

Perceptions and performances of experienced incident commanders

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Rescue operations have been organized in accordance with strict hierarchical management structures for decades. There seem to be minor differences between emergency response units within and between countries with respect to formalized routines and command structure. This presupposes that the incident commander is important for the emergency response performance and the actual outcome of the crisis. This paper presents findings from a study carried out in Norway, Sweden and Bosnia-Herzegovina, designed to reveal the assessments carried out by incident commanders and other professional leaders of emergency response units, the police, paramedics and fire brigade. The study encompasses aspects of naturalistic decision making in the different accident response phases. On call-out, the leaders constructed their mental maps of the situations from a combination of information from the call center, knowledge of standard procedures, their expectation of available resources and personal knowledge of the site. Typical management strategies involved incremental problem solving within narrow time horizons. The incident commanders were more concerned with details than with evaluating the overall situation. In general, the commanders expected normal situations, i.e. typical accidents they were trained to cope with and in response to which their preparations and strategies were standard. Our study shows that these incident command strategies are more reactive than proactive, and that the commanders rarely command. Risk management is limited to evaluations of the response units' safety.

Keywords: emergency management; rescue operations; incident commander; naturalistic decision making; uncertainty

Introduction

In recent decades, societies have become more focused on disasters, being risk societies (Beck 1992). The world is becoming increasingly complex with tight couplings between infrastructures, systems and geographical areas (Perrow 1999). Incidents with major consequences occur frequently worldwide and if the incident is of sufficient magnitude, the media broadcast it live with direct observations of the performances of emergency responders and the victims. Disasters and accidents, both minor and major, are unexpected, unplanned, unprecedented and unpleasant for the victims (Rosenthal, Boin, and Comfort 2001).

Every society has some sort of emergency management systems, although there are differences in what is regarded as acceptable or sufficient. In a crisis, the need for prompt action from various response units is obvious. Rescuers respond to emergency situations that are unique, and decision making on scene an accident is context bound, embedded in ever-changing environments. Decisions in action therefore sometimes involve large uncertainty. The decision-making situation is characterized by critical choices, as Rosenthal (1986) puts it, 'a serious threat to basic

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structures or the fundamental values and norms of a social system, which – under time pressure and highly uncertain circumstances – necessitates making critical decisions'. A decision is a commitment to an action that is intended to yield satisfying states of affairs for particular parties, called the beneficiaries of that action (Yates 2003). The action is distinguished from the decision itself, but the intention emphasizes the deliberate commitment of the decision maker to the achievement of important goals for targeted beneficiaries (victims, stakeholders, themselves). It is widely acknowledged that the incident commander's decision making on scene is important for the outcome. A typical incident rescue organization is depicted in Figure 1.

Figure 1 presents the Norwegian emergency management organization, emphasizing the sharp end structure. Some main communication lines are shown as arrows, being important means of decision support for the incident commander and the operation leaders. The management structure remains the same for all types of incidents, assuming the incident commander as having the holistic view of the situation. The incident commander is a nominated police officer normally reporting to the local rescue centers or rescue sub-centers, headed by the Chief of Police.¹ The system is intended to be flexible in accordance with the demands of the particular crisis situation. If a situation includes injuries to people, environmental spills or energy out of control, and the situation is long lasting requiring a number of simultaneous responses, all parties in Figure 1 would be in action. In this paper, we do not distinguish between the four leader-categories depicted in Figure 1, because they are all responsible for parts of the crisis management. The collective term is *incident commander*.

In order to ensure self-protection and to optimize life-saving achievements and damage mitigation activities, the rescuers' competence must span from automatic

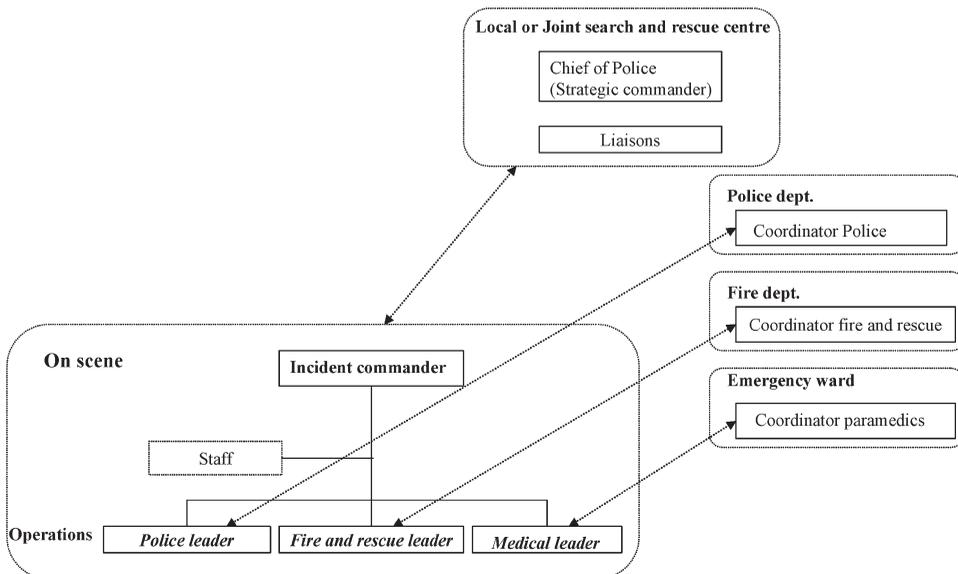


Figure 1. The Norwegian incident command system: basic functional structure (Police Directorate 2007).

skill-based behavior to problem-solving knowledge-based behavior. The incident commander orchestrates the overall response effort, maintaining the hierarchical command structure on scene. The overall responsibilities placed upon the incident commander may include legal, contractual, political and moral responsibilities. In practical terms, the incident commander is responsible for directing, prioritizing and controlling available personnel and resources within the context of the situation and the formalized operational plan. Even though operational command and decision making in emergencies are complex activities, some common emergency phase patterns can be outlined, cf. Figure 2.

Alarm is the time from when the commander is notified until he is on his way to the incident. The response units are normally called out by use of internal loudspeaker, radio calling, cell phone or pager. The leader has normally less than two minutes to process information, assess and make decisions before leaving the station.

