO is highlighted by the IC's response requesting company name or street address, which is the standard method to define an incident location. The reaction from the CCO is an accentuation and repetition of the preceding information. The CCO is at this moment in a troublesome position where he is unable to deliver requested information to the IC. A solution is immediately formed by the CCO when telling the IC that contact will be taken with the energy company, to find out if they have something in the area. The IC supports this action and confirms that the CCO shall make the contact. This conversation (line 06,08,09) shows how the interaction between the IC and CCO results in a commitment, a commitment to take contact with the energy company. This commitment will have implications on the following actions presented in sequence B.

When the conversation with the CCO ends, the IC turns to the foreman in the back seat compartment, expressing that he does not understand which company the CCO refers to. The interpretation of this is that the IC has a company as a reference point different to "Nuevo-hotel" and "along the cycle-way" being the compound reference point for the CCO. The foreman expresses his understanding of the intended location and

¹ Text in *italics* represents talk over radio

describes where they should proceed, without mentioning a company as a reference point but instead a selection of buildings. The IC responds by mentioning the existence of an entrance gate corresponding to the location presented by the foreman. What is shown here is how the IC and the foreman uses their knowledge about the area and based on each other descriptions extract cues that frame their understanding. In this particular case, the IC changes reference point from an undefined company to a very detailed reference point consisting of a gate in the local area.

4.1.2 Describing type of incident

In the opening conversation (line 02), the CCO describes the type of incident by saying “electricity-house” and “there is smoke” and declaring that this is information provided by the caller. The explicit reference that the information is what the caller has expressed implies that this information could be unreliable. In the conversation (line 06), following the IC’s question regarding company or address, the CCO adds the description “there is some...a large..an electricity house...with smoke coming out”. The term “electricity house” indicates that this incident concerns a fire in an electrical power station. However, the hesitation in the CCO’s description of the constitution of the building makes potentially this information uncertain. But, the joke made by the IC (line 13) referring to potential dangers with ground current shows that the IC has framed his understanding of the incident type.

The interpretation of how the CCO and IC talk about type of incident suggests a serial sequence where type of incident is subordinate to establishing a well-defined location description. Meaning that it is more important to determine the correct location rather than establishing an understanding what will face the fire crew up on arrival. The fire crew will be able to respond to almost any incident but this requires them to know where to go.

5. SEQUENCE B

This sequence shows have the information obtained in the contact with the energy company affects the actions of the fire crew.

#	Time	Actor	Conversation ²
16	2.31	CCO:	<i>411 to, 400 over</i>
17	2.35	IC:	<i>411 responds</i>
18	2.37	CCO:	<i>I have talked to the energy company, it is the case that they have an electrical power station on the backside at Jellyfishstreet behind Nuevo-hotel and he will send a guy, over</i>
19	2.51	IC:	<i>That’s great, then I will know, over</i>
20	2.53	CCO:	<i>That’s acknowledged, over and out</i>
21	2.58	IC:	<i>Did you hear that a guy from the energy company is also on his way</i>
22	3.02	Foreman:	Electrical power station, or?
23	3.04	IC:	Yes
...			
24	3.17	Driver:	Should go...could come that way too, thought if you drove round there and in there
25	3.22	IC:	yes...
26	3.23	IC:	Think we shall do that
27	3.24	Driver:	Yes it feel so
28	3.25	IC:	Enter Jellyfish street instead
29	3.26	Driver:	Yes, it feels more [right]
30	3.27	IC:	We’ll do that
31	3.31	IC:	413, we enter at Jellyfish street
32	3.35	413:	That’s acknowledged

5.1.1 Emerging information affects initial understanding

After two minutes the CCO calls for the IC’s attention and explains the he has talked to the energy

² Text in *italics* represents talk over radio.

company and that they have an electrical power station on Jellyfish Street behind Nuevo-hotel.

The CCO also informs the IC that the energy company is sending a person to the location. In this conversation the CCO have switched terminology from “electricity-house” to “electrical power station”. The IC does not comment the shift of terminology but responds to the new information with the general expression “that’s great, then I will know”.

Immediately after, the IC turns to the firemen and foreman in the backseat compartment and says in a question-like phrase if they heard that the energy company sent a guy. The response by the foreman is a new question “electrical power station, or?” to which the answer of the IC is “yes”. What is shown here is a committing act where the IC and foreman socially define the incident type as a fire in an electrical power station. This committing act defines the context and has effects on following actions.

Moments before the fire crew approaches a road intersection the driver and IC negotiate an alteration (line 24) to the initial route choice that corresponds to the newly established understanding that Jellyfish Street is the incident location. Prior to the contact with the energy company, Jellyfish Street was never discussed. It could therefore be stated that the alteration of the route choice is a justification of the previous committed act by the IC and foreman.

