

Good, Poor, and Disastrous Small-Unit Command: Lessons from the Fireground

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“The key is control: control of our attacks; control of our defense; and control of ourselves in the face of disaster.” (Rear Admiral Woodward, Falklands campaign, evening of May 4, 1982 following the loss of HMS Sheffield to an Argentinean Exocet missile)

Introduction

The purpose of this paper is to stimulate discussion of small-unit command competencies associated with fundamental characteristics of the human information processing system. Significant advances in weapons and communications technology over the last 10 years have changed dramatically the nature of military operations. However, operational activity - especially small-unit activity - remains a fundamentally *human* endeavor. It involves hierarchical teams of trained individuals, using specialized equipment, whose efforts must be coordinated via command, control, and communication processes to achieve specified objectives under conditions of threat, uncertainty, and limited resources, both human and material. While firefighting differs from military operations in the lack of an “intelligent” enemy in the former, there are important similarities (see McLennan, Omodei, & Wearing, 2001). Operational exigencies make it difficult to study small-unit command systematically in combat situations. Research into fire fighting incident command has proved somewhat more tractable.

Advances in technology, particularly information and communications technology, now mean that the small-unit commander has potentially much greater access to sources of information than previously. Casual inspection of writings on the likely future of military activities suggests a naïve “more is better” assumption by some: more information being available to a commander will inevitably result in better decision making. We take issue with such assumptions. Our program of research into decision making in a range of real-world settings suggests strongly that providing decision makers, including small-unit commanders, with more information in time-pressured, high stakes, complex situations may result in a set of new problems likely to degrade decision quality under some circumstances rather than enhance it. These problems are likely to result from mismatches between the capabilities of a commander’s information processing system (both hard-wired and acquired through training) and the amount and form of information provided. In particular three characteristics of the human information processing system appear to be critical:

- The limited capacity of working memory (Baddeley, 2001).
- Knowledge-based problem solving is appreciably slower than rule-based decision making (Rasmussen, 1983).
- Decision making effectiveness in complex situations is heavily dependent on emotional self-regulation (Omodei & Wearing, 1995).

We explore these issues in this paper by presenting some general conclusions reached about the effectiveness of decision making by fire officers in local command at fires and related emergencies and applying these conclusions to aspects of small-unit military command. We argue for the importance of a particular class of small-unit command competencies: those

relating to effective information processing and decision making under operational task demands.

Methodologies

The research program utilized a range of methodologies. These have been described in detail elsewhere and illustrative references are provided. For each methodology, the means by which judgments of commander competence were arrived at is noted.

- Analyses of fire-related death and injury investigation reports (USDA FS, 2001) - consensus judgments by domain experts.
- Naturalistic field observation and post-incident interviews (McLennan, Omodei, & Wearing, 1996) - judgments by peers.
- Structured retrospective interviews (Holgate, 2003) - judgments by peers and by superior officers.
- Head-mounted video-cued post-incident recall interviews in operational settings (McLennan, Omodei, & Wearing, 2001) - judgments by peers.
- Head-mounted video-cued post-incident recall interviews in field experimental settings (McLennan, Pavlou, & Omodei, in press) - performance ratings made by an expert panel of observers.
- Laboratory studies of incident command processes for managing wildland fires, utilizing the *Networked Fire Chief* computer-generated microworld simulator (Omodei, Wearing, McLennan, Elliott, & Clancy, in press) - objective measure of incident command team performance in terms of proportion of total assets saved from destruction.

Characteristics of Good Incident Commanders

We begin with a negative finding: we have so far failed to find any evidence of a “personality type” associated with good incident command. We found our good incident commanders to range from calm and phlegmatic to excitable and talkative, from aloof to gregarious, and from reserved to extroverted. It seems that good incident command is less a matter of what kind of person a commander *is* than what he or she *does* while in command.

At a surface level of description, first, good incident commanders quickly extracted the most relevant (and not necessarily the most salient) features of the situation from the array of information at hand or available. They purposefully scanned both central and peripheral features of the information array to ensure they had accounted for all relevant features of the environment. The information array often comprised conflicting items, and items of doubtful reliability in terms of accuracy or timeliness. Second, these commanders then rapidly developed a conceptualization, or mental model, of the core of the problematic situation confronting them. Third, they speedily chose a response with a high probability of being implemented effectively, having regard to the level of threat and the resources available. Fourth, they monitored changes in the situation closely in anticipation of likely problems, changing both their problem-conceptualization and their response tactics quickly as circumstances dictated. Thus far, we have simply provided a description. The challenge is to go beyond this and to identify those processes which enabled these incident commanders to function so effectively while other incident commanders in comparable situations failed to do so.