En route the accident, time could theoretically be spent on preparation, for example, to request more resources, ask for more information, communicate with the call center and other response units, or discuss the task with crew members. In practice, however, this time is more typically spent on giving directions to the driver, thus curtailing any opportunity to reflect, assess and plan.

Arrival on scene the accident includes the time when the commander arrives at the scene, parks the engine, gets out and initially sizes up the situation. An initial appraisal of the situation, sizing up the situation, is critical in order to assess its extent and escalation potential. However, the commander has normally less than two minutes at this stage and his use of the time will be influenced by the immediate incident area and the level of chaos. For example, casualties complicate the situation since they need immediate response upon the rescuers' arrival.

The **response** phase can last for hours or days, but normally, the critical period is less than an hour. The critical period is delimited by the rescue potential, the time in which the rescue units can save lives or mitigate other damage. The phase is characterized by stressful and complex dynamic environments with time pressure, unique and badly structured organizations involving multiple players, critical values at stake, and unclear and competing goals.

This article presents results from a study designed to reveal the incident commander's reasoning and assessment in different challenging situations. Premises related to the theory of naturalistic decision making (NDM) (Flin et al. 1997; Klein et al. 1993; Lipshitz et al. 2001; Salas and Klein 2001; Zsombok and Klein 1997) have guided the research. The recognition primed decision (RPD) model (Klein 1989, 1993) has been chosen as the theoretical perspective for further scrutiny of incident commanders' perceptions and performances in crises, encompassing situation recognition, cues and mental simulation. NDM research is mainly distinguished from traditional decision-making research by its emphasis on studying experienced people such as fireground commanders, airline pilots and police officers, and using

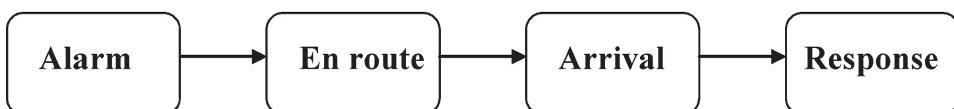


Figure 2. Main phases in emergency response.

realistic task setting, such as traffic accidents, burning buildings and problems in airplane cockpits. The focus is on situation assessment rather than comparison of options. Traditional decision-making research has generally focused on static, well-defined tasks while NDM on the contrary focuses on more realistic dynamic, complex, ill-defined decision problems to be solved in real-time and under time pressure.

The results of this study are presented in terms of the *informal competences* of involved ICs as revealed through their responses to accident situations and their *perceptions of what is related to on scene risk management and successful incident command*.

The study approach

Based on the assumption that leadership is vital, the study was designed to reveal how incident commanders and professional leaders on accident scenes considered and responded to scenarios presenting serious threats and requiring urgent responses. Furthermore, the commanders' approaches to dealing with uncertainties in the situation, the escalation potential and the performance of available resources were emphasized. Important issues in the study were: Which decisions did the incident commanders make? Did the commanders mentally simulate the situations and plan their actions in a proactive manner? How did they provide information during the different phases? What indicators were regarded as important for successful management of rescue operations? How did different commanders perceive the concept of risk and risk management? Neither the incident commanders in the police nor those in the fire brigades have substantial experience from large incidents. Such moments will encompass novelty and different kinds of uncertainties.

Figure 3 depicts the relationships between the researchers and the respondents. The researchers 'constructed' or observed situations (S) that were 'thrown' at the respondents. All the respondents were male and they were experienced incident commanders. The ICs were both observed and interviewed in relation to real scenarios or they were interviewed applying a hypothetical scenario. The data material includes 28 interviews based on hypothetical scenarios and 22 real time

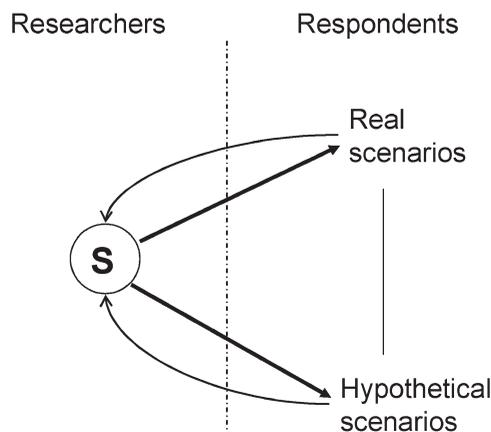


Figure 3. Issues and structure of the study approach.

participant observations,² of which 17 occurred in Norway (Stavanger region) and five in Sweden (Malmö).

The hypothetical situation interviews were informal and semi-structured. They were all based on an accident scenario in which each commander would be under great pressure. The scenario was a fire in a large discotheque/public place in the region. Some adaptations were made to familiarize the respondent with his actual location. The scenario consisted of well-known challenges: the lives of young people at stake, uncertain course of the event, time pressure and multiple rescue units on scene. The scenario was divided into four phases: alarm, en route, arrival on scene and the emergency response. During the progress of the scenario, it was important to keep the available level of information as realistic as possible. The respondents were asked to comment on their perceptions, reasoning, assessments and presumptions of what decisions they would make based on their specific assumptions of the prevailing conditions.

Different rescue units in Norway³ and Sweden were followed during a two-year period. The events⁴ varied from building fires (1–7), forest fires (10), two minor fires in oil drilling rigs located in a wharf dock (8, 9), traffic accidents (16, 17, 19), scuba diving to rescue persons in a car driven into a canal (18), missing person in a harbour basin (20), industrial accident (22), suicide attempt (21) and five alarms with no need for active response on the scene (11–15). The emergency responses lasted from five minutes to 18 hours, according to the complexity of the situation and the type of response called for, from demanding situations with large uncertainties to ‘normal responses’, in which standard procedures work very well. The ICs were followed from alert until the response unit returned to its station. Decision points/nodes and communication were registered. The focus was on leadership and decision making in the context of the specific scenario/incident. Normally, the commander was interviewed immediately afterwards. The phases depicted in Figure 2 were used to structure the commander’s observations, assessments, decisions and actions (including his own behavior). A secondary goal of this design was to check the consistency between what was said and what was actually done in different contexts. The discrepancies between real cases and responses described for the hypothetical cases were of interest.

