

The Perception of Reality

Analyzing the Influence of Situation Assessment on the Decision-Making Process of a Dutch Fire Incident Commander



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Abstract

When firefighters are called in to combat a fire incident, the incident commander is the designated person to coordinate the incident, give out orders, and the one who decides how a fire must be dealt. Commanders make decisions based on their perception of reality, meaning how they assess the situation they are confronted with. The situation assessment phase is considered to be the first stage of the decision-making process of an incident commander. There is still a lot unknown about how an incident commander assesses and makes sense of a situation and how it influences his decision-making process. This research aims at exploring this knowledge gap, and examines the influence of situation assessment on the decision-making process of a Dutch fire incident commander. To answer this research question, 10 bodycam video recordings of real-life incidents, worn by Dutch fire incident commanders, are analyzed. Through the use of process analysis, it is identified how processes such as situation assessment, sensemaking and decision-making emerge and unfold over time. The results indicate that commanders who (re)assess the situation that match the reality of the incident and have a high understanding of the situation, are able to make good decisions and therefore handle the incident more effectively. Consequently, commanders who struggled with assessing the situation, had a low understanding of the situation, or suffered from cognitive biases, are not able to give out clear and direct orders which leads to an overall ineffective coordination of the incident.

Chapter 1: Introduction

1.1 Background and Research Question

On August 5, 1949, a massive wildfire broke out in the Mann Gulch area. When the emergency call came in, 16 smokejumpers were appointed to fight the forest fire and they flew out of Montana right after (Weick, 1993, p. 628). The smokejumpers arrived at the scene thinking the fire would be contained by 10:00 am, because that is the information they received from the fire spotters (Weick, 1993, p. 635). Because the smokejumpers had received such confident information of the situation, they became blind to the cues that proved otherwise (Maitlis & Sonenshein, 2010, p. 555). Without realizing what was going on, the fire spread immensely and ended up surrounding the crew. By the time the crew noticed the expanding fire, it was already too late (Weick, 1993, p. 635). Out of 16 smokejumpers, 13 lost their lives during the Mann Gulch disaster (Weick, 1993, p. 628). Weick (1993) analyzed this horrific incident and found that there was a severe collapse in sensemaking. The crew had a completely incorrect assessment of the situation, and the crew realized too late what was actually going on (Weick, 1993, p. 635). Eventually, the Mann Gulch fire was put out after five days of hard work of around 450 men (Weick, 1993, p. 629).

The Mann Gulch disaster serves as an interesting starting point for this research. During a fire incident, the incident commander is the designated person to coordinate the incident and the one who decides how a fire must be dealt with. Not seldom, the commander takes difficult decisions under high-risk and time-pressured circumstances. Before a commander can make a decision, he has to understand the situation and comprehend what is going on. The first step of a commander's decision-making process is therefore the situation assessment phase, where the commander gathers and analyzes incoming information and cues to assess the incident (Ley et al., 2012, p. 1). During this phase, the commander tries to grasp an understanding of the situation and form a mental picture of it. This attempt by an incident commander to comprehend the situation is called sensemaking (Weick, 1988, p. 308). This concept aims at finding out 'what is going on', instead of 'what do we have to do' (Dyrks, Deneff & Ramirez, 2008, p. 2).

Nowadays, still a lot is unknown about how an incident commander assesses and makes sense of a situation and how it influences his decision-making process. Existing literature focuses merely on the decision-making process of the commander, but only limited studies analyze incident commanders' internal process from a sensemaking perspective. Because an incident

commander first has to assess the situation and make sense of what is happening before he can make a decision, it is a vital topic to study. Moreover, authors have also acknowledged the relevance of this phase, describing situation assessment as the ‘basis for efficient decision-making’ (Ley et al., 2012, p. 1). Thus, this thesis focuses on the situation assessment of an incident commander, and in particular to what extent it influences the decision-making process of a commander. Throughout an incident, commanders receive new information and cues. It is interesting to see if, and how, they process this new information and if they revise their frame. If the results of this research give more insight in the situation assessment phase of a commander, how it shifts, and how it influences the decision-making process, then this can contribute to the understanding of an incident commander’s thought process.

The question that is central in this research is therefore:

How does the situation assessment of a Dutch fire incident commander influence the decision-making process?

This research question is divided into the following three sub questions:

- 1) How do incident commanders assess an incident situation?
- 2) To what extent do commanders reframe their situation assessment during an incident?
- 3) In what circumstances does a reframing of a situation occur?

The aim of this research is to better comprehend the nature of the situation assessment and decision-making of a fire ground commander during incidents, and is therefore exploratory by nature. For the purpose of this research, 10 bodycam video recordings of Dutch fire incident commanders are observed and analyzed. In 2017, a group of around 50 incident commanders volunteered to wear bodycams during incidents for a research conducted by the Institute for Safety. Several of those recordings will be analyzed for this study. Through the use of process analysis, the results will be analyzed and linked to the theoretical concepts of this research.

1.2 Academic and Social Relevance

This research is relevant academically because there is still a lack of understanding about the situation assessment phase of the incident commander. Moreover, previous research focuses mainly on analyzing incidents and command from a decision-making perspective, and not from the sensemaking perspective. This is interesting, because sensemaking has actually been proven

to be very relevant for the practices of fire incident commanders (Dyrks, Deneff & Ramirez, 2008, p. 2). Furthermore, the situation assessment of an incident commander has not been researched before in-depth in the Netherlands. Because of this knowledge gap, this research can contribute to the discussion of the topic, Lastly, this study can give insight into the thought process of an incident commander, and how commanders make decisions based on their assessment.

The research is of social relevance since the results can be useful for future purposes. If the study results in a better understanding of an incident commander's situation assessment, and how sensemaking plays a role in it, then it can give insight into the thought process of incident commanders. Once a better comprehension of a commander's internal process is established, then this can be used for training and educational purposes. If the training programs of incident commanders can be improved, then this could eventually lead to an enhancement of safety procedures of firefighters and lessen the chances of (severe) injuries.

1.3 Reading Guide

This study is divided into six chapters. The first chapter serves as an introduction, where the topic of the research, its background, and the research question are presented. Moreover, the academic and societal relevance of the research are also mentioned. The second chapter includes a literature review, where concepts such as decision-making, sensemaking, and situation assessment are explained. This chapter is written from an analytical approach, to create a better understanding of these concepts. Different definitions and contradicting explanations of these concepts are explored in order to encourage the reader to comprehend the main debates and purpose of this study. In the third chapter, the methodological approach of this research is explained. It does not only elaborate on the methodological approach, but also on the data collection, method of analysis and limitations of the study. Basically, this chapter explains what procedures will be followed to answer the research question. The research analysis is presented in the fourth chapter, which provides a comprehensive explanation of the results. The fifth chapter includes the discussion, where the results of the study are discussed in light of the theoretical framework that is provided in the second chapter. Several recommendations are given at the end of this chapter as well. Lastly, an answer to the research question is given in the sixth chapter, the conclusion.

Chapter 2: Literature Review

Firefighting is considered to be one of the most high-risk professions in the world. Not only does the work physically and emotionally demands a lot of a person, they are also often confronted with uncertain stressful situations along with an intense workload under very hot, contaminated and damp environments (Michaelides et al., 2011, p. 956). Studies have found that the risk of a firefighter to become injured or that those injuries eventually lead to a fatality, is very high. From 1990-2000, an average of 100 firefighter deaths were reported annually in the United States (Fabio et al., 2002, p. 1059). Moreover, a different research reported an average of over 30.000 fireground injuries in the United States from 2010-2014 (Campbell, 2016, p. 1).

With the knowledge in mind that a fireground is a dangerous, high-risk setting, it can be stated that it is very challenging for incident commanders to make decisions in this type of environment. The fire incident commander is the one on scene that coordinates the incident, and has to make decisions based on incoming information and their perception of the situation (Groenendaal & Helsloot, 2016, p. 2, 4). Because of the fact that an incident commander makes decisions based on their assessment of the situation, this particular part of the decision-making process is crucial. Therefore, it is vital to study the situation assessment of an incident commander, and in particular to what extent their assessment shifts throughout an incident. Existing literature shows a lack of knowledge on the situation assessment of an incident commander. Though research into the decision-making process of firefighters have been done in the UK and Scandinavia, only limited studies have been done in the Netherlands. In order to understand how this research adds value to the general debate, a few concepts need to be explained. Therefore, an overview of the main discussions on decision-making, sensemaking, and the situation assessment is provided in the following sections. Contradicting explanations are examined, and the knowledge gaps are addressed as well.

2.1 The Decision-Making Process of Incident Commanders

During an operational incident, an incident commander faces a variety of difficulties. One can think of problems such as uncertainties, time pressure, a high cognitive load, or the unpredictability of a situation (Groenendaal & Helsloot, 2016, p. 2). Misinterpreting a complex situation or making a poor decision could be fatal in some instances: it could lead to a bad outcome of the incident that can cause injuries, severe damage or loss of human life (Cohen-

Hatton, Butler & Honey, 2015, p. 793). To prevent such situations from happening, it is important to examine the decision-making process of incident commanders. Moreover, a comprehensive understanding of the decision-making process of an incident commander could improve the training programs and other educational services, and eventually enhance the overall safety of firefighters as well (Cohen-Hatton, Butler & Honey, 2015, p. 793).

There are a few models that are central in the discourse on the decision-making process of fire incident commanders. Scholars have argued that there are two different models of decision-making that incident commanders tend to follow: the rational decision-making theory and the recognition-primed decision-making theory. Both models are discussed in the following section and the differences are examined. A third model is also shortly addressed, to elaborate on the recognition-primed decision-making theory.