In comparison with less effective incident commanders, the good incident commanders functioned as if they had a good practical understanding of the limitations of their information processing system. In particular, they operated in such a manner that (a) their effective working memory capacity was not exceeded, and (b) they monitored and

regulated their emotions and their arousal level. The foundation of their ability to manage their information load effectively seems to be prior learning from past experience. In summary, good commanders (mostly) knew what to look for and they knew what to do once they found it. This ability was not simply a matter of “years on the job”. While none of the good commanders had less than three years experience in the incident commander role, beyond this there seemed to be only a weak association between amount of experience and performance. (Within firefighter culture the difference between learning from experience and merely participating is well recognized. A dismissive evaluation of the form: “*So, he is supposed to have 10 years experience - or has he just had one year’s experience 10 times?*” is heard regularly). The crucial issue seemed to be that good commanders had reflected at length on the effectiveness of their past performances and developed mastery of their craft in the form of extensive rule-based decision making ability (Rasmussen, 1983). These learned rules allowed the commanders to mostly use fast, robust **recognition** decision processes rather than slow, vulnerable **analytical** problem-solving processes which are very intensive of working memory capacity.

In addition, good commanders were often able to transcend their, necessarily limited, range of specific past experiences and use fast, robust **analogical** decision processes to apply previous learning to novel situations. For example, an incident commander was confronted by a serious leak from a large container of liquid oxygen in the grounds of a hospital. He had never encountered an incident involving cryogenic material before. He reasoned by analogy that the best thing to do was to handle the emergency by treating it as he would a volatile toxic flammable chemical leak. The emergency was speedily contained and resolved, though some of the precautions he took were, in fact, unnecessary. In situations characterized by high levels of uncertainty (lack of useful information, unfamiliarity with such a situation, lack of resources) good commanders used a small number of simple and robust heuristics to guide rapid decision making about what action to take. Two heuristics in particular were used often. The first was that of **minimaxing**: selecting the action least likely to lead to the worst outcome. “*Anyone in the warehouse was probably dead by now. I’ll start a crew in Breathing Apparatus organizing the evacuation (--from an adjacent child care centre--). I don’t want a kindergarten of dead kids*”. The second was that of **means-ends-analysis**: when unable to deal with the total situation immediately, using available resources in such a way as to contribute to a complete solution later. “*Even though there are people unaccounted for (--in the motel--), I won’t start a search yet. There are 140 rooms. I’ll put the crew to containing the fire and when the next two appliances come on-scene I’ll start the crews on search*”.

Good commanders took active steps to control both the type of incoming information and the rate at which it was presented. They did so (face-to-face and radio) by (a) asking for specific information they believed to be most relevant, (b) delegating particular individuals to find out and communicate needed-to-know information, (c) delaying receipt of less immediately relevant information. On occasions, they cut-off eager subordinates wishing to contribute to the decision process by stating that the issue being raised could be dealt with later.

Good commanders reduced the load on their working memory by writing down reminder notes and incident management plan steps on whiteboards, post-it notes, clipboard pads, or the vehicle windscreen! - whatever was available. They gave closed, rather than open-ended, orders wherever possible. For example: “*Take a team of two in Breathing Apparatus and check that the (hospital) ward has been completely evacuated, no-one left behind. When you have done that, report to Station Officer Smith, the Sector One Controller, for further instructions*”. In contrast, less effective commanders often gave orders in such a

form as to require them to keep in mind where they had sent crew and risk losing track of where resources had been deployed.

Good commanders attempted to anticipate developments in the situation rather than being forced to react to changes: they endeavored to “stay ahead of the action”. As one wildland firefighting service officer interviewed put it: “*You don’t fight the fire in front of you, you fight the fire you’re going to have in an hour from now*”. In particular, they attempted to simulate mentally how the situation could go wrong. They reminded themselves of their major working assumptions (such as wind speed and direction, probability of success of particular fire-suppression activities, and availability of equipment) and made plans for changing tactics if these assumptions proved to be false.

Good commanders monitored their level of physiological arousal and their level of negative emotions (anxiety, frustration, helplessness) and they used these as indicators of their subjective level of mastery of the situation. They used active processes to prevent arousal level and negative emotions from disrupting their decision processes: physical activity; deliberate physical methods of relaxation - muscle tensing and relaxing, calm breathing; and positive self-talk

Characteristics of Poor Incident Commanders

It is tempting to say that poor incident commanders simply lacked the characteristics displayed by the good commanders. However, that would not necessarily be helpful and some characteristics seemed to be associated particularly with (relatively) poor performance.

First, poorer commanders seemed to have fewer decision rules to draw upon. They were less likely to use rapid and robust recognitional decision processes and more likely to employ problem solving approaches. The lack of available rules to guide sizing up a situation meant that they were likely to be swamped with information, all of which had to be attended to some degree, so that situation assessment was slowed. Very salient information was likely to be given undue importance and other highly relevant information was likely to be overlooked. Where relevant information was not immediately at hand, its absence was often not noted and active steps to search out the missing information were not taken. As a result of these processes, commanders’ situation conceptualizations were likely to be both slow to develop and inadequate in important respects.

Poor commanders often gave the impression of, and sometimes described themselves as, being overwhelmed by the circumstances of the situation. They reacted to developments in an *ad hoc* manner and found great difficulty in formulating a coherent plan to coordinate activity. Resources were often not used effectively: crews were left idle for long periods, and excessive resources were deployed to “side shows” while crucial aspects of the situation were neglected, without such problems being noted and remedied. Poor commanders were particularly prone to being surprised by changes in the situation, feeling disconcerted, and responding rather slowly to the new circumstances. It appeared that all their cognitive resources were fully occupied with the immediate situation: they had no cognitive capacity to devote to planning or anticipating.

