A discussion of decision making applied in incident command

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Abstract: Rescuers respond to unique emergency situations. Decision making on the scene of an accident is context-bound, embedded in ever-changing environments. Thus, decisions in action sometimes involve huge uncertainty. This paper discusses decision making as part of incident management, as presented in the research literature. Two main theoretical perspectives on decision making in crises are compared. The Naturalistic Decision Making (NDM) and Contingent Decision Path perspectives show the similarities and differences in on-scene crisis decision making. In the light of prevailing crisis management research, we conclude that the researcher faces several challenges. Assumptions about experiences, situation awareness, cognitive reasoning and the reconstruction of on-scene behaviour are not easily retrieved. There is a need to develop a better understanding of and methods for rigorous observation and knowledge elicitation of decision making in crisis settings.

Keywords: incident command; crisis management; decision making; naturalistic decision making, contingency approach.

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1 Introduction

This paper discusses the different views on on-scene decision making. The rationale behind the descriptive and normative decision models related to emergencies is of special interest. How can we determine whether or not these models properly describe the real world and are normative suggestions useful for the people they are meant to serve? We apply *crisis decision making* as a collective term for decisions on incident scenes, regardless of the extent of the crisis. The focus is on the nominated leaders on-scene: incident commanders and operation leaders. Crises involve a cumulation of adverse conditions: severe threats, uncertainties and the necessity of prompt decision making (Rosenthal *et al*., 1989b). We do not distinguish between leader categories working on accident scenes, because they are all responsible for parts of crisis management. The collective term used in this paper is *incident commander*. The on-scene management structure remains the same for all types of incidents, assuming the incident commander as having a holistic view of the situation, deciding where to locate the control/command post, managing the staff (*e.g*., communications, log function, reconnaissance and resource), preparing the superior aims and plan, initiating rescue operations and assessing the resources.

Crises can take many forms. For the incident combating resources crises are concerned with values at stake related to social, human, material and environmental values at immediate risk. Crises are described as borderless *threats*, creeping and acute (*urgency*), relative to contending reality claims (*uncertainty*), to be viewed as ongoing processes (compressed decision-making), political and conflictual and subjected to conditions wherein media roam free (Rosenthal *et al*., 1989a; 2001). Crises may be considered 'occasions for decisions'.

Crisis management as presented in textbooks includes four phases: *mitigation*, *preparedness*, *response* and *recovery*, in which the first two relate to pre-impact activities whilst the latter two relate to post-impact activities. This paper places emphasis upon response activities, albeit dependent on pre-impact preparations.

The decision-making situation is characterised by the necessity of critical choices or, as Rosenthal (1986) put it: "a serious threat to basic structures or the fundamental values and norms of a social system, which – under time pressure and highly uncertain circumstances – necessitates making critical decisions". The uncertainty concept relates to observable quantities. Related to on-scene activities, such quantities could be the number of victims trapped under earthquake debris, the volume of gas from a gas leak, the diffusion of an ammonia cloud, the location of children caught in a fire scenario, materials exposed to fire, structural breakage during fire fighting, the time and capacity

needed to carry out rescue operations, the number of injured and killed victims, injury categories and so on. Such quantities are of interest to the on-scene commander in times of crisis. However, these quantities are uncertain and this uncertainty could be expressed by probabilities. In this sense, the risk is purely epistemic; we are uncertain because we lack sufficient knowledge (Njå and Rake 2003).

A decision is a commitment to an action intended to yield satisfying states of affairs for particular parties (the beneficiaries of that action) (Yates, 2003). The action is distinguished from the decision itself, but the intention emphasises the deliberate commitment of the decision maker to achieve important goals for targeted beneficiaries (victims, stakeholders, themselves). It is widely acknowledged that the incident commander's on-scene decision making is important for the outcome. We do not intend to systematically challenge this hypothesis in this paper, but merely place the focus on how to obtain empirical evidence of the incident commander's reasoning and performance.

When the crisis is novel, the consequences could be unclear, different authorities could be involved, many actors would struggle on-scene and the media will pay particular attention. In such cases, a visible and determined incident commander seems to be essential for the crisis outcome. But what kind of decisions must be made? To what extent are the actual emergency response actions automatically performed or conducted as normal procedures? How critical is the incident commander for emergency performance, either as an active commander or as a monitoring supervisor? The incident commanders in neither the police nor fire brigades have substantial experience from large/major incidents. Such incidents/situations will encompass novelty and different kinds of uncertainties.

The next section compares two different perspectives on crisis management: the Contingent Decision Path or Contingency Approach (CA) and the Naturalistic Decision Making (NDM) approach. The theories are compared with respect to the scientific disciplines involved and the analytical remises and research approaches related to the inherent characteristics of decision making. The research techniques employed as basis for the models are discussed with respect to appropriateness. In conclusion, the paper discusses the implications for professional incident command performances.