2.1.1 The Rational Decision-Making Model

Initially, the belief was that fire commanders make decisions in a rational way, and that their thought process follows a three-phase model. This decision-making model is called the rational decision-making model, or also known as the normative, reflective model. It makes use of the people's ability to reason (Groenendaal & Helsloot, 2016, p. 5). The model follows an order of phases: situation assessment, followed by a plan formulation, which then is proceeded by a plan of execution (Cohen-Hatton, Butler & Honey, 2015, p. 794). During the situation assessment phase, the incident commanders gathers information, clues and cues and shapes an understanding of what is going on. Then, the rational decision-making theory assumes that an incident commander formulates a course of action based on the risks and solutions that the commanders identifies. In this phase, it is expected that the commander sets certain goals, recognizes risks, evaluates the different options and comes up with a plan. The last phase is the plan execution phase, where the incident commander executes the tactical plan. In theory, the incident commander communicates the plan to the firefighters, divides roles and tasks, and monitors if the plan is being carried out (Cohen-Hatton, Butler & Honey, 2015, p. 794).

In the past, this reflective model was the designated theory for many incident command training programs. The UK Fire and Rescue Service for example, implemented the rational decision-making model in their training programs in 2008 (CFRAU, 2008, p.17). This traditional model was adopted because it allows an incident commander to 'make the 'best' decision, provided

that you have the mental energy, unlimited time and all the relevant information to carry out the decision analysis' (CFRAU, 2008, p. 107).

2.1.2 The Recognition-Primed Decision-Making Model

Studies into the actual practice of incident command argue that incident commanders do not follow the beforementioned rational decision-making model (Cohen-Hatton, Butler & Honey, 2015, p. 794). Several scholars have found that other factors play a role in the decision-making of commanders, such as their previous experiences. This causes their decisions to be more impulsive and automatic: 'in such cases, options are not evaluated against one another, but rather, the decision to act might be one that is deemed, by the decision maker, to be satisfactory rather than optimal' (Cohen-Hatton, Butler & Honey, 2015, p. 794). The realization that incident commanders tend to make a plan based on their experience and usually do not compare various options was the result of a research conducted by Gary Klein. On the basis of these results, Klein came up with the recognition-primed decision-making model (RPD) back in 1986 (Klein, Calderwood & Clinton-Cirocco, 1986, p. 30). The RPD model includes three phases: situation recognition, serial option evaluation, and mental simulation. In the first stage, the commander identifies a situation as either typical or novel. If the commander recognizes a familiar situation, this leads to a typical action. However, when the commander recognizes a situation to be novel, the commander cannot rely on his previous experience. In the second stage, the commander goes through several options until an acceptable option is found. Thirdly, to determine if an option is acceptable, the commander envisions the potential steps and outcomes of the option (Klein et al., 1993, p. 107).

Throughout the years, research has pointed out several factors that explain why incident commanders tend to follow the RPD model instead of the rational model. Stress, for instance, plays an important role. The RPD is simply faster than the rational approach, which makes it easier for incident commanders to rely on their previous experience (Gasaway, 2007, p. 15). In situations where time is limited and risks are high, incident commanders will not be able to evaluate and compare different options. The RPD model can therefore be an effective tool when incident commanders do not have time to administer an in-depth analysis (Klein, Calderwood & Clinton-Cirocco, 1986, p. 30).

On the other hand, the recognition-primed model also has its limitations and risks. A variety of cognitive biases may occur when an incident commander is confronted with the coordination

of an incident. The biases may influence the commander to disregard important pieces of information, and may affect his decision-making process. Because the commander is not always conscious that he is suffering from a bias, it may possibly lead to an ineffective or wrongful decision (Kinsey et al., 2019, p. 465). According to the RPD model, an incident commander tends to rely on his past experience when assessing a situation and determining a course of action. If he recognizes an incident as something he has dealt with before, his mind will most likely provide him with a learned response that matches the incident (Kinsey et al, 2019, p. 469). This intuitive judgment – as it is called – happens automatically and goes without effort. Kahneman & Klein evaluated this intuition, and argued that expert intuition usually results in the right and successful decision, but that it can also lead to faulty or terrible decisions (Kahneman & Klein, 2009, p. 521). This shows that relying on past experience too much can lead to a wrongful decision of a commander.

Another risk of the RPD model is that a commander can suffer from an error called confirmation bias. Cohen-Hatton describes this phenomenon in her book ‘The Heat of the Moment’. When an incident commander only seeks and processes information that confirms his or her viewpoint, one can speak of confirmation bias. The danger of only looking for evidence that confirms his or her perspective, or original bias, is that it can lead to the misinterpretation of a situation (Cohen-Hatton, 2019, p. 57). Cohen-Hatton elaborates on this phenomenon with an example of James, an incident commander who participated in a simulated command unit where he had to handle a fictional incident. The incident is a fire in a building on Parliament Square, and James hears that there are still around 150 people inside (Cohen-Hatton, 2019, p. 53). Moreover, James asks the commander who arrived at the scene first if there are signs of a terrorist attack, and if it could be the cause of the incident. The first commander responds that there aren’t any, but James continues to ask terror-related questions and he is not considering other possibilities (Cohen-Hatton, 2019, p. 54). Because he assesses this incident as a terrorist attack, he refuses to send men in to rescue the 150 people that are still inside. The fictional incident ends up with the loss of two firefighters, due to the ineffective decision-making of James (Cohen-Hatton, 2019, p. 61). As Cohen-Hatton also states, this example illustrates perfectly how biases or assumptions influence the decision-making process of an incident commander (Cohen-Hatton, 2019, p. 56).

Over the past centuries, the RPD model has appeared to be the most popular one of the two. Professor Rhoha Flin argues that this model contributes significantly to the knowledge of the

decision-making process of incident commanders, because it ‘offers descriptions of what expert commanders actually do when taking operational decisions in emergencies’ (CFRAU, 2008, p. 107). However, other scholars have developed decision-making frameworks that are based on both the RPD model as the rational decision-making model. Groenendaal & Helsloot (2016) for example, developed the so-called FADCM model. This framework, which includes both rational and recognition-primed aspects, encompasses five stages: fact gathering, analysis, decision making, communication and monitoring (Groenendaal & Helsloot, 2016, p. 4).

2.2 The Concept of Sensemaking

As described above, the decision-making of incident commanders is a significant process to focus on in order to enhance the overall safety of firefighters. However, in order for an incident commander to come to a decision, he first has to assess and make sense of the situation. This situation assessment stage, where the incident commander initially gathers information and creates a mental image of the incident, is a crucial starting point for the concept of sensemaking. This concept focuses on the question of ‘what is going on’ instead of ‘what do we have to do’ (Dyrks, Deneff & Ramirez, 2008, p. 2). Because sensemaking, and thereby situation assessment, serve as a springboard for the incident commander to make decisions, it is a vital concept to examine for this study. It is also important to emphasize that sensemaking is a continuous process that keeps developing throughout the incident and that situation assessment is considered to be the starting point. This is further explained in the following sections.

2.2.1 Definition by Weick

Karl Weick developed the concept of sensemaking back in the 80’s. He underlined the importance of understanding the process of sensemaking, and tried to shift away from the focus on decision-making. He argued that if we can understand the process of sensemaking during a crisis, then this could help organizations or institutions to prevent an emerging crisis and develop a better comprehension of how crisis situations can be confined and repressed (Weick, 1988, p. 308). The definition Weick initially provided was: ‘reality that is an ongoing accomplishment that emerges from efforts to create order and make retrospective sense of what occurs’ (Weick, 1993, p. 635). Essentially, the concept of sensemaking according to Weick, is that it is a continual process. It can be seen as a puzzle where the pieces continuously change and where the sensemaker has to define and redefine the developing situation and has to seek for new solutions (Brown, 2020, p. 246 & Weick, 1995, p. 20). In 2005, Weick finetuned the

definition, and reconstructed it: 'sensemaking is about the interplay of action and interpretation rather than the influence of evaluation on choice. When action is the central focus, interpretation, not choice, is the core phenomenon' (Weick, Sutcliffe & Obstfeld, 2005, p. 409).

2.2.2 The Role of Enactment

In the article 'Enacted Sensemaking in Crisis Situations', Weick tries to explain the importance of the role of enactment in sensemaking. He argues that the word 'enactment' covers the idea that people form structures and events by acting a certain way, and thus setting them in motion (Weick, 1988, p. 306). Basically, the idea of enactment is that human action and crises are interweaved. When people become part of a crisis, their actions can bring small deviations to a crisis. These deviations can shift or merge with other events, which eventually can create 'an environment that is a rare combination of unexpected simultaneous failures' (Weick, 1988, p. 309). Looking at crisis situations from an enactment perspective contradicts the idea that crisis events are uncontainable. If you think about it, when an incident commander perceives that he has more control over a situation, his stress level lowers, which therefore causes him to see more when he examines a situation. Moreover, this could lead to a higher level of control because the commander is more likely to recognize things he can take care of. Consequently, this lowers the level of the crisis intensity (Weick, 1988, p. 315).

An example of an incident where the meaning of the crisis was suddenly lost, is the Mann Gulch fire that was shortly addressed in the introduction. In 1949, 16 smokejumpers were appointed to fight a wildfire in the Mann Gulch area (Weick, 1993, p. 628). Though initially thought that 'the crew would have it under control by 10:00 the next morning', the fire expanded unexpectedly in a rapid pace and caught the smokejumpers by surprise, which resulted in the loss of 13 men (Maitlis & Sonenshein, 2010, p. 555). How could this have happened? Weick (1993) analyzed this incident in detail and found that there was a severe collapse of sensemaking within the crew of smokejumpers: the initial assessment of the situation was completely wrong, and the crew realized too late what was actually going on. Because of the initial wrong mental picture, the following events that occurred throughout the incident also made no sense to the smokejumpers (Weick, 1993, p. 635).

