

Is a contained fire less risky than a going fire? Career and volunteer firefighters' perception of risk

Sadler, Holgate & Clancy investigate how career and volunteer firefighters perceive risk in different scenarios

Abstract

Since fighting fires can pose a great risk to the lives of firefighters, it is important to understand how they perceive risks in dynamic wildfire situations. The aim of the current study was to determine whether career and volunteer firefighters differ in their perception of the risk of a going vs. contained fire and whether descriptions of a fire as either going or contained affected perceptions of risk. It was expected that career firefighters would rate a contained fire as significantly riskier than would volunteer firefighters. The sample consisted of 55 career and 84 volunteer CFA Victorian firefighters (134 males and 5 females). An ambiguous wildfire scenario was presented and described as either going or contained and risk ratings were recorded. Two-way ANOVA results showed that career firefighters rated a going fire as equally risky as a contained fire. On the other hand, volunteer firefighters perceived a fire described as contained to be significantly less risky than a fire described as going, despite the fact that the same fireground conditions were described in both cases. It was concluded that a framing effect had occurred and that career firefighters demonstrated a higher level of situation awareness than volunteer firefighters due to their heightened levels of risk perception when exposed to contained wildfire scenarios. A practical implication of the current research is that those conducting firefighting briefings need to be aware of possible framing effects in the way information is presented to firefighters and need to ensure that all briefings make risks cognitively salient to firefighters.

Despite the number of well-trained career firefighters worldwide, many fire brigades rely heavily on their volunteer base. The Country Fire Authority (Australia) is one of the world's largest volunteer-based emergency services with approximately 58,000 volunteer members supported by over 400 career firefighters.

Firefighting is a risky activity. This is especially evident in wildfire situations where the environment is dynamic and potentially life threatening. For instance, in 1998 the Linton (Victoria) bushfire burnt more than 660 hectares of open eucalypt forest and took the lives of five firefighters as a result of a sudden wind change (Dunlop, 2002). Since fighting fires can pose a great risk to the lives of career and volunteer firefighters, it is important to understand how they perceive risks in dynamic wildfire situations.

Although risk perception would appear to be an obvious aspect to firefighter safety and effective wildfire operations, there has been no previously published psychological research into risk perception on the fire ground.

The concept of risk perception has generally referred to people's judgements and evaluations of potential hazards (Slovic, Finucane, Peters, & MacGregor, 2004). The individual is seen as an information-processing unit that gathers information about a risk through the use of schemas (mental models) and heuristics (cognitive shortcuts) to determine a rational conclusion (Trumbo, 1999). These cognitive mechanisms are used as guidelines and shortcuts to enable perceivers to quickly make sense of risky situations (Reyna, 2004).

Although the rational approach has been thoroughly investigated and widely applied, this literature has primarily focused on theoretical explanations of risk perception and has yet to address how people perceive risks in dynamic naturalistic settings. The current research project aims to expand the domain of risk perception by investigating whether firefighters' perception of risk varies depending upon how a firefighting scenario is framed.

There has been a growing interest by applied psychologists into the study of naturalistic decision making (NDM). NDM is an attempt to understand how people make decisions in complex real-world settings (Klein, 1998; Lipshitz, Klein, Orasanu, & Salas, 2001; Zsombok & Klein, 1997). Klein (1997) found that fireground Commanders' accounts of their decision making did not fit in to any conventional decision-tree framework (e.g. rational approach). Fireground Commanders argued that they were not making choices, considering alternatives, or assessing probabilities. The Commanders saw themselves as acting and reacting on the basis of prior experience by generating, monitoring, and modifying plans to meet the needs of the situations. On the basis of these groundbreaking findings, Klein (1997) developed a template called the Recognition-Primed Decision (RPD) model.