2 Incident commanding models and perspectives

The literature on crisis and emergency management outlines theories and models on how decisions are typically made (descriptive models) or how they should be made (prescriptive models). We have explored two different perspectives: the CA (Rosenthal *et al*., 1989) and the NDM perspective (Klein *et al*., 1993). Both perspectives have led to models and conclusions about the characteristics of decision making in crisis situations. The purpose of such models could be proactive as well as reactive, for example, either as a learning tool for future incident commanders, a basis for developing procedures (*e.g*., action cards) or a basis for accident investigation. The rationality behind the models is interesting. To what extent does research support the development of the models and what related strengths and weaknesses can be revealed from the state-of-the-art?

"a" or "b"?

In a crisis, the decision-making context is limited in time and space; situations occur which involve stress and uncertainty with respect to dynamic and continually changing conditions. Changing conditions require real-time reactions. At the incident site, the information is fragmented and ambiguous and it is difficult to form a clear picture of the situation. The goal of a successful outcome is not straightforward in a crisis. Therefore, we have to look at the goals and tasks, which may be ill-defined and ill-structured. The decision making is often incremental, making it difficult to relate subgoals to the ultimate goal. Every crisis consists of a unique combination of available knowledge (expertise) encompassing the rescuers and victims. To cope with the event, incident commanders must be able to weigh the real-time situation and perceive the inherent dynamics, which are heavy responsibilities.

3 The contingency approach

Rosenthal *et al*. (1989a) based the "contingent decision path perspective" on case-oriented retrospective analyses of different crises. Their work was followed up in 2001 (Rosenthal *et al*., 2001), in which the crisis concept was reconsidered as more than discrete events limited in time and space to a "process unfolding as manifold forces interact in unforeseen and disturbing ways. Modern crises are increasingly characterized by complexity, interdependence, and politicization". Rosenthal *et al*. also claimed that future crises will take on an endemic quality and will be compounded and prone to become self-perpetuating in nature. The dynamic and contingent approach to crisis management includes the perspective that a system is going through temporary states, a process in which the crisis facilitates/precipitates major changes. Private and public affairs are interleaved in crises and preconceived notions about the functions and roles of specific players in the crisis are unclear. Even though explicit individual on-scene decision making has not been a major issue in this research, the researchers have identified decision patterns in crisis management. They claim that in crisis situations, the patterns of bureaucratic organisations are bound to change profoundly:

- Decision-making becomes increasingly centralised.
- Formal rules and procedures give way to informal processes and improvisation.
- Bureaucratic politics flourish.
- There is a considerable increase in the volume and speed of upward and downward communications. Crises demand rapid information processing, but also very careful information processing.
- Decision makers tend to give priority to the source of information instead of its contents. It may become impossible to acquire the most crucial aspects of the crisis.
- Decision makers need to cope with a peculiar variety of information 'overload' and 'underload' in incoming data as well as external demands for information.
- Decision makers tend to reduce uncertainty by supplementing sparse information with analogous data and arguments. Specifically, decision makers are inclined to refer to previous crises as a reference point and a means to achieve stability in an unstable and uncertain environment.

- Decision makers can have extreme difficulty in redefining the situation. They stick to the chosen course of action. Decision makers tend to focus on one goal and one particular way of achieving that goal.
- Decision makers in crisis units can yield to groupthink (Janis, 1982), *i.e*., the preservation of group harmony overrides the group's ability to critically assess decision problems and choose an adequate course of action.

The CA (Kouzmin and Jarman, 1989) relates to the system and the critical decisions within the system as a process well before and after the acute crisis situation, encompassing decision characteristics such as algorithms, opportunity cost, muddling through and crisis. As such, the incident command is just a minor part of the model, however dependent on the situation that has emerged. In major events, the incident command is within the crisis path, characterised by nonroutine action in turbulent environments, which leads to 'inspirational' decision-making typology. At this stage, it is the incident commander's degree of expertise, intuition and situation awareness that are important for success or failure. Flin (2001) combined the CA with NDM to analyse the Piper Alpha disaster with respect to offshore installation managers' reasoning in the emerging situation. Her analysis of the three offshore installation managers involved in the crisis revealed significant weaknesses in their situation awareness and willingness to mitigation risk (for example, shutting down production). She concludes that "leadership in routine situations may not predict leadership ability for crisis management".