Two areas in Norway (Stavanger and Drammen) and one in Sweden (Malmö) were chosen to reveal regional and national differences in services with presumed similar frame conditions. We also conducted five open-ended unstructured interviews with fire chiefs in Bosnia-Herzegovina. The use of these interviews is limited to analyzing how Bosnia-Herzegovina ICs approached uncertainty and risk. Bosnia-Herzegovina was interesting due to its turbulent past with war, horror and constant uncertainty, which threatened the responders as much as the public. The hypothesis was that rescuers in Bosnia-Herzegovina would approach uncertainty in a significantly different way than that of Scandinavian rescuers. Below is a short description of the regions we studied at the time of data gathering:

- *Drammen* is located 60 km from Oslo in the south-eastern part of Norway and contains almost 60,000 inhabitants. The rescue services in the region have slightly different geographic areas of operational responsibility. During the last 10 years, the region has had two serious accidents, of which the explosion in the Bragernes tunnel (DRBV 1999) killing three people (two fire fighters) was the most severe. The bombing of a motorcycle gang quarter (DRBV 1997) was also a serious and demanding event.

- *The Stavanger region*, with approximately 250,000 inhabitants, is located in the south-western part of Norway. In the last 10 years, the region has experienced some demanding and uncertain cases for the rescuers involved: loss of the catamaran *Sleipner*, with 16 fatalities (NoU 2000), a hostage situation in a kindergarten, and an armed robbery of a bank with one police officer shot to death.
- *Malmö* has 250,000 inhabitants and is located in the southern part of Sweden, near Copenhagen (Denmark). In the last 10 years, the region has experienced some demanding and uncertain cases for the rescuers involved, such as a fire in a mosque with violent riots and attacks on rescuers.
- In *Bosnia-Herzegovina*, we collected data from five different professional fire services located in the cities of Banja Luca, Doboj, Brod, Derventa and Sarajevo. These urban centers are in different areas of the country and the number of inhabitants varies from 15,000 to 400,000. During the last 10 years, the major focus has been on recovery and reconstruction of the services after the war. In Sarajevo 13 firemen were killed and 58 injured during the war because of continued bombing and sniper activities. Sarajevo was badly damaged, and treasures like the national library were burnt down. In Brod they had a major fire in an oil refinery (six persons killed). The area is also severely exposed to flooding from the river Sava. In 2004 they had total flooding for a period of 16 days. Forest fires and devastating accidents are in many regions still a problem because of the thousands of mines in the forest floor.

The observed and interviewed Scandinavian emergency responders can be described as professional, well-equipped, educated and trained responders with substantial experience from normal incidents but less from severe incidents. The national differences between first responders' experience were minor.

Table 1 shows the distribution of the interviewees with respect to location and services. Forty individual leaders were interviewed, all of them being male. We also carried out five meetings, which included a total of 10 ICs from Bosnia-Herzegovina.

The commanders taking part in the scenario-based interviews had an average number of years' experience in the response unit=23.9 (SD: 9.3), average age=47.9 (SD: 8.0) and average years as commander=9.4 (SD: 6.7).

The informal competences of the incident commanders

Klein (1993) sees the distinction between experts and novices mainly in terms of the experts' situation assessment abilities, not their general reasoning skills. Klein (1993),

Table 1. Distribution of all interviews (scenario and observations).

	Drammen	Stavanger/ Sandnes	Malmö	Total
Police	2	1	0	3
Ambulance	5	4	1	10
Fire department	7	7	13	27
Total	14	13	14	40

Orasanu and Conolly (1993), Cosgrave (1996) and Dreyfus and Dreyfus (1986) define an expert as a person who generally knows what needs to be done based on mature and practised understanding. An expert's skill has become so much a part of him (or her) that he does not need to be more aware of it than he is of his own body. When things are proceeding normally, experts are not actively solving problems or making decisions, but rather intuitively doing what normally works. While most expert performance is ongoing and non-reflective, when time permits and outcomes are crucial an expert will deliberate before acting. This deliberation does not require calculative problem solving, but rather involves critically reflecting on one's intuition. On the other hand, there will be no such thing as a novice IC. An IC will always be a person resting on a specific educational and training background; he or she will be competent (Dreyfus and Dreyfus 1986). A *competent* performer sees a situation as a set of facts. The importance of the facts may depend on the presence of other facts. The competent performer has learned that when a situation has a particular constellation of those elements, a certain conclusion should be made. He/she does not entirely follow context-free rules but tends to act in accordance with situational elements to obtain the goal in mind, although decisions are based on an analytical approach.

In order to understand the basic assumptions of the RPD model, we investigated the ICs in relation to three aspects. First, we analyzed the data material with respect to how they approached the situations in the different response phases. Second, we identified the process of how the different actions were developed and implemented. Finally, we assessed how they responded to uncertainties and how they coped with uncertain quantities.

Situation recognition: situational cues

An interesting question to us was how the serial option evaluation became part of the IC's mind-set. Thus, we were interested in when he began to form a mental picture of the situation and how he expressed his rules of thought from the early alarm through to the response phase. The IC's response to the hypothetical situation gave us a fairly comparative case, enabling us to discern some IC background variables.

In particular, the Swedish ICs (fireground) did not really consider the contents of the situation described in the alarm phase through en route to the arrival on scene, except for those commanders (level 1) who knew they would be in the first response engines. These commanders sought cues relating to the object (building), the fire condition, weather conditions and the surroundings. The other two commanders (levels 2 and 3) were much less pro-active, relying on the information from the call center. Although they knew that the situation was demanding, requiring all resources in the Malmö region, they were more occupied with confirming that all resources were called out and that everything followed predefined procedures. For these people, situation recognition first became significant after arrival on the scene when the 'window-report' was given and the accident scene required organization. Interviews with the Swedish IC revealed that the first response appeared to rest predominantly on predefined structures and procedures, which in turn defined the practical work. The paramedic respondent also seemed to have adapted to this system. He listened to the fire department radio channel and made his paramedical situation assessments en route.