The RPD model illustrates how experienced decision makers rapidly decide on the appropriate course of action in a high-pressured situation. Rather than going through laborious logical and rational processes to make decisions, experienced firefighters could simply pattern-match cues in the environment to stored schemas with the use of heuristics to make a decision (Klein, 1997). As a result, NDM type strategies (e.g. RPD model) felt like intuitive responses to experienced fire Commanders rather than like analytic comparisons or rational choices of alternative options (Klein, 1997).

If firefighters are to perceive risks accurately in order to operate safely and effectively in NDM settings, then they must not only have experience in these environments, but they must also have a sound understanding of what to expect and how to operate effectively in wildfire conditions. This understanding is referred to as situation awareness.

Situation awareness involves an internal conceptualisation of the situation at hand and becomes an important factor in the decision making process (Endsley & Garland, 2000; Ericsson & Lehmann, 1996). Research has indicated that individuals will differ in their capacity to perceive, comprehend and predict the situation depending upon their level of training and expertise (Barnett & Breakwell, 2001; Lewandowsky & Kirsner, 2000). For example, those with greater training and expertise (e.g. career firefighters) are likely to have developed richer cognitive schemas to draw upon in comprehending a situation.

Furthermore, research has shown that professionals in a domain are better able than novices in a domain at distinguishing relevant cues from irrelevant cues (Barnett & Breakwell, 2001; Ericsson & Lehmann, 1996; Lewandowsky & Kirsner, 2000). Although many volunteer firefighters have advanced levels of expertise it may be expected that, in general, career firefighters may



Firefighters must maintain situation awareness in dynamic circumstances

consider that there is more risk of being overrun by a contained bushfire than will volunteer firefighters due to their generally greater levels of specialised training and experience which should lead to higher levels of situation awareness (e.g. picking up relevant cues in the environment). Consequently, it is likely that career firefighters will demonstrate a greater overall awareness of risk than will volunteer firefighters.

The way in which a scenario is presented or "framed" also has a powerful impact on an individual's risk perception (Perrin, Barnett, & Walrath, 2001; Tversky & Kahneman, 1981). Research has demonstrated that framing derives from the individual's knowledge about events that had led up to the situation in question (Endsley & Garland, 2000; Perrin et al., 2001). This information serves to tie events to the decision maker's ongoing experience, thereby endowing those events with meaning. Therefore, prior information can tell an individual what to expect and how to behave.

Knowing the frame that a decision maker is processing is likely to aid in predicting and understanding the decisions that an individual might make. One of the ways in which fire is officially framed in firefighting briefings as defined by the CFA (2007) is as "going" ("any fire expanding in a certain direction or directions, spreading at the perimeter of the fire") or "contained" ("the fires spread has been halted but may be still burning freely within the perimeter, and further work is required to bring the fire under control"). If firefighters' are briefed that they are being deployed to fight a dangerous spreading fire, then firefighters' may perceive this situation as of high risk. On the other hand, if firefighters' are briefed that they are being deployed to mop up a contained fire, then the firefighters' may perceive this situation as involving lower risk.

Investigating the effect of framing is an important area of research because it was believed that a framing effect was a contributing factor in the deaths of five firefighters at Linton (Victoria, 1998). According to testimony to the 2002 Coronial inquiry into the Linton bushfire, the firefighters at Linton perceived the fire to be a 'marshmallow fire' (e.g. a fire of such low intensity that it is suitable for toasting marshmallows), which possibly led to complacency about the risks involved in the fire-fight (Johnstone, 2002).

Based on the previous research, the aim of the current study is to determine whether career and volunteer firefighters differ in their perception of the risk of a going vs. contained fire. It is expected that career firefighters, presumably with more specialised schemata upon which to draw, will rate a contained fire as significantly more risky than will volunteer firefighters.