When an incident commander relies on his past experience to decide what action to take – which is the case when he follows the RPD model – there is a particular risk of collapse of sensemaking. As seen in the Mann Gulch fire, the smokejumpers had no sense of what was

going on and therefore no idea what action to take (Weick, 1993, p. 336). This is why sensemaking is such an important aspect, because a commander only knows what to do once he has developed some sense of the crisis. If the commander does not develop a sense of the situation, and creates a wrong mental picture, the risk of collapse of sensemaking is high. The commander enacts based on his (incorrect) image, but these decisions and actions also shape a new situation. Chances are that the commander becomes stuck in the wrong frame, which could increase the levels of crisis intensity and lead to a collapse of sensemaking.

2.2.3 A Case Example: The Shootdown of Two Friendly Helicopters

To clarify the concept of sensemaking and the role of enactment even better, an example provided by Snook (2000) is elaborated on. On 14 April 1994, two F15 pilots flew over Iraq when two helicopters showed up on their radar. The F15 pilots decided to investigate if these helicopters were friendly or hostile, but their identification system failed to recognize the unknown helicopters. Because of this unsuccessful attempt, the pilots proceeded to a visual identification and concluded that the helicopters were Soviet attack helicopters (Snook, 2000, p. 6). The F15 pilots then went over to fire missiles at the two helicopters, killing all 26 people on board instantly. Five hours after the shootdown, the F15 pilots heard on the news that these helicopters were in fact friendly Black Hawk helicopters (Weick, 2001, p. 148).

Instead of finding out why the pilots decided to shoot the helicopters down, Snook tries to answer the question how the shootdown could occur (Snook, 2000, p. 15). This means that the question ‘why did the F15 pilots shot the helicopters down?’ is approached from a meaning perspective, and not a decision-making one (Snook, 2000, p. 75). When Snook describes the accident, he addresses how important context and history are in this case. The accident cannot be understood if it is seen as a loose incident, but has to be placed in a broader range (Snook, 2000, p. 26). He found that the accident was a result from a variety of factors: the misidentification by the F15 pilots, the AWACS crew who failed to intervene, and the flawed alliance between army activities and the air force. Snook explains how these errors intertwined at three levels, at an individual-, group-, and organization level, and eventually led to the accident (Weick, 2001, p. 148). Because Snook analyzed how the shootdown could happen from a sensemaking perspective, it gives more insight in accidents where individuals are having a hard time to make sense, rather than individuals making bad decisions (Snook, 2000, p. 207). Instead of merely focusing on the individual decision to fire the shot, this example shows us a

lot about how the whole context of a story, circumstances, and the role of individual actions can lead to accidents such as this one (Weick, Sutcliffe & Obstfeld, 2005, p. 410).

2.3 Situation Assessment

Now that the concept of sensemaking is examined, it is important to look at the situation assessment phase, because this is the crucial starting point for sensemaking. The situation assessment phase is considered to be the first stage of the decision-making process of an incident commander. Within this stage, fact finding plays an important role, because ‘front-line people make decisions based on their perception of reality’ (Groenendaal & Helsloot, 2016, p. 4). During this stage, the incident commander is trying to figure out the nature of the problem (Klein et al., 1993, p. 6). Information is gathered by the incident commander, to try and understand what is happening and what actions need to be taken. Part of this assessment is ‘based on sensory cues like sound, smell, and even taste, as well as what is visible’ (Rimstad & Sollid, 2015, p. 3). Visual cues could include smoke, broken windows, fire or damaged structures for example, while the commander could also identify audio cues such as an explosion or falling glass (Rimstad & Sollid, 2015, p. 3). As a result of this information gathering and fact finding, an incident commander can assess the risks of the incident and it ‘provides the foundation of the planning process and consists of both understanding and a projection of the situation into the future’ (Cohen-Hatton, Butler & Honey, 2015, p. 794).

2.3.1 Situation Assessment According to the RPD Model

The RPD model that has been mentioned and described earlier, is a framework developed by Klein. In this model, the situation assessment phase is crucial because incident commanders try to assess a situation when they do not recognize the situation or when it doesn’t peer with their mental image (Schraagen et al., 2008, p. 123). Klein recognizes four important aspects of situation assessment. The first one is where the incident commander comprehends the types of goals that can be achieved in the crisis situation within reason. The second aspect is identifying the critical cues that can contribute to his understanding of the situation and that are important. Moreover, the commander develops expectations of the situation, which can aid him in analyzing the correctness of the situation assessment. Finally, the commander recognizes the appropriate actions to take, which is considered to be the fourth aspect of situation assessment of the RPD model (Klein, 1993, p. 142).

To understand how these four steps of the situation assessment phase work in practice, an example provided by Nja & Rake (2009) is examined. In January 2006, a fire broke out in a small town in Norway. The fire officer who arrived at the scene recognized the vital cues, assessed the situation, implemented actions and evaluated these actions. After a while, the incident commander also arrived at the scene and the fire officer talked him through the incident. The incident commander identified the important cues, which in this case included the direction of the wind, the strength and location of the fire, and the possible chances of fire expansion. Moreover, the goals were understood by the commander: to prevent the fire from expanding, keeping the emergency responders safe, and evacuating all the persons from the house. The incident commander assessed the situation, and concluded that the house was a lost cause, and that no one was in direct danger. The actions the commander decided to take was to call for more stepladders and fire trucks, which led to a renewed plan: to prevent the fire from spreading to the other side of the road. Finally, the commander divided the tasks among the firefighters and observed if they were carrying out the right tasks (Nja & Rake, 2009, p. 7).

2.3.2 A Different Perspective on Situation Assessment

Tissington (2004), on the other hand, criticizes the situation assessment phase of the recognition-primed decision-making model. He argues that although the RPD model predicts that the above described aspects are on the mind of a commander when he makes a decision, little evidence for this prediction has been found. Tissington finds this surprising, since this phase is the level at which commanders are being trained at (Tissington, 2004, p. 43). After doing extensive research among the UK Fire Services, Tissington eventually developed a different method which is derived from the RPD model. The result of the research found that there are four things that are on a commander's mind when he makes a decision: 1) he considers the safety of his crew, 2) he thinks about how complex it is to rescue any potential casualties, 3) the feeling of being pressured under time, and 4) he considers the level of containment of the incident (Tissington, 2004, p. 44). Tissington explains that these aspects are not usually focused on, but that the incident commander unconsciously does think about these dimensions when he tries to make a decision. He argues that the training programs can be adapted to these findings and aid commanders in making better decisions (Tissington & Watt, 2019, p. 253).

2.4 Shift in Situation Assessment

As described above, the incident commander tries to assess the critical situation when he arrives at the scene of the incident. Based on the cues and information he receives, the commander tries to understand what is going on and what actions need to be taken. Throughout the incident however, the commander often receives new information, and he usually has to process loads of complex information under limited time (Krasuski et al., 2013, p. 229). When this occurs, it is interesting to see to how a commander reacts to the new incoming information. Does he process the new information, or is he not able to due to a high cognitive load for example? Does he revise the situation when new information or evidence comes in? And to what extent does the incident commander hold on to his initial assessment? By examining these questions, an attempt is made to create a better understanding of the situation assessment of an incident commander.

Klein (1993) describes a textbook example of an incident commander's shift in situation assessment in his book 'Decision Making in Action: Models and Methods'. The incident he elaborates on is a reported fire in the basement of an apartment with four floors. The incident commander who was in command at the incident assessed the situation, and concluded that the fire spread through a shaft in a laundry tube. He did not see any smoke outside of the apartment, which made him believe that the fire had just begun. His situation assessment can be divided in several parts: he recognized that there was enough time to control the fire (possible goals), examined how much the fire had already expanded (vital cues), assumed that the firefighters could reach the right floor in time to stop the fire (expectations), and sent a fire crew with hoses to the first and second floor (needed actions to take). However, shortly after his initial assessment, the incident commander received new information. The fire crew was not able to reach the second floor because the fire had already spread, and reported this back to the incident commander. Moreover, the incident commander now saw smoke coming from the building, right below the roof (Klein et al., 1993, p. 141). This is the moment that the incident commander's situation assessment shifted: he pictured how the fire had already expanded to the fourth floor, and realized that the whole building was on fire. This shift made the commander realize that he had to change his goals and course of action, and adapted his plan and goals to the new situation, which was to search the building and rescue possible victims (Klein et al., 1993, p. 142).

2.4.1 Adaptive Sensemaking

The incoming of new information and the (re)assessment of the situation by an incident commander is also intertwined with the concept of sensemaking. After an incident commander has assessed a situation, but new information comes in, it is possible that he will begin to question the sense that he had made of the situation. This is when adaptive sensemaking comes into play (Strike & Rerup, 2016, p. 880). As Weick describes it, adaptive sensemaking is about constantly integrating more of the observed information and revising an evolving situation so that more pieces of the puzzle fall together (Weick, Sutcliffe & Obstfeld, 2005, p. 415). Moreover, Maitlis & Sonenshein (2010) refer to two conditions – updating and doubting – as being crucial for a commander to engage in adaptive sensemaking. Through updating, a commander can reassess the situation based on the incoming of new information, while doubt reminds him of other options that could be fitting for the situation, and drives him to keep developing new perspectives (Maitlis & Sonenshein, 2010, p. 565). Thirdly, Cornelissen, Mantere & Vaara (2014) suggest that adaptive sensemaking is the ‘ability of sensemakers to query an initial frame and commitments, and to mobilize instead an alternative frame from background knowledge or make novel associations as a way of structuring expectations and make inferences’ (Cornelissen, Mantere & Vaara, 2014, p. 703). Basically, all these definitions come down to the same idea: that adaptive sensemaking is about the internal process of an incident commander to revise his framing of a situation.