The Norwegian ICs did not show the same tendency. The differences in their situation recognitions were more of an individual than organizational character. However, in Norway, there is also a strong, predefined on-scene command structure, cf. Figure 1. The Norwegian commanders relied heavily on the call-centers' ability to provide the necessary situation information. For many of the commanders, this would be sufficient to mentally prepare themselves for the forthcoming actions. They postponed their planning and organization of the incident scene until after they arrived, in order to include all the visible and direct information. Nevertheless, different approaches to their management strategies were discernable. Five fireground commanders stated that they would not interfere with the tactical decisions already made on scene, because they either saw their roles as support for the operations leader or they emphasized the excellence of their crews. The commanders with an academic degree (bachelor or master) were much more analytic and alert to possible situational cues than commanders with a 'traditional' career development.⁵ An exception was one commander who was clearly committed to early preparation and situational appraisal. This commander was responsible for educating the emergency responders in local industry and thus had sound knowledge of the objects in his district. The paramedics' need to make early situation evaluations related more to personal preparations than to tactical paramedic decisions. In the case of a major fire, they had to adapt to the structure created by the fire department and, in close cooperation with the police and fire department, choose their locations for dealing with the dead and injured.

From the observation study, we could draw inferences about the influence that different kinds of emergency call-outs had on the immediate preparations. In general, the standard initial response procedure was always followed. No commanders made any particular decision before leaving the station. The predetermined alarm procedures were followed, in which different accident categories had typical turnouts. The fireground commander's appraisal did not modify the normal call-out procedures or initial standard procedure on arrival. There was a tendency for planning to be postponed until arrival. The visual impression on arrival was said to be important to the leaders. One ambulance officer said, 'It will give you information, it's telling you something vital' and to him it determined the first response. He continued, 'Many decisions are made the moment you see the accident scene'. A vast majority of the commanders emphasized that the first response was situational and that they relied on familiar, automatic responses to typical incidents. Below are some examples showing the uniqueness in the situations that somehow challenged the ICs:

- The fire department was notified early one morning about a fire in an apartment building (case no. 5), which according to the message contained snakes and spiders. This message had to be clarified both due to the technical quality of the loudspeaker installation and the uncertainty of what they had understood. It was important to confirm both mission and address. The snake and spider message alarmed one of the smoke divers and he was replaced.
- When a fireground commander was called out to a fire inside a leg of a drilling platform (case no. 9), he requested a report from the first fire engine to arrive. The first arriving fire officer described the situation as 'quite unfamiliar to me' and he initially wanted to contact a person well-acquainted with the rig, but this was never done and the level of uncertainty remained high.

- Around midnight, the fire department in Malmö was notified of a car that was reported to have driven into a frozen canal (case no. 18). In this situation, the commander and the leader of the diver squad discussed what preparations to make and what resources to use initially before they left the station. This type of accident was the first for the IC, and his uncertainty about the response was the main reason for the delay. The leader of the diver squad was a very experienced junior officer.

It generally took a long time, normally more than 15 minutes, for the ICs to ‘grasp the big picture’ after they arrived on scene. The ICs did not understand the situations before the response units were in full action. However, some coordination existed by virtue of the fact that incoming response units always contacted the IC. The first response units to arrive started their action immediately, confirming that they needed no orders to start working. Standard procedures were initiated from the information given by the call center and what they experienced on arrival. They recognized the situation and responded automatically.

None of the leaders that we observed tried to identify anyone on scene who could give them vital information about the occurrence, even though a large number of the leaders emphasized the need for information from people well-acquainted with the local area. This would be the obvious solution in case no. 9. However, the first fire officer to arrive at the fire on board the rig did not contact the rig manager, the commander on board. The fire officer went straight to the leg and the location of the fire.

Action development: mental simulation

According to the RPD model (Klein 1993), action development is part of the IC’s situation recognition. ICs hypothetically implement the actions by running a mental simulation to foresee the effect of the strategy. Experienced commanders are supposed to rely more on their serial evaluations than less experienced commanders. Tissington (2001) studied fireground commanders from the UK and he claimed that written procedures of incident command were not in practical use. We wanted to challenge this statement, not in the sense of the ICs slavishly following written texts, but rather to identify whether or not tacitly well-known routines directed the actions. We analyzed the hypothetical scenario interview material to identify how different actions came into play, in which emergency phase and how they were supported by the ICs. The hypothetical scenario study also enabled the ICs to use their creativity in problem solving without the risk of being *post hoc* rational and explaining causal relationships that the interviewer ‘wants’ to hear, which is a pitfall in retrospective studies (Miles and Huberman 1994; Tissington 2001).

All first responders saw their prioritized goal as saving lives in a safe manner. An operation that leads to injuries to, or loss of, rescuers is the IC’s worst nightmare. However, many of the respondents recounted situations in which they themselves had been exposed to uncontrolled risks or in which there had been losses. In one of the locations, a fire in a road tunnel construction site escalated into an explosion which killed two fire fighters and one construction worker. Apparently, the enormity of this event struck everyone in the emergency services. Six of the 13 respondents from this location unsolicited discussed the event. Their stories varied substantially with regard to what they thought leaders knew about the hazards at the site at the

time of the explosion. We have not pursued the causes of these discrepancies, whether they were due to bad communication on site or *post hoc* rationalism amongst the respondents.

The officers reported that they thought through the situation en route and what they were likely to find at the scene, what to do on arrival and what factors to consider. More than 50% stated that they actively planned the management en route. They anticipated finding a 'normal' situation: what they had personally experienced at earlier scenes. They used this as a basis. Only a few of the leaders expected to encounter catastrophic situations, even if the alert was on the highest level. Typical comments were: 'There's no need to exaggerate', 'We have to cope with the situation, whatever it is'.