4 Naturalistic decision making

NDM was first published in the late 1980s, claiming to be a new paradigm in opposition to the prevailing classical decision theories. Pruitt *et al*. (1997) characterised the introduction of NDM as a paradigm shift, in which "new methodologies, new topics, new theories and new perspectives in decision making research are being explored and developed". The major objections to the classical decision theories were (Cohen, 1993; Beach and Lipshitz, 1993; Orasanu and Connolly, 1993):

- Laboratory experiments could not encompass all decision-making elements in the real world. The students taking part in experiments had no experience in decision making and the nature of errors that people make in real life was different from the biases described by rationalist research.
- Classical decision theory, comprising decision models such as 'administrative man' and 'rational decisions', is not analogous with real-world decisions.[1] Normative tools such as subjective expected utility, cost/benefit analysis and risk analysis, with the aim of evaluating a number of alternatives, are hardly employed at all in crisis decisions.

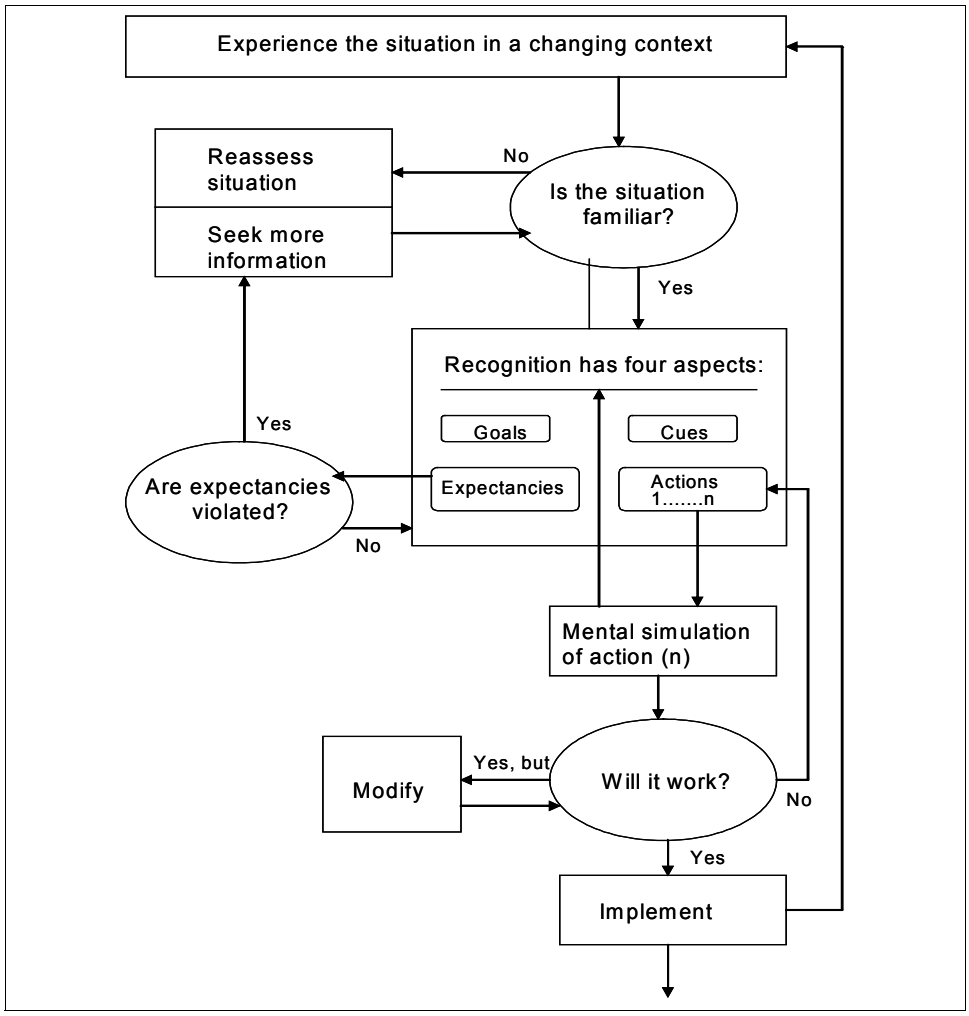
The NDM researchers replaced four essential characteristics of the classical decision theory: comprehensive choice was replaced by matching, input-output orientation was replaced by process orientation, context-free formal modelling was replaced by context-bound informal modelling and normative decision models were replaced by empirical-based prescriptions (Lipshitz *et al*., 2001). NDM places the human, rationally

bounded, proficient decision maker at its centre of interest and as its basis for prescription. Yates (2001) criticised the contrasting view on decision theories and was sceptical about the innovative basis of NDM as an alternative to the 'classical theories'.

The main model often referred to as a contribution of NDM is the Recognition-Primed Decision (RPD) model (Klein, 1989; 1993) (Figure 1), although several similar alternatives have also been put forward (Beach, 1990; 1993; Lipshitz, 1993a–b; Rasmussen, 1993).

