COMMAND & CONTROL

Helmet-mounted cameras provide recordings that provide an opportunity for scientific and applied researchers to study fireground command and control.

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Using helmet-mounted cameras to learn about leadership on the fireground

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More and more often, helmet-mounted cameras are used by fire services in the Netherlands to provide fireground commanders a better insight into their command and control skills. Battalion chiefs in particular use helmet-mounted cameras during both exercises and real-life situations to get a better understanding of how they act and what firefighters do on the fireground. These video-recordings are not only valuable for training purposes, but also provide a genuine opportunity for scientific and applied researchers to study fireground command and control.

In this article we discuss the application of helmet-mounted cameras in research, training and operational practice in the Netherlands and point to the opportunities and challenges for research and fireground command and control training and practice.

FIREGROUND DECISIONS

Fireground command and control can be defined as making decisions about the fireground operation and ensuring that subordinates at the front line will properly carry out those decisions. To do this, fireground commanders need to gather and analyse information about the situation and their resources, make decisions about the fireground operation, communicate orders and monitor the implementation of those orders.

In the past few decades, considerable scientific attention has been devoted to fireground decision making, which is a major aspect of fireground command and control (e.g., Klein, 2008; Tissington, 2001). Probably the best-known example within the firefighter community is Klein's Recognition Primed Decision Making (RPD) Model, which states that decision-makers use their experience to make a satisfactory decision under time pressure and uncertainty. This research has provided much insight into the way fireground commanders arrive at decisions under demanding circumstances, but is neither sufficient for understanding how these decisions are transformed into orders nor how these orders are communicated and monitored (c.f. Groenendaal et al. 2013). As a consequence, from a scientific viewpoint little is known about the effect of fireground command and control on fireground operations.

A first step toward understanding the effect of fireground command and control is to examine what fireground commanders actually do when they are in command, and how they

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Helmet-mounted cameras can be powerful tools to assist in better learning from experience, particularly because they provide fireground commanders with accurate feedback.

do it. Mintzberg (2009), in his seminal studies on general management, has showed us how important it is for theoretical development of management, as well as the progression of evidence-based management practice, to demythologize the work of managers in public and private sector by systematically unravelling what managers actually do in practice and how they do it. A major limitation of the current research on fireground command and control, and particularly decision making, is that it is based on retrospective (subjective) accounts of fireground commanders. Gary Klein's RPD model, for example, is primarily based on interviews with crew commanders and battalion chiefs. Likely due to practical barriers, observational research on fireground command is still rather limited (Nja and Rake, 2008; Groenendaal et al. 2013).

RESEARCHING FIREGROUND COMMAND & CONTROL

When relying on the perceptions of fireground commanders, researchers face significant methodological challenges, such as self-justification, hindsight bias, blame, incomplete recollection and remoteness in time. In providing self-reports, decision makers tend to present an image of the self that is self-enhancing and self-consistent, resulting in distortion and censoring of data (Omodei et al. 2002). Video recordings taken from a commander-point-of-view provide a more reliable and rich interpretative insight into the working world of fireground commanders (see for example Lipshitz et al. 2007). First, it becomes possible to objectively determine what fireground commanders do for three of the five stages of the command and control process: 1) information gathering, 2) communicating about decisions, and 3) monitoring decision implementation. What kind of information do they get from their environment? What kind of information do they actively gather? Do they conduct a 360-degree size-up, and if so, what do they look at? How many and what kind of decisions do they communicate? Do they monitor the implementation of decisions? How? How many orders are correctly carried out by subordinates? And if they notice, what do they do when decisions are not carried out? With whom do they talk? How much time is spent on monodisciplinary (fire service staff only) versus multidisciplinary (diverse emergency services) on-scene consultations?

These questions are currently under investigation in the Netherlands with the use of helmet-mounted cameras. In his PhD candidate research, author Groenendaal had battalion chiefs throughout the Netherlands equipped with GoPro HD or VholdR Contour helmet cameras. On a voluntary basis, the battalion chiefs record their performance during exercises and real life situations. The video recordings are then turned in and systematically analysed using the questions stated previously, in addition to others. This analysis may then yield findings which can be used for fireground command education and training purposes.

For instance, to what extent do fireground commanders actually exercise control over the fireground operation? Do fireground commanders primarily respond to incoming information or do they act based upon information they deliberately seek? Is the way orders are communicated and monitored related to the degree to which orders are carried out? To what extent do fireground commanders behave differently in exercises and real-life situations? And so on.

FINDING THE ANSWERS

Answering these questions is not only important for improving fireground command and control skills, but also for enhancing the organizational environment in which fireground commanders operate. Currently in the Netherlands, a large-scale research project led by the National Fire Academy is being conducted to discover what organizational structure is best suited for fireground commanders in different task environments, ranging from simple to difficult and complex. Research on which helmet-mounted cameras are used has helped support (a) a better understanding of recurring problems in the organization of large-scale fireground operations, and (b) the formulation of an initial hypothesis for improvement.

Furthermore, when the video recordings are discussed with the fireground commander (sometimes referred to as video-cued reflective interview) afterwards, the "objective" data obtained from the video recordings can be supplemented with perceptions about performance and commanders' intentions. This may yield interesting results regarding the differences and similarities between the video recordings and perceptions of reality.