However, it can be a difficult task for a commander to revise his frame and adapt his understanding of the situation when new information comes in, especially when he is under a high level of stress. As discussed before, a commander can become stuck in his frame which can lead to a collapse of sensemaking, which happened during the Mann Gulch disaster. Another example of how difficult it is to reassess a situation is the 1996 Mount Everest climbing disaster. Researchers analyzed the year 1996 because it was the year where the most fatalities occurred in expediting the Mount Everest (Kayes, 2004, p. 1267). The study examined how eight climbers in three climbing teams died during the expedition, and found that there was a severe organizational disaster (Kayes, 2004, p. 1267). Similar to the Mann Gulch disaster, there was a variety of reasons why they struggled to make sense of the situation. First of all, the climbers were under the impression that they faced a clear problem. This shows from statements such as ‘we’ve got the Big E all figured out’, and ‘as long as the weather holds, we will have success’ (Kayes, 2004, p. 1277). However, the team struggled to make sense of problems such as weather changes, very few resources, difficult group dynamics and a misjudgment of how

fast they could reach the top of the mountain (Kayes, 2004, p. 1280). The Mount Everest disaster of 1996, another example of how sensemaking can collapse, shows how difficult it can be to reassess a situation and adapt the sensemaking. As an Everest climber said, 'things that are black and white down here aren't really black and white up there. You know, the decision-making process is a little bit more muddled' (Kayes, 2004, p. 1263).

Chapter 3: Research Design

3.1 Methodological Approach

The aim of this research is to examine the influence of situation assessment on the decision-making process of an incident commander. Since situation assessment takes place before a commander is able to make a decision, it is important to explore this phase of the decision-making process. The research is qualitative of nature, due to the fact that it is an under-researched topic that needs to be examined. Qualitative research is used to create a better understanding of people's actions, their opinions, and reasons within certain situations. Moreover, it contributes to more insight into a problem or an unexplored phenomenon (Bengtsson, 2016, p. 8). The approach I chose to answer the research question is through the analysis of bodycam video recordings of real-life incidents – worn by Dutch fire incident commanders – and conducting process analysis.

3.2 Data Collection

For this study, bodycam video recordings of 10 real-life incidents were analyzed. These video recordings have been gathered by the Fire Academy of the Netherlands and the Institute for Safety. In 2017, the Institute for Safety started a pilot to examine the command tactics of Dutch fire incident commanders. Their specific goal was to research if the theory of situational command and control works in practice. Around 50 incident commanders volunteered to wear bodycams during incidents from the period July 2017 until January 2019. In total, around 60 recordings were collected (IFV, 2020). From these 60 recordings, I was allowed to watch and analyze 10 of them for my study.

The reason why these particular 10 recordings were provided to me for this study was because these incidents included themes that were relevant for the topic of my thesis. These specific incidents gave me more knowledge on how commanders assessed a situation and how they processed incoming information for example. Sometimes, the incident commander of the incident either received a lot of new information and reframed his mental image, and other times he did not process the information at all. Moreover, these recordings gave me more insight into the sensemaking and decision-making process of incident commanders. Due to the variety of the recordings, several patterns were found that showed the difference between the sensemaking process of commanders. Some cases showed commanders who were able to create a good understanding of the situation, while there were also recordings that displayed the

commanders' inability to make sense of the situation, which influenced their decision-making process. All of this made these particular recordings very interesting for my research. Out of the 10 incidents, nine were fires that broke out in houses, buildings, or industrial properties, while one incident was a toxic dumping. All of the incidents I analyzed took place in either the region of Haaglanden, Drenthe, or Gelderland-Zuid. Moreover, the incidents ranged from small to very large fire incidents and usually lasted between one and five hours. In total, I watched and analyzed 23,5 hours of bodycam video recordings.

3.3 Method of Analysis

3.3.1 Observing the Bodycam Video Recordings

For the data analysis part, the video recordings of the incidents were observed and analyzed thoroughly through the use of a coding scheme. This scheme has been developed for the purpose of this research by the thesis supervisor and can be found in Annex 1. The scheme includes several categories to analyze the recordings: a timestamp, observation, analysis, situational awareness, phase of command tactics and type of command tactics.

To understand how these videos were observed and analyzed, I will go through each particular part of the coding scheme. When I watched the incidents on video, I put down the timestamp, and wrote in the observation part what precisely happened at that moment. This could include the sight of a building on fire, an interesting statement of the commander, or a dialogue between fire officers for example. In the analysis part, I described in more detail what was going on. Questions such as 'did the incident commander pick up certain cues?', 'did he formulate a plan before he made a decision?', or 'does the incident commander keep an eye on his crew?' are examples of what I asked myself and what I wrote down. Based on the analysis part, I concluded what the phase of command tactics was at that moment. This was either the situation assessment phase, the plan formulation phase, or plan execution phase. Moreover, when an incident commander experienced emotions or a high/low cognitive load, this was also entered in the scheme. In the next part, the level of situational awareness of an incident by a commander was written down. This was divided up into three levels: ranging from a perception of elements to pattern recognition. However, it was known upfront that an incident commander almost never reaches the third level. Lastly, the type of command tactics was recorded as well. The three different types of command that the commanders used were marked as either a hierarchical form, a specialistic form, or as swarming. At times, it occurred that two types of command

intertwined, which is written down as ‘mixed type of command’. For this research however, the focus is mainly on the observation, analysis and situational awareness part because those are most relevant for the topic of this study.

3.3.2 Process Analysis

This study tries to examine why and how things develop over time, and can therefore be considered a process study (Langley et al., 2013, p. 1). The research question in particular focuses on how processes such as situation assessment, sensemaking and decision-making emerge and unfold over time. For that reason, the method of process analysis is used for this research, which will take the form of a more interpretative use of content analysis. Through the use of process analysis, I will try to identify certain patterns in the processes at both a macro- and microlevel of analysis. In this way, I will not only explore the general patterns in assessment or sensemaking in the different incidents, but I will also examine the interpretations of incident commanders in detail. This will give me a broad understanding of why and how the processes of situation assessment, sensemaking and decision-making play out over time.

The selected content that I used for this research include 10 bodycam video recordings that were provided for me by the Institute for Safety. As described above, I analyzed 10 out of 60 recordings, because the themes in these recordings were the most relevant for my research. The incidents that were covered in these recordings all occurred between 2017 and 2019. Because it is essential for process analysis as a form of content analysis to have written text, I wrote the results of my observations down in a coding scheme. Furthermore, I developed a codebook, where I identified the codes, categories, definitions and indicators for the data analysis. This codebook can be found in Annex 2. After the process analysis was conducted, the results were put in a coding sheet which is attached as Annex 3. With the use of the coding sheet, the themes and patterns were examined to gain a better comprehension of the situation assessment, sensemaking, and decision-making of the incident commanders.

3.4 Limitations

Finally, it should be noted that the research comes with a few limitations. The weakness of using video recordings as a method for data collection, is that they are prone to biases. Since I interpreted the patterns and findings myself through the use of process analysis, the research is therefore prone to subjective interpretation. This may affect the reliability and validity of the

results of the data to some extent. Moreover, there are only recordings of officers that volunteered to participate in the pilot, and the number of regions is also limited to Drenthe, Gelderland-Zuid, Haaglanden, and Kennemerland. Therefore, the findings cannot be generalized due to the restraints of the pilot. Another limitation is that at times, the video recordings did not capture the entire incident. It has happened that incident commanders forgot to start the cameras, or paused them before the incident ended. There were also time periods where the cameras flickered between day and night mode, which made it hard to see what was going on and difficult to hear what was said.

Chapter 4: Analysis

In this chapter, the results of the analysis of the 10 bodycam video recordings are presented and described. A variety of patterns between the incidents are identified after analyzing the footages and are discussed together with examples from the incidents. The results of the analysis are presented along the three sub questions that were stated in the introduction: first, it is examined how incident commanders assess an incident situation. Moreover, it is explored to what extent incident commanders reframe their situation assessment during an incident. Thirdly, the circumstances under which a reframing of a situation occurs are also discussed.

To offer more overview of the incidents that are discussed in this section, a table is provided below that summarizes the most important patterns that have been found in the different incidents.

Incident	Situation assessment	Processing information	Sensemaking	Reframing SA	Cognitive biases
Nr. 1 Nursing home	IC bases SA on vital cues and identification of needed actions.		IC's (adaptive) sensemaking is high as he experiences low pressure.	IC reframes easily as he experiences low pressure.	
Nr. 2 Gaming house	IC doesn't base SA on vital cues, but more on expectancies.			IC reframes easily as he experiences low pressure. Example of reframing after decision was made outside of control of IC.	
Nr. 3 Farm	IC bases SA on vital cues and identification of needed actions.		IC's (adaptive) sensemaking is high as he experiences low pressure.	Reframing occurs after receiving information of risks. Example of reframing after rational decision-making process.	
Nr. 4 Storehouse		IC struggles with processing information as he experiences high pressure.	IC's sense-making starts low due to inability to process information. Sensemaking becomes higher throughout incident.		