The presence of tacitly understood procedures is strong in all the three studied locations, with the most visible and applied documented procedures in the Swedish rescue organizations. In Malmö, accident scenes are organized from the on-scene command of a fire department representative, consisting of a three-level emergency response system. This system regulates who is to be called out, who is to define and set the break points, who is to organize the incident scene, who is to plan the tactical attacks, who is to delimit the object into sectors, etc. By viewing the rigid structure as a frame condition, it was much easier to analyse the different respondents with respect to mental simulation. Thus, mental simulation is to be seen as the respondents' creativity or level of involvement evidenced in different settings presented to them. One sector leader (level 1), two operations leaders (level 2) and in part one fire engineer (level 3) showed early preparatory action developments. These respondents deviated from the others (in total eight fireground ICs), by mentioning specific measures which they discussed in the light of the scenario development. For example, en route one operations leader commented: 'I imagine that there will be lots of people outside causing a chaotic situation. The place has to be closed off and the people removed. We need calm working conditions to assess the situation and execute our mission'. The other respondents were much more general in their presentation of actions, for example, emphasizing that 'they needed to cooperate with the other disciplines', 'step back to assess the situation', 'communicate with the coordinating fire executive'.

The Norwegian emergency responders are less dedicated to a rigid structure. The paramedics in particular seem to adapt to the ongoing situation (organization) *ad hoc*, without any predefined requirements. We saw more variation in the Norwegian assumptions of which resources would be called out, what they planned en route, how they sized up the situations and which measures they prioritized on the scene. This does not mean that the Norwegians were more creative or involved in their response to the scenario than their Swedish counterparts. The general impression was that they responded to information with well-known standardized measures, for example, 'ensure triple alarm', 'I must clarify where the escape routes might be', 'establish contact with the other operations leaders', 'maintain good communication lines', without being specific in relation to the discotheque fire scenario. The Norwegian fire officers, two of whom were from part time services, had different roles in the crisis management. Of those who did not fall back on standardized general actions, we identified three fireground commanders out of nine.

The paramedics and police officers varied mostly with regard to how structured (focused) they were in describing their roles and the clarity of prioritized measures.

The tendency was that they had a reactive approach to incident command and they prioritized detailed, concrete information or observations rather than trying to understand 'the big picture'. It was important to all of the ambulance officers to help the young man who had jumped from the window (one of the detailed bits of information given to the leaders during the scenario). We identified three paramedics and one police officer out of a total of 11 respondents who showed creativity in action development and involvement in assessing the effects on the scenario.

None of the respondents said that they generated alternative solutions and assessed the solutions' impact on the scenario. The hypothetical scenario data material indicated that 25–50% of ICs do their reasoning proactively, employing some sort of mental simulation. However, it is difficult to claim that those who were creative or involved in the interviews regarding the hypothetical scenario were more expert or better at performing mental simulation than the other respondents. In order to better illuminate this issue, we used the observed scenarios and the IC's expressed reasoning for the activities decided upon.

Little planning was carried out before the units turned out, meaning that there was little focus in advance on what could happen, the threats and coping. The information from the call centers was fragmented and limited. The commanders explained that they postponed planning because of lack of information and time. This indicates that analysis, planning, safety and risk assessment were more or less absent in the initial phases.

After arrival on the accident scene, whether it concerned a traffic accident (case no. 16), drowning fatality (case no. 18) or fire in a block of flats (case no. 5), the commanders focused immediately on what they saw in front of them. They concentrated on details instead of sizing up the incident in relation to the threats and risks. It was very difficult to make them describe what they had to cope with and answer the question: 'Are there any contextual elements to consider?'

The car in the canal in Malmö (Krook 2005) was the most complicated event observed in our sample. The on-scene commander had an extremely narrow time horizon. It was the middle of the night. A car with four people presumed in it had driven into the frozen canal. Upon arrival, the diving squad immediately jumped into the water. After the divers had localized the car, they had to return for a prick-punch to open the doors. Only three persons were found and with one person still missing the commander ordered a mobile crane to raise the car. This was 45 minutes after arrival. In the aftermath, the divers reported that they did not dare to enter the car and they could see practically nothing. Fortunately, there were actually only three persons in the car, of whom two died.

Uncertainty conceptualizing and management

Lipshitz and Strauss (1997) define uncertainty in a naturalistic decision-making setting as 'a sense of doubt that delays action'. Accordingly, uncertainty is conceptualized as inadequate understanding, incomplete information or undifferentiated alternatives. Based on their study of 102 self-reports of Israeli military officers, they found that crisis decision-makers have five strategies for coping with uncertainty: reducing uncertainty, assumption-based reasoning, weighing pros and cons of competing alternatives, forestalling and suppressing uncertainty (RAWFS). The choice of strategy (heuristic) was related to the source of uncertainty.

Inadequate understanding was primarily managed by reduction, incomplete information was primarily managed by assumption-based reasoning, conflict among alternatives was primarily managed by weighing pros and cons, forestalling was equally likely to be used as a back-up strategy for all sources of uncertainty. Suppressing was the least likely heuristic to be used, but it was evenly distributed among the three sources of uncertainty.

When presenting the hypothetical scenario for the respondents, we included high stakes at risk and significant time pressure in the search and rescue work. However, none of the candidates conceptualized uncertainty through the discussion until in the interview. We asked them how they responded to situations that were abnormal to them. Eight incident commanders described that they perceived an unusual situation different from ordinary events, and that they experienced feelings spanning from stress to obtaining a higher level of awareness. The majority indicated no special cognitive or emotional effects. Most of the candidates had their own strategies in the face of abnormality, of which several included consulting with other rescuers, experts or superior commanders. One respondent said: 'I need to consult with people. I carry no prestige and acknowledge the competence of other actors. We must not become too stereotypical; the routines cannot overrule the choice of activities'. In relation to the individual psychological perspective of Lipshitz and Strauss, this would coincide with assumption-based reasoning and forestalling. The other major strategy was to increase the resources applied in the crisis combating activities, thus reducing the uncertainties. Four respondents did not admit that there were abnormal situations, thus suppressing uncertainties. None of the respondents discussed a strategy where they generated different alternatives to assess for pros and cons.

In Bosnia-Herzegovina, the general conclusion drawn from the interviews was that the safety of the responders was the incident commander's main concern. Nevertheless, there was a distinct difference from the Scandinavian approach to coping with complex and risky situations. The ICs from Bosnia-Herzegovina stated that it was important to the officer to be respected, be brave and 'lead the way'. If a situation was assessed to have an undesirable risk, the IC would enter the situation first, for example, a burning building. Only then could he expect or demand that his subordinate should follow him. The hazard was in any case tied to assessments of the chances of successfully combating the situation.