The two major elements in NDM are *situation assessment* and *mental simulation*, which is context-specific and experience-based. The RPD model is based on research from a variety of tasks and domains, such as fireground command, wildland fire incident command teams, battle planning, critical care nursing and chess tournaments (Klein, 1993). The research is mainly based on retrospective interviews, but on-site observations and protocol analysis were also employed.

Figure 1 The RPD model



Source: Klein (1989; 1993)

The RPD model is a process model where decision making is a sequence of activities. Klein's conclusion was that proficient decision makers rarely compare alternatives. Instead, they assess the essence of the situation and select an action which they 'know' will cope with the urgent situation. A fire that occurred in the town of Bryne in south-west Norway on January 2006 (Rake, 2006) could stand as an example of the RPD model. A house of architectural importance in the town square was set on fire. The first fire officer to arrive on the scene *identified critical cues* (the location and extent of the fire, wind direction and feasible spread of the fire). The goal was to put out the fire from the inflammation site. He *assessed the situation* (the fire was burning intensively in the garage in the basement and in parts of the main floor) and *implemented actions* (attacking the fire in the basement with one of the engines and the main floor with the second engine; he called for back-up after a second alarm). The actions were *evaluated* (the attack failed to put out the fire, which was spreading). A new critical cue arose (possibly the persons living in the building). The assessment resulted in actions by smoke divers to rescue an old lady living on the first floor.

The incident commander arrived after 20 min, sized up the situation and was briefed by the fire officer in command. The *critical cues* were now related to other officers for further dissemination/escalation. The goals (ensure the safety of the responders, rescue all people in the building and prevent the fire from spreading across the road) had to be dealt with. The situation was *assessed* (apparently no persons were in immediate danger and the burning building could not be saved). His decision and *actions* were to call for a third alarm – more fire engines and ladders – and establish a new tactic and set the final goal: prevent the fire from crossing the main street. The firefighters and fire hoses were redeployed and the performance continuously monitored against the goal.

The RPD model includes feedback loops (*e.g*., the effect of the actions that have been carried out) and mental simulations promote feed-forward loops – a way to be proactive. The key features are:

- experience enables a decision maker to understand a situation in terms of the plausible goals, relevant cues, expectancies and typical actions
- experienced decision makers usually try to find a satisfactory course of action (Simon, 1955); one simply chooses an option that is available and will work
- experienced decision makers can usually identify an acceptable course of action as the first one they consider through mental simulation and they rarely have to generate and compare another course of action
- experts are distinguished from novices mainly by their situation assessment abilities, not their general reasoning skills
- mental simulation/reasoning is 'schema-driven', guided by the decision maker's capacity to search for and assess information and build causal models of events
- deciding and acting are interleaved
- a proficient incident commander often collects more information, collects it more systematically, establishes adequate goals and evaluates the effects of his/her decisions (Brehmer, 1992)
- decision makers who are faced with uncertainty try to diminish it by acquiring more information.

These key features have one thing in common: they presuppose that the assessor/researcher is able to distinguish novice incident commanders from experts, taking into account all the different levels of knowledge/expertise in between.

5 The experienced commander: an expert in decision-making?

Klein (1993), Orasanu and Connolly (1993), Cosgrave (1996) and Dreyfuss and Dreyfuss (1986) defined 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 that he does not need to be more aware of it than of his own body. When things proceed normally, experts are not actively solving problems or making decisions; they are intuitively doing what normally works. Whilst most expert performance is ongoing and nonreflective, 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. How can we relate these expert characteristics to incident commanders? How do incident commanders develop from novices to experts? How can we measure their level of expertise? On what premises do the incident commander actually contribute to emergency response performance? Finally, how do we measure emergency response performance?