Incident	Situation assessment	Processing information	Sensemaking	Reframing SA	Cognitive biases
Nr. 5 Warehouse	IC barely identifies goals.	IC struggles with processing information as he suffers from confirmation bias.	(Adaptive) sensemaking is low due to confirmation bias.		IC suffers from confirmation bias.
Nr. 6 Industrial property	IC barely identifies goals.	IC struggles with processing information as he experiences high pressure and suffers from bias.	IC's (adaptive) sensemaking is low due to inability to process information and influence of bias.	Reframing occurs after receiving information of risks.	IC suffers from confirmation bias.
Nr. 7 House		IC struggles with processing information as he experiences high pressure.	IC's sense-making starts low due to inability to process information. Sensemaking becomes higher throughout incident.		
Nr. 8 Retirement home		IC struggles with processing information as he experiences high pressure.	IC's (adaptive) sensemaking is low due to inability to process information and high pressure.	IC reframes many times, but SA doesn't match the reality of the incident.	
Nr. 9 Beach club	IC bases SA on vital cues and identification of needed actions.		IC's (adaptive) sensemaking is high as he experiences low pressure.	IC reframes easily as he experiences low pressure.	
Nr. 10 Toxic Dumping	IC bases SA on vital cues and identification of needed actions.		IC's (adaptive) sensemaking is high as he experiences low pressure.	IC reframes easily as he experiences low pressure. Example of reframing after recognition-primed decision-making process.	

Table 1. Overview of the identified patterns in the 10 incidents.

4.1 How Do Incident Commanders Assess an Incident Situation?

As discussed in the third chapter, a codebook was developed to analyze the behavior of incident commanders throughout the incidents. Specifically focusing on how incident commanders assess a situation, four important aspects of the situation assessment phase were identified. These aspects, which have been discussed in the literature section of this research, include 1)

the identification of critical cues, 2) the comprehension of possible goals that can be achieved, 3) the expectations of the development of the incident, and 4) the appropriate actions that need to be taken. Along these four aspects, an examination was done into the question of how incident commanders assess an incident situation. Moreover, this section includes an evaluation of how incident commanders process new information, and what patterns were found with regards to the sensemaking process of commanders.

4.1.1 The Four Aspects of the Situation Assessment Phase

After thorough analysis of the 10 incidents, it is evident that commanders mostly assess a situation based on an identification of vital cues. In 9 out of 10 incidents, the commanders mainly recognize critical cues to create a mental picture of the situation. These cues varied extensively, from seeing smoke escaping through windows, to the recognition of possible risks such as an unknown substance leaking in the water. Also, the analysis shows that the information provided by fire officers, other commanders, medical teams and police officers plays a vital role in framing the incident situation. Take incident nr. 3 for example, which was a fire that broke out at a farm. The commander received lots of information from fire officers right at the start of the incident: the fire grew quickly but has been put down, that there was still a horse inside, and how there was a problem with water extraction. Moreover, the commander noticed large clouds of smoke. After receiving this information, the commander responds with:

“Thank you, this gives me a good image of the situation.”

Next to the critical cues that commanders include in framing the situation, it is noteworthy that commanders pay close attention to identifying the appropriate actions to take in order to control or contain the incident. In nearly every incident, commanders quickly assess what actions need to be taken. These actions were usually about upscaling the incident to large or very large fire, calling for an extra fire truck or more materials, or asking an expert for advice. There were four incidents that showed how commanders easily identify the appropriate actions to take, but these were all incidents where the commander either recognized the situation, or when the fire was already under control. During incident nr. 1, which was at a nursing home where the fire was already under control, the commander was very relaxed and quickly made an evacuation plan. However, the videos also showed how in a few cases, the commanders barely established the appropriate actions to take because they struggled with processing information. This was especially the case in incident nr. 4. The commander was the second commander to arrive at

the scene of the incident, and you could tell that he was overwhelmed by the large amount of information he received from the first commander. He barely responded to the questions of the first commander and the risks he mentioned, which indicates that he was experiencing a high cognitive load. Whenever the first commander made a suggestion, the second commander would merely agree or disagree, but didn't contribute to the discussion by making of a plan or giving recommendations. The analysis therefore shows a link between the identification of needed actions and the pressure the commanders experience during an incident.

With regards to the identification of the expectancies of the incident, and the recognition of possible goals, the analysis shows how these two aspects are barely deliberated on during an incident by the commanders. It makes sense that not a variety of possible goals is debated, because the goals are limited to some extent and are usually directed towards controlling the fire, preventing its expansion, or preserving the safety of the people involved. However, the expectancies of the development of the fire is also not a broad discussed subject of the commanders. An explanation of this could be that they do think about the development of the situation, but just not discuss it with others. Perhaps commanders assess expectancies within themselves, and jump right to the needed actions. This is a possibility, because a limitation of analyzing video recordings is that I can only analyze the commander's thoughts when he expresses them. There was one incident where the commander actually constantly spoke about how he expected the incident to develop, and that was incident nr. 2. In this case, the commander led the coordination of a support team that was put on standby once they arrived at the scene. Throughout the whole incident, the commander constantly spoke of how the fire could develop and possible scenarios. At one point he told his crew:

“There is a chance that the structure might collapse. If that happens, and the chances are very likely that it will happen, it will be a challenge and we have to work hard (...) this is the reason why we were put on standby, just in case that scenario unfolds.”

The commander also discussed with the head of command and other incident commanders to prepare the fire trucks just in case they were needed. As this incident shows, the commander was constantly trying to figure out how the incident could develop because he wanted to know how his standby crew could prepare for the possible scenario's.

4.1.2 Processing Information

When commanders assess a situation, they try to grasp the information they receive and create a mental picture based on this. Processing incoming information is therefore key for a commander in framing the incident situation. As the analysis shows, it differs per incident to what extent commanders are able to process incoming information. There is one clear pattern, however, that shows that commanders struggle with processing information when they are confronted with certain stressful factors. For example, commanders find it hard to process information when the cause and development of the fire is unknown or unclear, when they receive an overload of information in a short amount of time, or when fire officers and others demand guidance and answers to the questions they have. Faced with these factors, commanders tend to become overwhelmed and the cognitive load heightens. Several incidents display how commanders have trouble administering the information. This was also the case in incident nr. 8, which was a reported fire at a retirement home. From the start, the commander in charge had trouble with assessing the situation. There were many first responders and fire crews involved, the building was very complex, and there was no clear course of action. The commander received unclear and disorderly information from the first fire officer and was faced with many questions of others which he did not have a clear answer for. An example of a chaotic conversation about the evacuation plan between the fire officer and the commander is the following:

Fire officer: *“Do you want to evacuate everyone from the building?”*

Commander: *“If the residents can stay inside, then they can stay there. I don’t want people to walk through the smoke unnecessary. Removing the smoke is the fastest way.”*

Fire officer: *“Okay, because the police is evacuating everyone at the moment.”*

Commander: *“Alright no, we just need it out, everything out.”*

The vague instructions the commander gave indicate that the commander was not able to process the incoming information, and that he experienced a high cognitive load. Later, when the commander had to brief the other commanders, he was also not able to explain the development of the situation and the evacuation plan. He also didn’t notice that he was being

called through his transceiver multiple times, until a fire officer told him to answer it. In short, this case clearly illustrates how the commander was not able to process the incoming information.

4.1.3 Making Sense of the Situation

Once a commander has gathered information and created a mental image of the situation, the concept of sensemaking comes into play. As discussed before, sensemaking is considered to be a continuous process that keeps emerging throughout the incident and situation assessment is basically the starting point. Getting an insight in the sensemaking process of a commander provides us with more knowledge of what is going on inside his head. There were two significant patterns visible after analyzing the video recordings. First, commanders that struggled with processing information also did not have a strong understanding of the incident situation. The incidents where commanders clearly could not manage the incoming cues and information, also showed that the commanders struggled with making sense of the situation. An example of such a happening occurred in incident nr. 7, which was a reported fire at a house. Right from the start, the commander started mumbling to the fire officers as soon as he received the first pieces of information. He asked lots of questions about water extraction and the roof, but it didn't seem that he processed the answers because he sounded very confused. At one point you can hear him swear "*f* hell*", which indicates that he felt a high pressure. Also, when the head of command arrived at the scene and asked several questions, the commander was unable to explain what exactly was going on and how the fire expanded so quickly:

Head of command: *"Is the attic open?"*

Commander: *"I have no idea."*

Head of command: *"Do we know what caused the fire and what is burning inside?"*

Commander: *"No, I have no idea."*

Head of command: *"Can you walk with me towards the back of the house? Then I can show you where it is burning."*

Commander: *“The fire officers just went back there, so I assume that what they saw and reported back to me was the right information.”*

The commander clearly became defensive when the head of command asked him to check the back of the house. However, the commander had no sense of the situation and did not understand what was going on before the head of command arrived at the scene and showed him the back of the house.

On the contrary, the analysis also illustrates how commanders who were not under a lot of pressure, and where the incident was under control, had a far better understanding of the situation. The commander who handled incident nr. 9, which was a fire that broke out in a beach club, had a pretty clear understanding of the situation and his sensemaking was therefore high throughout the incident. The moment he arrived, the decision was already made by a fire officer to let the beach club burn down, and that the goal was to prevent the fire from spreading to beach clubs nearby. From the start, the commander comprehended what he had to do, because of the information he had just received. Throughout the incident, the commander stayed calm but very alert. He recognized the risks and listened well to the information provided by other fire officers. Moreover, he communicated clearly to other first responders and the fire crews and gave updates that matched the development of the incident:

“We are giving up the beach club. It is completely engulfed by fire, but we are trying to prevent the fire from spreading to other beach clubs on both sides. The water extraction is a problem, that is why I made the decision to scale the incident up to very large fire and asked for a fifth fire truck. We also might have a possible victim inside the beach club.”