Although we obtained some answers as to how incident commanders cope with uncertainties, we question whether or not ICs recognize abnormal situations and carry out special evaluations as part of their strategy development in real world responses. In order to get an idea of how the ICs conceptualized uncertainty, the 22 real incidents was assessed on various characteristics. We based the uncertainty assignments, cf. Figure 4, on the observations and the information that were given at the two assessment points: (1) the time of notification (black digits in bold type); (2) when the commander sized up the situation (red digits). Most of the incident responses were 'normal'. A normal response is considered to be 90–95% of call-outs (Rake 2003), in which standard procedures work very well and the uncertainties are minor. Uncertainties were assigned in accordance with the predictive Bayesian approach (Njå and Rake 2003). There were five fatalities altogether in three of the 22 accidents.

Figure 4 presents connections between the consequences and the related uncertainties at the two points of time. As a general rule, the uncertainties were

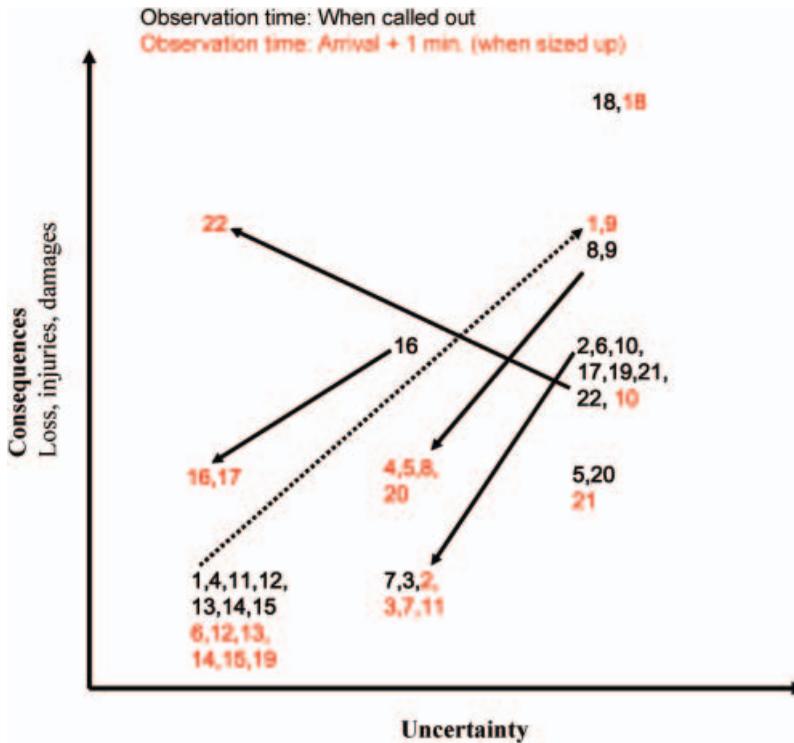


Figure 4. Uncertainty assessments at two different points of time.

high at the time of notification and gradually decreased as the ICs received more reliable information. The uncertainty delayed, or postponed, the planning until arrival on-scene. Stress effects, such as arguing loudly, were observed to a certain extent, but it was not possible to observe inappropriate behavior caused by the stress. A typical event is case no. 16, a traffic accident in the countryside (icy and slippery road conditions, two cars involved). The alarm message was: 'traffic accident, at least three persons injured'. The reporting and extent of damage from traffic accidents is often unclear, which implies uncertain conditions. On the IC's arrival, the paramedic had already arrived and assessed the medical condition of the trapped victims. All three persons were released and taken to the hospital by helicopter (one person) and ambulance (two persons). The uncertainty was initially high but rapidly decreased to a low level.

Incidents nos. 1, 9, 10, 18 and 22 were somehow different from the general tendency. In case 1, the uncertainty increased, in cases 9, 10 and 18 the uncertainty remained high, and in case 22, the consequence was fatal:

- In case 1, the uncertainty increased dramatically after the situation was called in. The call center was not aware of two missing children in a house fire scenario, which made the working condition for the IC⁶ significantly worse. It was in the morning (10:00 a.m.), and the IC and the response unit expected a 'normal building fire', where the residents had escaped. When the IC arrived as the first fire responder, the message was: 'two children are missing inside the

burning house'. The uncertainty changed dramatically and was now a matter of life and death for the two children, aged 2 and 3 years.

- The car in the frozen canal, case 18, is described above. From a high degree of uncertainty, the situation was not resolved after arrival. The possibility of loss of life was extensive and the IC's uncertainty changed from limited information about the situation to larger uncertainty about the condition of the missing persons. There was a serious lack of rescue divers and ambulances. Only two ambulances were at the scene in the first 20 minutes and actually effective in the life-saving work. Three persons were found and brought ashore: one of them survived.
- A short unclear note from a drilling platform situated in a shipyard for maintenance and repair resulted in a major call-out (case no. 9). Three fire stations, a fireboat, one ambulance and a patrol car from the police responded immediately. The uncertainties related to the situation and the values at stake were large. On arrival, the IC was informed by a police officer that two workers were trapped by the smoke and waiting for help. The localization of the smoke inside a pontoon and of the missing persons did not reduce uncertainty but only changed it. Decisions were made and the two workers were rescued and brought to hospital.
- A reported forest fire resulted in three fire stations responding (case no. 10). The extent and intensity of the fire were uncertain and poor radio communication conditions were a challenge for the management. Upon arrival, the IC was informed about a woman trapped by the fire. The police had been in contact via a cell phone and reported that she was anxious and exhausted by the smoke and fire situation. The focus switched from the intensity of the fire to the trapped woman, her well-being and position.
- An unclear and vague alarm (case no. 22): 'a person crushed by a heavy construction'. The extent, the circumstances and the location were unclear. A fire station and an ambulance were alarmed. On the rescuers' arrival, the man was found to be dead, crushed by a heavy beam. The situation was stabilized and the uncertainty minor.

During the response phases, the constant need for information was solved visually and verbally. Every commander got information by generally walking around and talking to crew members and officers from other emergency units. It was typical that command post on scene was not established. The observed incidents were not considered as major at the time of the occurrences. The post-incident (debriefing) evaluations defined at least one incident as major.