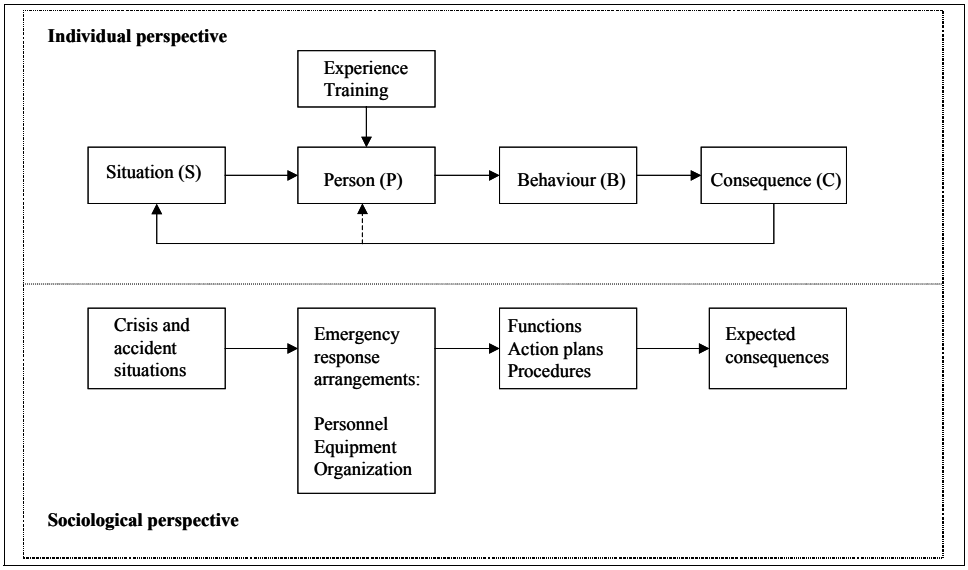
Finding answers to these questions is a vital element in incident command research. In field research, it is important to conduct reliable and valid comparisons of the forms of emergency rescue work that have proved most effective. Such a comparison requires reliable and valid methods for rating the actual effectiveness. Neither NDM researchers nor CA researchers have clearly distinguished how to assess the degrees of expertise in incident command. The two approaches have much in common, but they differ in perspective: NDM is concerned with individuals and their professional skills, while CA focuses on sociological perspectives.

If we agree on the need to evaluate the performance of incident commanding, it is important to establish a reference. Figure 2 provides the two different perspectives which could serve as references for NDM and CA. In both theories, crisis management could be evaluated in terms of the incident commander's abilities to *generalise and discriminate* situations.

Experienced or training situations will never be identical to real crisis situations. To develop proficiency, the goal must be to ensure that the knowledge is *generalised* to situations that look like experienced situations. *Personnel* (P) must be able to recognise typical signs (cues, characteristics) of the *situations* (S) and respond with determined *behaviour* (B). The personnel must also be able to evaluate the *consequences* (C) of their own behaviour and recognise whether it is effective or not. The level of expertise could be assessed in terms of one's ability to generalise situations with similar characteristics.

Discrimination is the opposite of generalisation. The personnel must be able to distinguish between situations that require different behaviour. The balance between discrimination and generalisation represents emergency management's philosophy regarding the behaviour flexibility of their emergency response organisations (Njå, 1998).

Figure 2 The sociological and individual perspectives on incident command



The behaviour shown in certain situations expresses the competence (knowledge and skills) of the individuals and organisations. The important tasks in an emergency response are concerned with outlining strategies for crisis mitigation, choosing tactics and performing damage limitation effectively. Rasmussen's (1983) behaviour model entails Skill-Based (SB), Rule-Based (RB) and Knowledge-Based (KB) behaviour. The SB level means that human performance is governed by stored patterns of pre-programmed instructions represented as analogue structures in a time-space domain. The RB level can tackle familiar problems in which solutions are governed by stored if (state) then (diagnosis) or if (state) then (remedial action) rules (productions). The KB level comes into play in novel situations for which actions must be planned online using conscious analytical processes and stored knowledge.

Experience and training can influence a person's behaviour to become more automatic (moving from KB towards SB). Experience and training can also improve the cognitive process and increase the quality of decisions (improving performance within the SB, RB and KB levels of behaviour). However, understanding these developments has not been a task for incident command research so far. Yates (2001) raised 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. On the other hand, a bad decision could very well be a result of people actually "knowing too few facts that really matter and too many about things that don't". A sharper focus on the issues related to the quality of decisions is needed in incident command research.

6 Assessment of research methodologies in the realm of incident commanding

Research into incident commanding differs according to whether the NDM is the *a priori* perspective or the CA is adopted for the study. However, the differences are much more of a contextual nature than related to the specific decision-making issues. While NDM is concerned with events that are limited in space and time, CA issues have a much wider span: from devastating acute events to long-lasting creeping disasters. Even though both theories implicitly have high stakes at risk, NDM is more frequently concerned with narrower perspectives, which are scenarios threatening individuals or smaller groups. Typical CA crisis research focuses on events that are characterised by complexity and the need for comprehensive coordination in the emergency response phase, while NDM is on the other extreme of the dramaturgical scale. However, there are no defined borders and the perspectives are overlapping, although the scientific environments apparently develop in isolation from each other. Very few works involve references across the different schools of thought.

The need to conduct studies on crisis scenarios is absolute, a process in which major actors must become involved. The data-gathering techniques are primarily interviews in various forms, but also observations and protocols and other written documents are important data material. "Field research in crises cannot only be done, but can be done well" (Quarantelli, 2002). How can research be done in the midst of varying social chaos, extreme personal stress and essentially very difficult working conditions?