5.1.2 Preferential right of interpretation

What is evident in sequence B is how the fire crew and specifically the IC and foreman and not the CCO, have the preferential right of interpretation. The CCO has never expressed that the incident concerns a fire in an electrical-power station at Jellyfish Street. However the interpretation of the CCO’s actions has pointed the IC and foreman in this direction. The preferential right of interpretation is never explicitly expressed but becomes visible in the actions of the IC and foreman.

6. DISCUSSION

The analysis reveals how the initial and vague information incorrectly framed the actors following actions and understanding of the situation. In the chain of interaction it is evident that commitment binds the actors to their actions. Once contact was made with the energy company it became severely hard to ignore the received information. The information flow was suffering of a filtering effect

where the IC had to rely on second hand information, becoming third hand information when it reached the fire crew. All information delivered from the CCO was obtained in conversations with external actors; the caller, and the person at the energy company. The filtering effect of the information in this communication chain and the inability of the IC to ask further questions to these actors could partly explain the result of the sense making efforts. Only one information channel delivered information. The lack of other complementary information channels restricted the fire crews ability to validate and finding inconsistencies. Understanding that the fire crew and not the CCO have the preferential right of interpretation elucidate the problem of information retrieval and delivery.

The analysis reveals how committed action creates the context for interpretation by narrowing the actors’ focus to a subset of cues in the available information that suggest reasonable justification of those actions. Based on the analysis a set of implications for re-design will be presented in the next section.

7. IMPLICATIONS FOR RE-DESIGN

Providing information technology to the fire crew will not only have consequences for the fire crew but for parts of the entire emergency management system. In this section, a set of functionality of information technology for the fire crew will be suggested and implications for the command and control structure will be briefly elaborated.

IT aiming at supporting fire crew enroute sensemaking is suggested to focus on functionality that provides complementary information from alternative sources, as well as direct access to first hand information. The objective is to provide richer information not more information. Rich complementary information would extend the range of possible cues for the sensemaking process, making the fire crew more capable to find inconsistencies in portions of the delivered information. Complementary information could constitute of interactive digital maps with enriched contextual location information from sensory systems such as fire alarm and surveillance camera installations. Having access to enriched contextual information represented on interactive digital maps have the potential to better support the practice of using reference points to make sense of the location.

Functionality should provide access for the fire crew to first hand information to the caller as well as from other actors. This does not imply that the incident commander should handle the administrative efforts to make contact or do the conversation, rather an ability to listen-in. A fundamental aspect in providing information technology to the fire crew is to improve collaborative support in the command and control structure.

Using information technology as proposed above have the potential to focus the conversation between the command centre operator and the incident commander on the available information instead of spending time to deliver the information by voice. This means that these two actors could have more time to make sense of the information. Having access to digital information would extend the possibilities to share this information with the entire fire crew.

The suggested functionality requires re-design of the information technology and information systems of the fire and rescue services. Existing geographical information systems existing only at the command centre must be deployed for the fire crew. This will have implications on the current network infrastructure requiring improved network capacity. Command centre applications cannot be pushed into the field setting without major modifications of the user interfaces to better correspond to the work conditions and user needs in a rescue vehicle and on the incident location. The fire and rescue services must also provide interfaces for external providers of sensory data.

Further, the voice-communication infrastructure must be able to integrate and manage a variety of communication channels such as radio-, mobile phone-, and fixed telephone-traffic. Such integration would enable the first responders to take part of information directly from the source instead of having to rely on other actors' ability to filter and mediate essential information.

The suggested functionality has potential to improve the fire crew's work during enroute. But these issues are not only a matter of technology re-design but a re-design of portions of the emergency management system. Providing collaborative functionality to the command centre operator and the incident commander will have consequences on their role specific tasks. Giving the fire crew access to incident information during enroute will change their relation to the incident commander currently mediating such information. Providing the suggested information technology will also have structural effects on the current command control hierarchy. Over time the work in the command centre will due to information technology improvements potentially

change from a command and control function to resemble more to an information broker service.

8. CONCLUSIONS

This paper has presented an analysis of fire crew enroute sensemaking based on the theory of sensemaking. Implications for re-design have been presented, suggesting a need of complementary information, direct access to first hand information, and improved collaborative functionality between the command centre operators and the fire crew. The consequences of the suggested information technology improvements have been briefly elaborated. However, what the exact consequences will be and the effect it will have on structure, roles, responsibilities are severely hard to foresee. Therefore, all technology re-design in this domain must be done with reflection and be driven by a clear objective to enhance the ability of the actors and not driven from a technology perspective.

9. REFERENCES

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