Perceptions of qualities of the incident command: success criteria

All respondents regarded the importance of the incident commanders as high. It was their opinion that a successful IC needed to be visible, available, attentive, calm, knowledgeable, and that the IC should perform leadership with authority, give clear messages and act in a communicative and cooperative manner. These normative premises are hard to contradict. Furthermore, a successful operation was regarded by most respondents as a situation where the first responders felt satisfied about the job performed, important values (lives, properties) were rescued, and the work had not caused any harm to the rescuers. When confronted with the concept of risk, all

but three respondents answered that risk was solely a matter of the rescuers' safety. One Swedish fire incident commander said: 'I know my staff. It is generally accepted that people die in fires. If a fire fighter sprains his ankle during smoke diving it will be remembered, but if you ask me three years after a fire in a flat with one person deceased, I would probably not have remembered'.

In Sweden, a representative from the fire department will be the overall incident commander, while in Norway, it is the Police. The Norwegian police officers were much more concerned about the working conditions for the other two emergency services in their responses to what was their view on a successful operation and success criteria for incident command. None of the Swedish respondents (fire department) discussed issues of the other emergency services, besides their own contributions to bringing out victims safely from the fire in the hypothetical fire scenario. It could very well be the case description (fire scenario) that encouraged their strict focus on the fire department tasks. However, the interviews revealed that the Swedish on-scene structure was more hierarchical with an expectation of clear commands from the nominated IC. Command posts are very rarely established and thus the respondents may have had different concepts of successful incident commanding, for example, those of the responsibilities of the operations leaders. Some of the commanders envisaged operational decisions during the hypothetical scenario passage, such as registration of injured persons, smoke divers entering from the main entrance, ensuring provision of more oxygen bottles and moving the ladders to specific windows.

We did not observe that the ICs were involved in any operational tasks. In one traffic accident (case no. 17), the driver was trapped in his damaged car. After the successful response, the IC was asked which commands he had given: 'Only one, it was to remove the roof of the car'. The IC explained that when the response evolved according to the procedures and his expectations, it was not necessary to interfere. He was only supervising.

The common way of managing the incident scenes was characterized by few decisions and the IC's monitoring of the activity, even in the case of unfamiliar complex accidents.

Discussion

In Norway and Sweden, normally 2–6 persons are involved in the initial phase, in which a low-ranking officer carries out the commanding on scene. The nominated incident commander arrives later, within an hour after the first alert has been received. It can therefore be quite circumstantial who becomes the incident commander and what managerial background and experience he or she possesses to make appropriate decisions. The RPD research does not consider these facts. The cognitive psychological approach naturally assesses the individuals, no matter what the degree of experience of the person in charge. However, the variability in workload, the criticality of the decisions, or the response phase (time of the decisions) has not been part of the particular assessments supporting the RPD model. A further challenge for the incident command is changes in roles (Sjöberg et al. 2005) during the combat. Normally, there is at least one transfer of the leading officer during a major incident, which is critical for the response performance. The dynamics of the commanding structure are almost absent from the NDM research

literature on crisis management. Can we rely on the descriptive RPD model as representative for crisis management decisions? Tissington (2001) raises criticism against the RPD model with regard both to derivation of the model and its correspondence to the empirical material from the UK fire brigade decision making. None of the data provided by Tissington stem from real scenarios but are based on replication and development of RPD research methodologies (CDM, Think Aloud protocols, simulation, etc.). Burke and Hendrie (1997), although not explicitly concerned with testing the RPD model, found support for serial option evaluation, but they also emphasized the influence of procedures and the personal characteristics of the decision maker.

The major issue in psychological research is to understand the present cognitions in real world crisis decisions, and the empirical data are therefore constructed to test the RPD model and the inherent prerequisites. The RPD research constructs the cases around the decision maker, thus the problem of 'controls' is evident and therefore of making valid inferences concerning significant relationships among variables in crises. Our data confirm a high degree of single option choices in line with the RPD model. Furthermore, we did not find any traces in the material of principles from classical decision theory. However, the IC is not a decision-maker *per se*. He does not make many decisions because many premises are in place before the IC is operational. Hence, it could be questioned whether he actively manages the crises or whether it is more correct to regard the IC as a passive, but important, supervisor, important for maintaining the communication flow.

The role and performance of the incident commander would be of utmost importance to the crisis outcome, if the formal rules and procedures were insufficient tools on scene. This presupposes that decision making is centralized and that response units lack autonomy. In highly uncertain situations, the need for problem-solving activities would naturally play a role, but we do not think that a single IC would be a lone working shaman directing the course of action. The ICs we interviewed had a humble but determined view of their responsibilities. Decisions are not made in a vacuum but rather in close cooperation with the other actors on scene. The pattern is that decisions and performances are highly influenced by tacitly understood procedures and incremental reactive problem-solving behavior by individuals and smaller units. At least 14 rescue units responded to the traffic accident in the canal in Malmö (case no. 18). The divers reported that visibility was only a few centimeters and it was difficult to enter the car and find the four missing persons. After 45 minutes, and one person still missing, the incident commander ordered a crane truck to raise the car and move it onshore. When the IC entered the scene and sized up the incident, an ideal proactive management strategy would have been at once to call for a crane truck.