Case studies are the predominant research strategies used to support the CA. The types of methods used in crises and accident research are not unique. However, crisis studies are differentiated by the context under which the research is carried out, not the methods used. Incident commanding occurs during the crisis' time period; thus, the timing of data gathering is of utmost importance: "The first thing you must do is to walk very slowly and several times through the area and observe everything you can. Your interpretation of all the statistics you may later play with will differ depending on your observations. In any case they will certainly be more accurate if you make the walk" (Quarantelli, 2002). The on-scene assessment and interpretations carried out by the researchers are of absolute importance.

From the *sociologists*' point of view, certain relevant data and assessment of data gathered in other ways can only be obtained by field studies, for example, certain activities can be noted via observations that could probably not be recalled in later interviews. Even the episodic and informal interviews that can sometimes be done during the crisis at a central site addressing the incident commander is likely to be more candid and honest than a more formal interview conducted later in a less hectic setting. As one respondent remarked to Quarantelli's (2002) research group, "I could tell you I know what I am doing, but you can clearly see I'm wildly guessing in much of what I'm doing." This is apart from the typical reconstruction of what should have happened that takes place in later interviews, away from the time of occurrence. The different perspectives and interests of the respondents (as well as those of the researchers) limit interviews. Each of the individuals (and organisations) interprets information and past experiences from their own unique frame of reference. They selectively accept information for decision making; consequently, they minimise the importance of some

facts and highlight others based on their abilities, interests and biases. Since damage and/or severe consequences are always involved, blame fixing is an integral – but often indirect – part of communication. There is a constant search for information about what caused the damage, who was responsible for the lack of success and what could have been executed better. Leaders, particularly formal leaders, may be defensive about the way they played their roles during the crisis. Since many investigations are made in connection with insurance claims and lawsuits, people may have an initial suspicion of (and resistance to) any sort of fact finding (Killian, 2002). Killian claimed that this is a serious problem about formal interview data that to this day has been almost completely ignored by researchers.

From the *cognitive psychologists*' point of view, retrospective interviews are considered powerful tools. The RPD model is closely linked to the Critical Decision Method (CDM) (Klein *et al*., 1989; Crandall *et al*., 2006), which is based on interviews with prominent decision makers aiming to reconstruct the stories of critical incidents. The method is semistructured with a strict focus on four phases (sweeps): incident identification, timeline verification, deepening and 'what if' queries. The interview technique is designed to continuously dig deeper into the cognitive processes that supported the decision maker's choices at the incident scene as the interview process unfolds the details of the incident. Based on analysis of the interview data, the researchers could draw conclusions as to:

- the important cues in the scenario
- the decision maker's experience, skill and knowledge
- the rules of thumb the decision maker had devised
- the kind of decisions that had to be made
- the features that make decisions tough
- the features that make incidents typical
- the features that make incidents rare.

Klein *et al*. (1986) studied fire ground commanders at 32 incidents and found that more than 80% of their decisions were nondeliberate decisions. In these cases, the fire ground commanders' situational awareness enabled them to select a course of action without consciously deliberating among alternatives. Another study contrasted novice fire ground commanders with expert fire ground commanders (Calderwood *et al*., 1987). The study confirmed recognition-primed decision making as the dominating decision strategy under conditions of extreme uncertainty, risk and time pressure. The experts showed a higher tendency to deliberate over situations and novices deliberated more on alternative options. A third study, wildland fire decision making, was conducted by attaching observers to an 'overhead team'. Five separate fires were burning simultaneously, each with its own team of firefighters. Compared to the urban fire ground studies, the time pressure was less and the need for team coordination and communication was greater. The study revealed a weaker tendency of RPD decisions than the urban fire ground study. However, the functional decisions (how to fight the fire) had a greater proportion of RPD characteristics than organisational decisions (how to get things done within the bureaucracy). The other pioneer studies contributing to the RPD model included military

planning, neonatal intensive care nursing, design engineering and chess playing. These topics are relatively remote from incident commanding and, thus, the relevance to predicting behaviour in crisis decision making is minor.

Field studies of disasters have been conducted beginning as early as two days and as late as five years after impact. Little is known about the effect of timing on the validity of disaster data, but these effects might be highly significant (Killian, 2002). With time, there is a danger that the subjects will have forgotten many details of their experience and that distortion of other recollections will have occurred. A 'group version' of an event can develop during a very short period. Disaster experience research and fragmentary evidence show only that we do not know with any precision how much bias and of what kind occurs among different types of respondents under different circumstances and at different periods after the disaster has occurred. Scott (1955, referred to by Killian, 2002) suggested that there is a possibility that memory errs in the direction of how the respondent feels he/she should have behaved. From the interviews with operations leaders (Rake and Njå, 2007), we found that the response patterns were highly normative, referring to standardised procedures or what the respondents thought would be the correct understanding of procedures. In one region where data were gathered, a critical incident had recently occurred. The event killed two first responders and one civilian. Several respondents brought this scenario into the interviews. The versions of their story varied substantially.