However, even though incident commanders might struggle with making sense of the situation after they initially framed the situation, there were incidents where the commanders realized later on that they had to adjust their comprehension of the incident. This makes sense since sensemaking is a continuous process, and commanders are able to get a grip on the situation and develop a better understanding of the situation throughout the incident. The ability of commanders to adapt their sensemaking is further examined and discussed in section 4.2.3.

4.2 To What Extent Do Incident Commanders Reframe Their Situation Assessment During an Incident?

Throughout an incident, a lot of things can happen which can lead to a shift in a commander's initial assessment of the situation. While analyzing the bodycam video recordings, it was very interesting to see how commanders reacted to new incoming information and cues, sudden changes, and the development of the incidents. Were they able to revise the situation when new information or evidence came in, or did they hold on to their initial assessment? To what extent did cognitive biases influence the shift in assessment? Moreover, how did the process of sensemaking within a commander's mind emerge during the incident? This section will elaborate on all of these questions, and provide an exploration of the commanders' ability to revise their situation assessment.

4.2.1 Reframing the Situation Assessment

Concluding from the analysis of the 10 video recordings, commanders reframe their situation assessment around two to four times throughout an incident. Regarding these shifts in the situation assessment, a few patterns were found which will be discussed. First, an obvious link was found between a commander's ability to revise his situation assessment and stress factors such as time pressure, lots of new incoming information, and an overall high cognitive load. Commanders realize more quickly that a situation is changing and what possible new actions need to be taken when they are not under a high amount of stress, and when there is a low risk of the fire to spread or the crew being harmed. Moreover, a shift in a commander's situation assessment occurs faster when the incident is under control to some extent, and when the response of the crew in combating the fire runs smoothly. This most likely has to do with the fact that commanders have the time to process the information and understand that a reframing of their mental picture is in order, and that they may have to adjust the course of action. On the other hand, it is only logical to state that commanders have trouble reframing their situation assessment when faced with stress factors such as the ones mentioned above. Another pattern that was found from the results is that the reframing of a situation occurs after the commander receives information from fire officers, other incident commanders, the head of command, or other first responders. Usually, these are pieces of information regarding risky circumstances or occurrences. It barely occurred that commanders realized the situation was changing and that they had to revise their frame based on signals or cues that they had noticed themselves.

Two examples are provided to illustrate the difference in a commander's ability to reframe his assessment. An incident where the commander quite easily reassessed the situation, was incident nr. 3. The commander's initial assessment was to prevent the fire from expanding to other houses and surroundings nearby, but that they had the fire under control to a great extent. During the incident however, a fire officer reported to the commander that he had noticed a sea container with pesticides inside the farm, and that they could smell it from the back. The commander recognized the risk of unknown chemicals and realized that he had to revise his frame of the situation. The actions he took – ordering the fire officer to monitor the container and actively seeking information about the substance by questioning the owner of the farm – reflect how his situation assessment shifted: from having the situation to a great extent under control, to an identified risk that needed to be taken care of. A contradicting incident was incident nr. 7, where the shift in the commander's assessment only occurred after the head of command faced him with the facts. The first half of the incident, the commander was overwhelmed by the turbulence of the incident and the overload of information he received. The commander gave out disordered commands about the deployment of water hoses, because he didn't know how the fire was developing:

Fire officer: *“Can we install the water transport on the other side?”*

Commander: *“If you know a good location, then I know it as well. I need water here, but over there is also fine. It needs to happen fast, so take care of it.”*

It was not until the moment the head of command brought him to the back of the house to check how far the fire had spread, that he realized that he had to reassess his situation assessment. He may have never come to this realization if the head of command hadn't guided him to the back of the house. Moreover, these incidents show how both of the shifts in assessment followed after the commander received information from a fire officer about a risky occurrence respectively the observation of the head of command.

4.2.2 The Role of Cognitive Biases

As discussed in the literature chapter, cognitive biases might occur when an incident commander is confronted with the coordination of an incident. The biases might influence the commander to neglect important pieces of information, and affect his decision-making process. Because the commander doesn't always realize that he is suffering from a bias, he might make

an ineffective or incorrect decision (Kinsey et al., 2019, p. 465). While analyzing the video recordings, the focus was to identify certain types of cognitive biases, such as confirmation bias, intuitive judgement and tunnel vision. An examination of the data illustrates that the commanders of the 10 incidents don't suffer from cognitive biases often while handling the incidents. Though the commanders obviously experience high levels of stress which clouded their judgement at times, the analysis shows that not many cognitive biases were found that affected the performance of commanders. Two incidents however, stood out and showed clear examples of commanders who suffered from confirmation bias. In both cases, the commanders only sought and processed information that confirmed their perception of the incident situation. Even though the commanders received contradicting evidence, they didn't process and comprehend it. Because the commanders only looked for evidence and cues that confirmed their point of view, and disregarded contradicting information, they misinterpreted the situation completely. Moreover, the incidents also showed how the commanders became stuck in the frame they had created and struggled with revising their mental picture. In both cases, it took a very long time before the commanders realized they had to reframe their situation assessment, and this only occurred after they received an enormous and inevitable amount of contradicting evidence from multiple actors involved.

To exemplify the above statements, the two incidents are discussed briefly. Incident nr. 5 was a reported fire at a warehouse. The commander who was in charge had a hard time framing the situation throughout the entire incident. First, it wasn't clear if the fire was under control or not. However, once the commander received new information from fire officers that the fire was under control and the flames were down, he would still not revise his view of the situation. He continuously sent the fire officers back to rule out any potential sources of fire. Even though he constantly received contradicting messages that the fire was put down, he was not able to process it and thereby misjudged the situation. Throughout the entire incident, it seemed that everyone had a better understanding of the situation than the incident commander himself. This was evidently seen during a conversation between the head of command and commander about the option to scale down:

Head of command: *“Should we proceed to scale down? The clean-up station is already installed, the crews are resting and not doing anything, just as the crane.”*

Commander: *“I will only proceed to the next phase if I know for sure that there is nothing here anymore. This area is being examined, and if that rules out anything then I am comfortable to scale. But to proceed to the next phase already doesn’t feel quite right.”*

A similar incident which shows a commander who suffered from confirmation bias is incident nr. 6, which was a fire that broke out in an abandoned industrial property. The commander in this case also had a hard time processing evidence that there weren’t any firegrounds inside the building anymore. When the head of command suggested to start ventilating the building, he refused and stated that he *“still has a feeling that something is burning inside”*, even though he had received information from many fire officers stated otherwise. At one point, the commander had an argument with a fire officer because he wanted to send him in again, but the fire officer found it unnecessary and disagreed:

Commander: *“What crew is currently examining the possibility of a fire ground to develop at the ground level?”*

Fire officer: *“Well, there is nothing to develop...”*

Commander: *“You know what it is, there is smoke coming from somewhere. If it goes wrong on that side, there is no one who will see it.”*

Fire officer: [chuckles] *“alright, well, I’ll put a crew there...”*

The above-mentioned fire officer finally went back to do another examination, but he did not agree with the view of the commander. After a very long time, the commander realized he was wrong, revised his situation assessment and started ventilating the building.

4.2.3 Adaptive Sensemaking

Concerning the adaptive sensemaking process that occurs within the mind of commanders, the analysis indicated three apparent patterns. First, commanders understand better that they have to adapt their sensemaking when they do not experience a high level of pressure. Consequently, commanders find it harder to adapt their sensemaking when they undergo a high cognitive load and are overwhelmed by lots of incoming information and cues. Incident nr. 1 for example, is

an incident where the fire was already put down when the commander arrived at the scene. The only problem the commander faced was when the evacuation plan of the medical team wasn't consistent with the one of the fire crew. The commander asked why the medical team was following a different plan than the fire crew. At first, the commander was convinced that the fire crew had a better plan, but after he spoke to the medical team he comprehended their perspective of the evacuation plan, and realized he had to adapt his understanding of the situation:

Commander: *“Are the residents staying at the second floor, or are they all being evacuated? I am receiving mixed messages.”*

Doctor: *“Our plan is to bring everyone to the hospital. Unless your crew has a different view, but then I'd like some arguments. I can adapt my decision, but at this moment we are bringing the residents to the hospital and I have communicated this to my colleagues as well. Also, from experience we have noticed that people are not reliable in their medical anamnesis due to their condition.”*

Commander: *“Alright sounds good, let's stick to that plan then.”*

A completely different incident was incident nr. 8, where many factors influenced the sensemaking of the commander. Because of the unclear situation, complex structure of the building, the large amount of information and the high cognitive load, the commander was barely able to make sense of the situation, let alone adapt his understanding of the incident.

A second pattern shows that sensemaking can become higher throughout an incident, even though commanders struggle with understanding the situation at first. There were commanders that couldn't grasp all the information and see the coherence of the evidence at the beginning of the incident, but gradually integrated more of the observations and finally developed a different perspective of the situation. At times, commanders realized after they adapted their sensemaking, that they had to change the goals of the incident or that different actions were needed to combat the fire incident. This occurred in incident nr. 4. The commander in charge had no idea what was going on when he first arrived at the scene, and was told that there was trouble with water extraction. However, as the incident emerges, he was able to reassess his

frame regarding the water extraction problem and assimilated information of different fire officers and water experts. Because of these actions, he was able to make sense of the problem and the pieces of the puzzle fell together. He finally identified that they needed to extract water from a pond where the water was continuously flowing, and that solved the water extraction problem.