One of the greatest challenges in assessing crisis management abilities is to relate situational demand characteristics to the incident command. How is it possible to identify the level of expertise that the different IC possesses? Endsley (2006) characterizes experts on the basis of their situation awareness abilities and subsequent strategies for gathering information. Much in line with Endsley's work, NDM researchers construct expertise from a number of variables: Perceptual Skills, Mental Models, Sense of Typicality and Associations, Routines, Declarative Knowledge, Mental Simulation, Assessing the Situation, Finding Leverage Points, Managing Uncertainty and Metacognition (Ross, Shafer, and Klein 2006). Yates

and Tschirhart (2006) oppose the NDM perspective, claiming that the NDM research lacks empirical rigor, and they propose evaluating expertise based on a decision process perspective containing 10 cardinal issues highly influenced by rational analytic tradeoff resolutions. We think that the behavior shown in certain situations expresses the competence (knowledge and skills) of the individuals and the organizations. Important tasks in an emergency response are: outlining strategies for crisis mitigation, choosing tactics and performing damage limitation effectively. Rasmussen's behavior model (1983) entails skill-based, rule-based and knowledge-based behavior. Experience and training can influence a person's behavior so that it becomes more automatic. Experience and training can also improve the cognitive process and increase quality of decisions. However, understanding these developments has not been a task for incident command research so far. Yates (2001) raises questions about NDM researchers' lack of distinction between good and bad decisions. The issue is that experienced decision makers, whoever they might be, make better decisions in concurrence with the RPD model. A bad decision on the other hand could very well be a result of the fact that people actually 'know too few facts that really matter and too many about things that don't'. In our opinion, making inferences about the IC's expertise must include analysis of a wider social perspective (Stein 1997) in a team framework (Salas et al. 2006), containing regulatory, organizational and technological frame conditions as well as situational characteristics, including physical energy, physical requirements, mental requirements, emotional requirements, cooperation prerequisites and dynamics (Brehmer 1992; Njå 1998). The incident commanders we observed had varying experience from real actions, but very few had been involved in abnormal responses. Their level of expertise is thus rarely challenged nor is it part of traditional training and debriefing activities.

Taking an external assessor's view: Do we actually know when the incident response is performing well? How can we conclude if the outcome is successful or not? Accident investigations provide in-depth analyses of causal factors relating to the responsible parties of the systems and objects involved. The debriefing activities conducted by the emergency organizations are often concerned with the well-being of the personnel involved. A critical view of crisis management and performance is rarely seen. The decisions are contextual and should be assessed on the specific evidence, circumstances and commander's assessments. Very little research exists that sheds light on the decision-making process in practice and the incident commander's role in real time. Furthermore, how can the incident commander make the best decisions, or at least a sufficient response? The RPD research pays very little attention to the context in which the decision making is performed. With reference to the Malmö drowning accident, the diving squad had incidentally had a diving training session earlier that day that showed poor performances and that resulted in discussions on how to prepare for and enter the water. In the real case, all precautions were left behind and the scuba divers ran downhill with their flippers. However, they forgot the prick-punch, which delayed the rescue work. Our view is that there is a high degree of heroic mentality and behavior among rescuers that can be in conflict with rationality in the situations.

The experienced incident commander's serial approach to making decisions is the key element in NDM theory, and this is presented in a positive manner in the research literature. A sociological perspective takes the opposite view to the serial

approach. These researchers claim that the incident commander who maintains a certain chosen course of action, being unable to reflect on and redefine the situation, threatens crisis mitigation (Rosenthal et al. 2001; Rosenthal, Hart, and Charles 1989). Groupthink (Janis 1982), information over-/underload, prioritizing the source of information, and increased communication demands are all issues that could detract from the incident commander's ability to make good decisions.

We could not identify any systematic risk management strategies in the cases we observed. The ICs did not consider critically the contents of the alarm messages nor did they actively ask for more information. An explanation for this can be that the initial response is generally automatic and starts before the leader has grasped the situation and outlined the response to be made. We would claim that automatic response behavior was prominent, even at major incidents where the units had limited experience from similar situations. Another explanation could be that the junior officers, or the crew members, normally make detailed decisions. Risk as a concept important for on-scene activity was very strongly connected with the responders' safety. Tissington (2001) claims that the IC's recognition can be described by four by-products: crew safety, casualty rescue, containment and time assessment. The essence of the incident is captured if these by-products are understood. The first three coincide with every fire fighter's prioritized goals for their response and the fourth is part of the prevalent contextual frame condition. However, incidents will always contain some degree of uncertainty, especially novel and dynamic situations. Our data material did not support the presence of a structured risk management process, neither by the individual ICs nor by the rescue teams. The idea of identifying critical observable quantities is interesting, for example, those proposed by Tissington (2001) or the situational cues described by Klein (1993), in order to assess the hazards at stake and the possible actions available. Rake (2004) has outlined a model addressing observable quantities in a crisis and relates uncertainties to these quantities in order to provide insight and proactive management strategies on the scene.

Conclusions

This study was designed to better understand the role and influence of ICs in crisis management. Our data are collected from relatively major emergency response actors on a Scandinavian scale, but not the largest. We cannot claim that our data are representative for all types of emergency response structures, even though the data showed typical patterns in ICs' reasoning and behavior across the locations. The fundamental ideas of the RPD model have been challenged, and we have found support for the characteristics of recognition and single action development. However, there are some additional aspects found in our data that are not often addressed by NDM researchers:

- Incident commanders gave few commands.
- The influence from tacitly understood routines and procedures on strategic and tactical decisions on scene is considerable. Recognition should include the ICs' general reliance on established practice.
- The Swedish search and rescue structure is more oriented towards predefined procedures than its Norwegian counterpart.
- Very few ICs searched for additional information beyond what was provided by the call center, especially in the earliest phases of a call-out.

- On arrival, it was vital to the preliminary response what the IC immediately observed. The observation can be described as an initial outline of the situation and not an entire and essential sizing-up.
- The responses were mainly reactive, comprising direct action to deal with the visible concrete hazard known to the ICs. Pro-active strategies aimed at revealing and tackling uncertain events and quantities were rarely seen.
- Risk assessments were mainly used to clarify the responders' personal safety. Bosnia-Herzegovina ICs approached risky activities by themselves leading the way into the hazardous zones.

The difference between interviewing ICs about a hypothetical scenario and observing them in real scenarios was mainly that they were seen to be more deliberative in the virtual situation. In real situations, they were less reflective about their behavior and followed 'normal' procedures.

Notes

1. The principles of the crisis management structure are quite similar worldwide but the holders of key roles may vary. For example, in Sweden, the incident commander is a fire department officer.
2. The researcher in the field observation has more than 20 years' experience as on-scene commander.
3. Five of the observations are reconstructions of incidents that were personal experiences of one of the researchers working as incident commander.
4. The event numbers are shown in brackets and referred to in Figure 4.
5. A traditional career in the Norwegian fire departments is based on number of years of experience, so that commanders 'grow' into leadership.
6. In this case, one of the researchers was the IC.

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