No precise measurements exist to show us the extent and consequences of retrospective distortions and faulty memories in post hoc disaster interviews to chart specifically the pitfalls to be avoided in disaster field studies.

7 Summary: a comparison of the two perspectives

We have presented two different schools of thought dealing with crisis management issues. The two perspectives show similarities and differences in several aspects, which are presented in Table 1. Even though the approaches to incident command research are different, there are also important similarities in their concluding decision-making characteristics.

Both schools of thought in Table 1 imply that in crisis situations, decision making becomes centralised and formal rules and procedures are insufficient as decision-making tools. Thus, the role and performance of the incident commander are of utmost importance to the crisis outcome. However, taking an external assessors' view, do we actually know when the incident response performs well? Why and when can we conclude if the outcome is successful or not? Accident investigations provide in-depth analyses of the causal factors related to the responsible systems and objects involved. The debriefing activities conducted by emergency organisations are often concerned with the well-being of the involved personnel. A critical view of crisis management and performances is rarely seen. Drabek (2002) has been frustrated by the lack of emergency response performances: "Maybe the explosion couldn't have been avoided, but too many people suffered even more because these emergency workers did not do their jobs. Or more accurately, emergency workers had been swallowed up in a system that failed them despite their best individual efforts."

Table 1 Comparison of dominating perspectives in incident command research

	Schools of thought	
Issue	*CA*	*RPD*
Discipline	Social science, sociology, political science, administration	Psychology
Basic theories	Contingency theory, institutional theory	Cognitive psychology
Analytical premises	Society and organisations	Individual
Research approaches	Single cases of major incidents; various issues, not strict decision focus	Naturalistic critical conditions requiring rapid decision making, cases selected in cooperation with respondents
Data provided	Protocols, interviews, observations, documents	Mostly interviews, observation, protocols
Analyses	Qualitative statements	Coding used in cognitive task analysis, a quantitative construct
Important factors	Level of expertise, experience, situation demands, coordination, leadership, politics, planning	Level of expertise, experience, situation recognition
Conclusive quality aspects	Seldom reflected	Few studies assess quality measures

If the outcomes were used as a basis for the assessment of the incident commanders' decision making, this would also be a highly dubious process. The decisions are contextual and should be assessed on specific evidence, circumstances and the commander's assessments in real time. Very little research exists that shed light on the 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 psychological perspective particularly pays very little attention to the context in which decision making is performed.

The experienced incident commander's serial approach to making decisions is the key element of the NDM theory and this is presented in a positive manner in the research literature. The sociological perspective has the opposite view on the serial approach. The researchers claim that the incident commander who sticks with a certain chosen course of action, being unable to reflect on and redefine the situation, threatens crisis mitigation. In addition, the incident commander could not be regarded as working solely with his/her own decisions. Groupthinking (Janis, 1982), information over-/underload, prioritising the source of information and increased communication demands are all issues that could detract from the incident commander's ability to make good decisions.

The workload on the incident commander can be extreme, compounded by the *critical values at stake*, the *multiple players involved*, *time constraints* and *competing goals* (Orasanu and Connolly, 1993). The decisions made in the first few minutes and hours are crucial to the successful mitigation and overall conclusion of the crisis (Kowalski and Vaught, 2001). In cases of severe accidents, the response group that first arrives at the accident location consists of a limited number of rescue personnel (police, fire brigade or ambulance).

In Norway and Sweden, normally two to six 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. Thus, it can be quite circumstantial who becomes the incident commander and what managerial background and experience he/she possesses to make adequate decisions. Neither the RPD nor CA considers these facts. Of course, the psychological approach 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 the changes in roles (Sjøberg *et al*., 2005) during combat. Normally, there is at least one transfer of the leading officer during a major incident, which is critical for response performance. The dynamics of the commanding structure are almost absent from the research literature, especially in the psychological approach. The sociological research approach has only a secondary interest in individuals as such. The focus is on the group level: what the organised group as a social entity did in a specific context, not what social roles particular people played.

There is no easily accessible and measurable output quantity of incident commanding which can be used as the dependent variable, for example, the production rate of a process system. The independent variables are also difficult to retrieve and scale in an analysis of incident command. The schools of thought in Table 1 have different agendas in their study of crisis decision making. The major issue in psychological research is to understand the present cognitions in real-world crisis decisions; thus, the empirical data are constructed to test the RPD model and the inherent prerequisites. The CA has a broader view in which incident decision making is obtained secondarily as an aspect of the crisis case and the specific issue studied. However, both approaches utilise case studies: the psychological approach constructs the case around the decision maker and the sociological approach constructs the case around the crisis phenomenon, including crisis management. Both approaches have the problem of 'controls' and, therefore, of making valid inferences concerning significant relationships among variables in crises. Can we rely on the presented theories? How do the researchers underpin generalisations from their case studies?