LEARNING FROM EXPERIENCE

Helmet-mounted cameras provide genuine opportunities to improve the learning effectiveness and efficiency of exercises and real life incidents. But research has shown that mere experience itself does not necessarily produce higher levels of expertise. Gary Klein points to the work of Serfaty, et al. (1997), who found clear expert-novice differences in the quality, level of detail and flexibility of the courses of action generated. However, high performance was not correlated with years of experience, nor it was correlated with rank. According to Klein, this finding indicates that experts, more so than their equally experienced counterparts, may make better use of their experience.

We have found that helmet-mounted cameras can be powerful tools to assist in better learning from experience, particularly because they provide fireground commanders with accurate feedback. The fireground is typically an environment in which feedback is often either missing or misleading (that is false or delayed). Additionally, for fireground commanders it is often difficult to process and make sense of the feedback they get during their response due to high time constraints (cf. Gonzalez, 2005). Furthermore, in our research we found that fireground commanders have difficulty remembering the decisions they made at different moments in time, the information they had available during these moments, and the exact way in which they provided orders to subordinates.

A successful introduction of helmet-cameras depends on a few ambassadors who are willing to show their video-recordings and demonstrate how they benefit from it.

Rather, we found that fireground commanders make sense of the past by organizing bits of memories in the form of a coherent story of what logically should have happened, not particularly what actually happened.

For example, in our research a battalion chief, reporting about a large fire in the compartment of a garbage truck in the inner city of Amsterdam, told us that he had decided to call for an additional fire engine equipped with special foam. When he arrived on scene, he told us that he saw it would be hard to reach the fire, so he invented an alternative solution: He suggested towing the garbage truck to an industrial site where the truck could be disassembled to better reach the fire. However, the video recording showed us that after the fireground commander arrived at the scene of the event, it was other firefighters who came up with the idea to tow away the garbage truck. In reality, the fireground commander waited at least ten minutes for the fire engine with special foam to arrive before he changed his mind and decided to tow away the truck. This example shows that memory can be distorted, but also that fireground command effectiveness is a product of input from all firefighters involved, regardless of rank and seniority.

Some fire services in the Netherlands currently use video recordings from a helmet-mounted camera (hence from the fireground commanders' point of view) during the evaluation of training exercises. These video recordings are used to present fireground commanders with a clear picture of their behavior during the most critical moments of the incident. These moments can be selected by the trainer or fireground commander. As there is often no best way to handle incidents, the aim of the "video-cued reflective interview" is not simply to show what went wrong, but rather to encourage fireground commanders to reflect on what they see on the video-recordings. In a dialogue between fireground commander and trainer, the video-recordings can be used to sharpen one's perceptions about past events and raise self-knowledge. Though it can be intimidating, many fireground commanders are very positive about seeing themselves acting in a way they've never seen before, showing behavior they were never aware of.

SITUATIONAL AWARENESS & DECISION-MAKING

Increasingly, fire services in the Netherlands use cameras to improve the situational awareness and decision-making of fireground commanders and operational teams. In the Amsterdam-Amstelland Fire Service, for instance, new vehicles for battalion chiefs are equipped with a camera mounted between the sirens on top of the vehicle. The camera can be controlled from all over the world as it has its own Internet connection and hence can be used by operational command teams located at a distance to watch what is going on at the fireground. In theory, this may improve situational awareness of higher echelon decision makers as it provides direct perpetual access to the scene of the event, an essential element to be able to make effective decision.

In addition, multiple fire services are experimenting with drones. Drones are particularly used during fires in large-scale or complex buildings or in the case of wild fires. Though the initial experiences are promising, it should be noted that the effectiveness of this and other camera applications aimed at improving operational decision making has not been proven by scientific research.

CHALLENGES

Using helmet-mounted cameras for research and training purposes is a recent development and challenges have to be overcome. In the first place, the use of helmet-mounted cameras during exercises and in real life is not mandatory but is based on voluntary cooperation. Interestingly, helmet-mounted cameras are particularly used on a voluntary basis by experienced battalion chiefs. Inexperienced chiefs seem to be reluctant to use cameras, possibly because they are worried that video-recordings will bring errors to the surface. This concern should not be underestimated.

In the worst case, video recordings can be used in a lawsuit against fireground commanders. However, we live in a society in which there are cameras all over the place. The electronic equipment we use stores all actions we do and can also be easily misinterpreted. In that sense, helmet mounted cameras can also be used in favour of fireground commanders by showing what they actually did and on what grounds.

Using helmet-mounted cameras necessitates support from senior management. It is important that

senior officers in the fire service encourage the use of helmet-mounted cameras. They should make explicit that video recordings serve as a learning tool and will not be used in official job evaluation conservations. And they should inform other services, including police and EMS, that helmet-cameras are used for learning purposes.

Finally, a successful introduction of helmet-cameras depends on a few ambassadors who are willing to show their video-recordings to other fireground commanders in the fire service and demonstrate how they benefit from it and how it can help others to become a better fireground commander.

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