Third, the analysis demonstrates a link between cognitive biases and adaptive sensemaking. Looking at the two incidents that were discussed in section 4.2.2, both commanders suffered from confirmation bias and therefore did not comprehend that they had to adapt their sensemaking. The commander of incident nr. 5 for example, had a hard time understanding what was going on. The commander received lots of information about the fire being under control, yet he did not fully process the meaning of this information and his actions that followed did not match the perception of reality. At one point, a fire officer walked up to the commander to inform him that no fire grounds were found during the examination of the warehouse. Instead of integrating this information, the commander sent the fire officer back inside to check it again:

Fire officer: *“I checked, and as far as I can see, there are no flames inside anymore.”*

Commander: *“Okay, can you go back in through the other side and check if there are flames over there?”*

His perception of the situation did not widen while the incident unfolded, and it was clear he wasn't able to include contradicting evidence to his situation assessment as seen in the above dialogue. This resulted in a misjudgment of the situation and a poor understanding of the incident.

4.3 In What Circumstances Does a Reframing of a Situation Occur?

In this last part of the analysis chapter, the circumstances under which a reframing of a situation occurs are examined and elaborated on. Several critical decision-making moments are identified, and it is explored if the reframing of a situation by a commander occurs after a more extensive cycle of decision-making, or if the reassessment occurs in a more recognition-primed situation. Moreover, the influence of the reframing on the development of the incident is also explored.

4.3.1 Critical Decision-Making Moments

One obvious pattern that was noticed in the analysis, was that commanders reframe twice as much in a recognition-primed situation than after an extensive cycle of rational decision-making. However, nearly every incident shows that when a commander reframes more than once during an incident, that it occurs after the commanders goes through the various stages of the rational-decision making model (situation assessment, plan formulation, and plan execution), but also that the commanders revise their frame based on the recognition of a situation from their past experience. This means that although commanders revise more often in a recognition-primed situation, they still also reframe after a thorough rational decision-making process at times. Furthermore, it happens incidentally that a commander reframes after a different actor – such as the head of command – makes a critical decision.

When commanders go through the extensive cycle of decision-making before they reframe their situation, it happens nearly every time in cooperation with other actors such as fire officers, other incident commanders, experts or heads of command. As discussed before, commanders rely heavily on the incoming information of their co-workers, and try to integrate these pieces of information to form a clear mental picture of the situation. In the plan formulation phase, commanders listen to their crew, ask for their opinion, and make a plan in collaboration with others fire officers or incident commanders. It barely occurs that when commanders follow a rational decision-making process, they make decisions by themselves without the input of others. An example of a commander who reframed after a thorough process of decision-making is the one in incident nr. 3. Near the end of the incident, the commander received the information from a fire officer that there was a bright yellow substance leaking in the water. The commander immediately gathered the second commander, the head of command and other fire officers to examine the yellow liquid in the water and discussed what actions needed to be taken. They also measured the pH value of the water, to identify the level of danger of the liquid. After a thorough formulation of a plan, the commander decided to shut down the water from the trench, call the water operator for further procedures, and ask a chemical specialist for advice. As this incident shows, the commander's reframing – an identified risk that needs to be dealt with – occurred after a rational process of decision-making.

Commanders who reframe their situation assessment in a more recognition-primed situation, follow a quite different path. When commanders recognize a situation, they tend to make decisions based on their previous experience and refrain from evaluating options against each

other. This makes their decisions more impulsive and reflexive, and this was clearly the case while analyzing the incidents. The analysis also shows that commanders do not ask for a lot of input from others when they make decisions based on their recognition of the situation. Another noteworthy finding that is interesting to mention is that there doesn't seem to be a link between high-pressured circumstances and the occurrence of reframing in a recognition-primed situation. The incidents where commanders made decisions and reframed after they recognized the situation, both occurred during 'easy-going' incidents as well as the more difficult ones. An example of a commander whose reframing occurred after he recognized the situation was the one in incident nr. 10. This was not a typical fire incident, but the commander in this case was faced with a toxic dumping on the side of the road. What is interesting in this case is that the commander immediately recognized the dumping as an ecstasy dumping. He mentioned multiple times that he saw similarities with a dumping he had seen before:

Fire officers: *“There are two large barrels, one lying on its back and one lying on its side. The crane of one of those barrels is broken. Moreover, there are about 40-50 white and blue 30-liter barrels as well.”*

Commander: *“Do they have the code 1789 on it?”*

Fire officer: *“Yes, here is a sheet with the codes on it...”*

Commander: *“Oh yeah, then it is acid. This is the second dumping of today. It is the same dumping; we have already seen this in Rijswijk this morning.”*

A little later, he asked a chemical expert for advice, but he was convinced that it was an ecstasy dumping:

“The chemical expert is doing an examination now to check if the barrels are stable, but we are dealing with known substances.”

The commander almost instantly makes the decision to start an investigation into the dumping and to call the municipality for a clean-up, which indicates he makes a decision based on his previous experience. This incident is also in line with the finding that commanders reframe in

a recognition-primed situation without being under immense pressure. The cognitive load of the commander was low in this case and there weren't any high-risk circumstances.

Lastly, it was found that commanders incidentally reframe their situation assessment after a decision was made without their consultation or input. These were decisions that were usually made by other commanders or heads of command outside of the commander's control, and where the commander solely received the news that a critical decision was made. Incident nr. 2 is a clear example of this. The commander in this case led a crew that was put on standby, and he continuously reframed the situation when he received information from other commanders about the change of plans. He was barely included in the formulation of plans, but was still able to revise his frame based on the incoming information.

4.3.2 The Influence of Reframing on Development of the Incident

With regards to the influence of reframing on the development of the incident, there were three patterns that stood out. First, it was obvious that commanders who had a high understanding of the situation, realized they had to adapt their sensemaking, and reframed their mental picture accordingly, were able to make good decisions which matched the reality of the incident. Consequently, these incidents were handled more effectively and therefore developed more steadily because the commander knew exactly what actions were needed to combat the incident. In incident nr. 9, the commander had a high understanding of the situation from the start, was able to reframe his assessment when needed, and made good decisions. He asked for extra support of a fifth fire truck, took safety measures for the unknown number of gas bottles inside the beach club, and was very careful with scaling down because he realized that the situation could still change because of the upcoming wind. All in all, the commander was very aware of the situation and reacted appropriately.

However, commanders who had a low understanding of the situation, struggled with reframing or incorrectly reframed many times, came to very chaotic and sometimes contradicting decisions. Basically, the exact opposite happened from the scenario described above: when a commander gave out vague or incorrect orders, this led to confusion within a fire crew, which then resulted in distorted performances and an ineffective handling of the incident. Incident nr. 8 serves as a prime example. The commander had a very low understanding of the situation, and gave out many contradicting orders. Specifically his order to check the apartments to see if there were any residents left in the building was very unclear. He constantly went from directing

the fire crew to check every door, to saying “*if you think the residents are on vacation, then you don't have to open the door*”. His vague orders caused a lot of confusion within the crews, and in the end it was still not sure if every apartment was checked or not.

Moreover, cognitive biases also influence the development of the incident. The analysis showed how commanders who suffered from a cognitive bias such as the confirmation bias – which was the case with the commanders in incident nr. 5 and nr. 6 – became stuck in their frame, struggled with making sense of the situation, and were not able to consider alternatives. As a result, the decisions they made were ineffective, did not match the reality of the incident or they were not able to make a decision at all. In both incidents, the commanders refused to reassess the situation because they were so convinced of their perception that there was still fire burning inside the structures even though the overwhelming contradicting evidence they received. If the commanders would have considered other options, processed the evidence, and reframed their situation assessment, then the incident could have been handled in a much better way.

Chapter 5: Discussion

5.1 Situation Assessment

The situation assessment phase is an essential stage of the decision-making process of an incident commander. As discussed in the literature chapter, the situation assessment is seen as both a crucial starting point for sensemaking as it is for the decision-making process of a commander. Within this stage, fact finding plays an important role, because ‘front-line people make decisions based on their perception of reality’ (Groenendaal & Helsloot, 2016, p. 4). While analyzing the video recordings, the focus was on four important aspects to examine how commanders assess an incident situation. These four aspects were derived from Klein’s RPD model, which is discussed in section 2.3.1. As described in the analysis, commanders base the assessment of the situation mostly on the identification of vital cues. Then, commanders pay close attention to identifying the appropriate actions to take in order to control the incident. Concerning the recognition of possible goals and the expectations of the incident, commanders barely deliberate on these aspects. With regards to the findings of this study in light of the existing literature, it is clear that the results show that the four aspects of the situation assessment phase that Klein identifies are used by the commanders to assess a situation. However, not much is written about what aspect occurs more often or is relied on more heavily. Therefore, it is interesting to see that this study shows that commanders mostly rely on vital cues and the identification of necessary actions, and less on the expectations of the incident or the possible goals.

5.2 Shift in Situation Assessment

As discussed in the literature, the commander often receives new information, and usually has to process loads of complex information under limited time (Krasuski et al., 2013, p. 229). Moreover, research suggests that when a commander receives new information, he might realize that he has to adjust his goals and course of action, and therefore adapt his plans because the situation is asking for a change (Klein et al., 1993, p. 142). This has also been found in the 10 incidents that were analyzed for the purpose of the thesis. On average, commanders reframe two to four times during an incident. However, an important pattern that was found in the analysis is the influence of stress factors on the commanders’ ability to process information and reframe their situation assessment. Commanders who were confronted with stressful factors such as time pressure, an overwhelming amount of new information, a high cognitive load, and risky circumstances, struggled with processing information and reframing their situation

assessment. On the other hand, it was also seen that commanders easier reassess a situation when they do not experience a lot of stress. The findings of this research suggest the idea that there is a link between high-pressured circumstances and a commander's ability to reframe. Though the influence of stress on a commander's decision-making process has been discussed in the literature, these findings can contribute to the debate in a way that there is also a relationship between stress and a commander's ability to reframe his situation assessment.