Case studies as a research strategy has its main advantage as a theory development tool through its "thick description", enabling comparison to establish theoretical congruity (Andersen, 2005). However, drawing conclusions on causal explanations based on the factors existing in one case could be misleading. The factors do not need to be present in similar cases, nor is it possible to treat partial effects in case studies. The CA is supported by a 'case bank' of numerous case studies. However, no meta-analysis has been identified that supports decision-making characteristics and it has been impossible to retrieve the background to the statements regarding crisis decision making presented by Rosenthal *et al*. (1989b).

The critical decision method has been scrutinised for the reliability of decision point identification and coding (Taynor *et al*., 1987) and, hence, internal validity related to the causal explanation of data. Two researchers reviewed selections of the interview data (four cases) from the urban fire ground and wildfire studies and found a high degree of correspondence. From the wildfire study, eight respondents were recalled three and five months after the interview. The correspondence between the critical decision points identified in the first and second interview varied from 56%–100%. The CDM approach has been widely adopted in NDM studies since the 1990s.

Research into crisis management is concerned with story telling from the event in question. Specific issues and judgements made in crisis research need to be considered, particularly the researchers' power as the narrators of 'true' stories. The starting point usually reveals the truth about what really occurred and why the crisis developed as it did. But to reveal the 'truth', *i.e*., all facts of the crisis, is practically impossible. Ochs (1997) described narratives in this way: "It is our cares about the present and especially about the future that organize our narrative recollection of past events." Killian (2002) claimed that interviewer bias could easily become a significant problem in dramatic situations, strongly affecting the subjects. In such situations, it might be appropriate to question whether the interview responses of involved parties may be especially subject to faulty memory and retrospective distortion and reconstruction. The greatest danger is not that the interviewer will appear unsympathetic to the respondent, but that he/she will become so identified with him/her that he/she drops the role of scientific observer. Interviewers must be cautioned and recautioned against retaining only the data which support the hypotheses of the research design.

Quarantelli (2002) raised this serious problem:

> "It has always bothered us that the "decision-making" we have observed during actual crises seldom corresponds to the picture evoked in later interviews outside of the actual crisis context, where the process is often depicted as explicit, conscious, individually based and involves the consideration of alternative options. This is why we think that it is very unfortunate that too many current disaster researchers who are the ultimate analysts of data often not only get the information third-hand via first an interviewer and then a coder, but also have absolutely no direct experience in disaster occasions which would give them a larger context for interpreting the data."

8 Conclusions

Decision making on accident scenes and incident commanding are difficult research topics. An important aim for the research will be to understand the decision-making process and on-scene incident management in a way that will help develop principles and models to increase the efficiency of crisis management. Our analysis of the two different research perspectives (the sociological and cognitive psychological) strengthened our belief that real-time data are necessary to understand and influence the features involved.

NDM research has provided useful insight into individual reasoning in crises, but the research could just as well have revealed experts' decision making based on established praxis rather than distinct expertise in crisis decision making involving great uncertainties, ill-structured goals, *etc*. The NDM perspective is based on cognitive psychology, where contributions from other disciplines have to be adapted to the cognitive basis. We recommend that input from other disciplines should be used to develop the NDM theory into a meta-analytical process that could be better adapted to incident command issues. The sociological perspective has a much more humble attitude to the generalisations from case studies. This approach does not specify the contributions of individual commanders. There is a need to analyse decisions and decision-making processes in the context it was carried out. The inherent assumptions seem (to a large extent) to be that emergency managers and incident commanders had a clear and comprehensive picture of the entire situation when critical decisions were made.

We conclude that both perspectives are important for research on incident commanding, but the influence potential in practical first-responder organisations, both within and across cooperating units, could be further explored. Based on our research in Scandinavian countries (Rake and Njå, 2007), incident commanders and their emergency organisations appear to be very little concerned with research and the practical use of scientific results. The barriers between researchers and first responders are both structurally and culturally conditioned. There are very few arenas where researchers and operative responders meet (Njå and Rake, 2008). Researchers developing descriptive and normative models seem unable to communicate with the responders. The responders, on the other hand, work in a rather enclosed community in which exposure to outside criticism is infrequent and experience transfer within and across services does not work very well.

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Note

1 This research is based either on laboratory tests, for example, the psychometric research of Kahneman *et al*. (1982) or mathematical and statistical simulations (von Neumann and Morgenstern, 1947; Savage, 1954; Edwards, 1954; Lindley, 1985).