Some of those interviewed acknowledged that they felt anxious and unconfident. They described how they found it very difficult to concentrate on the tasks at hand because intrusive task-irrelevant self-critical thoughts kept distracting them and interfering with their concentration on the tasks at hand.

Characteristics of Disastrous Incident Command

We use the descriptive “disastrous” to describe those circumstances where life has been lost, injuries have been sustained, or there has been serious damage to property or the

environment which, in the opinion of experts, could and should have been avoided. We readily acknowledge that the causes of such disasters are often complex.. Nevertheless, from careful analysis of post-incident investigation reports and retrospective interviews with those involved in “near misses” (when a disaster is narrowly averted by good luck rather than by good management) some characteristics of disastrous incident command appear to be identifiable. The first of these is seriously flawed conceptualization of the situation and a resulting inappropriate choice of tactics. Often this results from key information being overlooked or misinterpreted through inexperience or lack of training. For example, the commander of a fire team with experience in fighting grass fires and structure fires but no experience in fighting forest fires is likely to underestimate the danger of being trapped in a high fire intensity burn-over in a forest. Another source of flawed situation conceptualization results from preconceptions preventing accurate assessment of threat. For example, a (false) belief—and a failure to seek confirmatory evidence--that a predicted wind change has already passed through the area is likely to reduce consideration that a crew may be at risk of being trapped by a sudden future change in wind direction.

Other instances of disastrous incident command may result from insufficient self-awareness of what appear to be more-or-less hard-wired biases in the way we process information so as to make decisions. One of these can be described as a **sunk-costs bias**: persisting with a tactic, which to the dispassionate observer is demonstrably ineffectual, simply because time and resources have already been invested in the tactic. Another such could be described as an **optimism bias**: choosing a course of action which necessitates nothing whatsoever going wrong if it is to succeed. For example, positioning a crew on steep sloping terrain with high levels of burnable material above and below them. Another could be described as a **need for action bias**. Good incident commanders frequently report having to deliberately exercise self-restraint so as not to precipitately commit resources to a course of action before completing a thorough situation assessment.

A final bias which seems to have been associated with disastrous incident command could be described as a **linear rate of change bias**. Human beings seem to be incapable of accurately predicting non-linear rates of change. A range of laboratory experiments confirms this. Presumably, such an ability was not called for in our evolutionary past? Regardless, fire spread rates change dramatically with only modest changes in wind strength or ground slope. The history of wildland firefighter fatalities is replete with incidents in which crew appreciated that they were in danger, but failed to appreciate how immediate that danger was. They delayed escape, in some cases apparently reluctant to abandon their tools and equipment, and the fire overtook them - sometimes quite close to safety.

Lessons?

We do not claim to have made new discoveries about small-unit command on the fireground, rather we draw attention once more to important principles of small-unit command which are easy to neglect in the face of new technologies. Our particular concern is that high cognitive workloads resulting from such technologies may collide with the inherent information processing limitations of the human operators who must use them. We emphasize the importance of information processing competencies for effective small unit command, including:

1. Acquiring through experience an extensive set of simple and robust rules to guide situation assessment and decision making across a wide range of operational circumstances.
2. Developing effective means of preventing working memory capacity being exceeded in spite of the mental workloads likely to be associated with small-unit operations.

3. Developing self-awareness in order to monitor both arousal level and negative emotions.
4. Learning effective ways of controlling arousal level and negative emotions.
5. Developing a habit of watchfulness against processes likely to interfere with accurate situation assessment, such as preconceptions and decision biases.

Information/Communication Systems: Reject any such that simply present more information to commanders and allow them to be more readily interrogated by superiors.

Selection: Rather than rely on stereotypes of what constitutes “commander material”, seek evidence that candidates can (a) manage complexity, (b) learn quickly, and (c) retain a degree of self-control under stressful circumstances. Specifically constructed “assessment centre” challenges and evaluation procedures are probably superior to pencil-and paper aptitude or personality tests.

Training: Keep in mind the fundamental distinction between recognitional knowledge (knowing that) and procedural knowledge (knowing how to). Do not be fooled into thinking that classroom recognitional knowledge will automatically translate into procedural knowledge in the field. Train commanders the way they will be required to command in the field. Realistic training exercises are essential. However, devote considerable effort to enhancing learning from such exercises by providing effective feedback and facilitating reflective self-appraisal of performance.

Decision-aiding: Support commanders’ front-end situation assessments rather than back-end decision choice selections. Help them to understand, rather than specifying choices.

Monitoring operations: Remember that requiring information from small-unit commanders represents a load on their working memory capacity which may degrade the attentional resources they can devote to the immediate task. Be judicious with demands for sitreps and the like! In such ways, small-unit commanders’ information processing competencies can be accorded the importance these deserve.

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