5.3 Sensemaking

A lot has been written on the concept of sensemaking. This concept focuses on the question of 'what is going on' instead of 'what do we have to do' (Dyrks, Deneff & Ramirez, 2008, p. 2). Furthermore, research states that it can be seen as a puzzle where the pieces continuously change and where the sensemaker has to define and redefine the developing situation and has to seek for new solutions (Brown, 2020, p. 246 & Weick, 1995, p. 20). This indicates that sensemaking is a continuous process, and that it can develop inside a commander's mind throughout the incident. One of the patterns that stood out was the relation between processing information and the sensemaking of a commander. Commanders who struggled with processing information – due to a high level of stress for example – also had a low understanding of the incident. This shows that, just as the literature has acknowledged, the importance of a commander to integrate pieces of information to create a comprehension of the situation. When he fails to do so, he will most likely have a lower understanding of the evolving situation.

Existing literature on sensemaking also indicates that sensemaking is a continuous process. The patterns that were identified in the analysis affirm the statement that sensemaking is a continuous process, and that it relates to a commander's ability to revise his framing of a situation. As discussed in the literature section, it can be a difficult task for a commander to revise his frame and adapt his understanding of the situation when new information comes in, especially when he is under a high level of stress. This is also what was found in the analysis of the 10 video recordings. Commanders understand better that they have to adapt their sensemaking when they do not experience a high level of pressure. Consequently, commanders find it harder to adapt their sensemaking when they undergo a high cognitive load and are overwhelmed by lots of incoming information and cues. Therefore, the analysis again presents a relation between a high level of pressure and the sensemaking of a commander.

However, just because a commander struggles with making sense of a situation, doesn't always mean that he is not able to change this. As said many times before, sensemaking is a continuous process. One other pattern that was identified supports this statement, and demonstrates that sensemaking can become higher throughout an incident, even though commanders struggle with understanding the situation at first. There were commanders that couldn't grasp all the information and see the coherence of the evidence at the beginning of the incident, but gradually integrated more of the observations and finally developed a different perspective of the situation.

Commanders who were not able to adapt their sensemaking were also found in the analysis. As research debates, the risk of collapse of sensemaking is high when a commander does not develop some sense of the situation and creates a wrong mental picture. Chances are that the commander becomes stuck in a wrong frame, and this could increase levels of crisis intensity and lead to a collapse of sensemaking. Existing literature on collapse of sensemaking focuses mainly on events where the entire organization collapsed and led to horrible endings, such as the Mann Gulch disaster, the Mount Everest climbing disaster, or the shutdown of the two Blackhawk helicopters. These tragic incidents resulted in the loss of many people and firefighters due to the lack of understanding of the situation. Such a severe collapse of sensemaking with dramatic consequences was not found while analyzing the incidents. However, there were two incidents which displayed characteristics of a collapse of sensemaking. Though the endings of these incidents were not as terrible and did not lead to the loss of men, it still showed how the commanders had such a low understanding of the incidents that they were not able to adapt their frame and became stuck in their decision-making. A possible explanation that the outcome of the incidents was not as bad is because in both incidents, there were no victims inside the buildings, and there were many other fire officers who kept providing the commander with contradicting evidence. From an academic perspective, it would be interesting to examine the collapse of sensemaking in smaller incidents as well, because this research shows that commanders face sensemaking problems in smaller incidents as well.

With regards to the influence of sensemaking on the decision-making process of commanders, the following was found. The commanders who had a good understanding of the situation and adapted their sensemaking accordingly, followed the RPD model more often than the rational decision-making model during the incidents. On the other hand, it is noticeable that

commanders who had a low understanding of the incident, and thereby struggled with adapting, did not necessarily follow the rational model more often than the RPD model. Instead, the commanders who became stuck in their frame followed both the RPD as the rational decision-making model, or were not able to make a decision at all at times. This finding can contribute to the discourse of the influence of sensemaking on the decision-making process of the incident commanders, because it shows that a low understanding of the situation does not necessarily lead a commander towards a certain decision-making model.

5.4 Reframing After Different Decision-Making Moments

The analysis presented two noteworthy findings with regards to under what circumstances commanders reframe their situation assessment. First, commanders reframe twice as much in a recognition-primed situation than after an extensive cycle of rational decision-making. However, although commanders revise more often in a recognition-primed situation, they still also reframe after a thorough rational decision-making process at times. This is interesting to see, because current literature suggests that the RPD model is the dominant model, and this analysis shows that commanders also reframe after going through an extensive cycle of decision making. This means that the findings of this research contradict – to some extent – the main view in present literature.

Second, another interesting finding was displayed in the analysis that challenges the current literature. Existing research describes how stress plays an important role for following the RPD model, because RPD is simply faster than the rational approach (Gasaway, 2007, p. 15). Therefore, current literature suggests the idea that commanders follow RPD in time-pressured and high-risk environments. You would expect that commanders who do not experience a high level of stress, would take the time to carefully assess the situation, formulate a plan and execute a plan according to the rational model. However, this was not particularly the case in this research. It was found that commanders do not necessarily follow an extensive cycle of decision-making when they experience a low cognitive load; they also follow the RPD model when they are not under a high level of pressure. It was therefore very interesting to see that the reframing of commanders occurred during ‘easy-going’ incidents as well as the more difficult ones. This means that there doesn’t seem to be a link between high-pressured circumstances and the occurrence of reframing in a recognition-primed situation.

5.4 Cognitive Biases

A lot has been written about the risks of cognitive biases that commanders may experience during an incident. As literature describes, the biases may influence commanders to disregard important pieces of information, and may affect their decision-making process. This may possibly lead to ineffective or wrongful decisions (Kinsey et al., 2019, p. 465). This research shows two commanders who obviously suffered from a cognitive bias called confirmation bias. As shown in the literature, the danger of suffering from confirmation bias is that it can lead to the misinterpretation of a situation because the commander only looks for evidence that confirms his or her perspective (Cohen-Hatton, 2019, p. 57). This was also the case in the two incidents. Both commanders only processed information that confirmed their frame of the situation. Even though the commanders received contradicting evidence, they did not process and comprehend it. Because the commanders only looked for evidence and cues that confirmed their point of view, and disregarded contradicting information, they misinterpreted the situation completely and were not able to make the right decisions.

In present literature, there is still a lack of knowledge with regards to the relationship of cognitive biases and sensemaking. The analysis of this study showed that there is a clear link between cognitive biases and adaptive sensemaking. Looking at the same two incidents, both commanders suffered from confirmation bias and therefore did not comprehend that they had to adapt their sensemaking. Because of the severe influence of confirmation bias, the commanders were not able to coordinate the incident in an effective way or lower the intensity levels of the incident. For future purposes, it would therefore be interesting to examine this relationship more closely.

5.5 Recommendations

Several recommendations can be derived from this research. First, the communication skills of commanders can be improved. The analysis showed how often confusion and wrongful actions are followed after the commanders gave out unclear orders or information. More direct and clear orders will most likely contribute to a better development of the incident. Secondly, training programs could aim at enhancing the commander's ability to assess the situation. This study has shown the importance of the situation assessment as a first step of the decision-making process of an incident commander, and should therefore be focused on more. If the commanders do not have a clear image of the situation, they won't be able to give out good

instructions. Therefore, it could be useful to make commanders more aware of the incoming information they receive from other fire officers, or that they should pay more attention to the vital cues of the incident situation. A suggestion is that commanders could zoom out more often, and distance themselves from the incident every now and then to figure things out. Thirdly, I believe that commanders can be trained in recognizing the risks of cognitive biases, since this can influence their situation assessment to a great extent. Making them more alert of these risks and the consequences might help them in coordinating future incidents.

Chapter 6: Conclusion

The aim of this research is to examine the influence of situation assessment on the decision-making process of an incident commander. Therefore, this chapter will answer the research question that is central in this thesis:

How does the situation assessment of a Dutch fire incident commander influence the decision-making process?

The findings of this research showed how the concept of sensemaking plays an important role in a commanders' situation assessment and the influence on his decision-making. Commanders who were able to assess a situation that corresponds with the reality of the incident, also experienced a high understanding of the situation. This was usually the case when commanders experienced low pressure or when they handled an 'easy-going' incident that was already under control to some extent. These commanders realized that they had to adapt their sensemaking and reframe their mental picture if the situation asked for it. Because of their high sensemaking and correct assessment of the situations, the commanders were able to make good decisions that matched the reality of the incident. Consequently, these commanders were able to handle the incidents more effectively and the incidents developed more steadily because the commanders knew what was needed and what appropriate actions to take.

However, commanders who struggled with assessing the situation also had a low understanding of the situation. Moreover, these commanders had trouble with reframing their mental picture of the situation throughout the incident. Often, this was caused by the fact that commanders experienced stressful factors such as a high cognitive load, time-pressure, lots of new incoming information, and risky circumstances. Because these commanders were not able to process new information, they were not able to reframe their situation assessment nor adapt their sensemaking. Not seldom, this state of mind led to very chaotic orders of the commanders. They weren't able to provide the crews with direct and clear orders, and gave out contradicting information and decisions at times because they had a bad understanding of the situation. This poor command resulted in distorted performances of the crews involved, and an overall ineffective development of the incident.

A third relevant aspect is the influence of cognitive biases on the situation assessment respectively the decision-making process of a commander. Commanders who suffered from cognitive biases were not able to consider alternative options, struggled with reframing and making sense of the situation, and they eventually became stuck in their frame. As a result, the decisions these commanders made were ineffective, did not match the reality of the incident or they were not able to make a decision at all, which led to an unsuccessful coordination of the incident.

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