Method

Participants

The sample consisted of 139 CFA Victorian firefighters aged from 18 to 66 ($M = 37$, $SD = 12$), which included 134 males (96 %) and 5 females (4 %), with 55 (40 %) being career firefighters and 84 (60 %) being voluntary firefighters. Firefighters that participated in the current study were sampled from rural Country Fire Authority (CFA) Victoria, Australia, fire brigades. Of career firefighters 45% had previously performed in the role of incident controller at a fire (the highest level of command on the fireground) compared to 23% of volunteer firefighters who had performed this role.

Materials

Since no research has investigated the effects of framing on firefighters' risk perceptions, materials were specifically designed for the purpose of the current study. Participants were randomly assigned to complete one of two self-report questionnaires. All participants



Firefighters need to be aware of framing effects in briefing

were presented with the information that they were part of a firefighting crew consisting of 2 tankers and had been called to attend a fire at 16.00 hours. They were given the following information regarding the fire: the size of the fire was approximately 50 hectares; the current air temperature is 28 °C and the relative atmospheric humidity is 15%; the current wind prevailing is a Northerly at a speed of 10 km/h; fuel loads in the area vary from light to medium with grass but also patches of scrubby bush with some eucalyptus trees; flame heights are approximately 1 metre climbing to 2-3 metres in places; and the terrain is variable.

The bushfire scenarios that were described to participants were designed to represent ambiguous and variable conditions. The wordings of the bushfire scenarios were developed in consultation with experienced CFA personnel to ensure that they were unlikely to prompt consistent risk ratings.

Respondents were then presented with one of two descriptions of the fire status: 1. The fire is contained and you are being deployed to mop up ($n = 67$) or 2. The fire is going and you are being deployed to fight the fire ($n = 72$). Respondents were asked: how risky do you think this situation is for conducting safe firefighting operations? Respondents rated the level of risk on a 10 point scale from 1 (no risk at all) to 10 (extreme risk – avoid).

Demographic information of gender, age, educational level, occupation, and various types of firefighting experience was also gathered.

Procedure

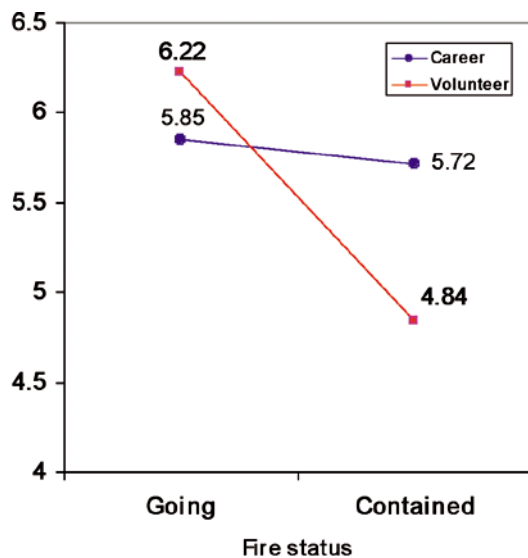
Ethics approval was granted by the Deakin University Human Research Ethics Committee. Participants were approached to participate in the current study from various rural Victorian CFA fire brigades during their attendance at routine training nights.

Data gathering was achieved by asking participants to complete the questionnaire that was randomly assigned to them. Questionnaires took approximately 15 minutes to complete. All participants were debriefed following completion of questionnaires.

Results

A two-way ANOVA was performed to compare mean risk ratings of a going vs. contained fire of volunteer vs. career firefighters. The model was significant overall ($F(1,138) = 3.51$, $p = .017$). The interaction between firefighter employment status and mean risk rating of fire status approached significance ($F(1,138) = 3.36$, $p = .06$). There was no significant difference between career and volunteer firefighters in their risk ratings of a going fire, however volunteer firefighters rated a contained fire as significantly less risky than a going fire ($F(1,138) =$

Figure 1: Differences in mean risk ratings between career and volunteer firefighters according to fire status.



Note: Standard deviations for career firefighters were 2.07 (going) and 2.38 (contained) and for volunteer firefighters were 1.95 (going) and 1.49 (contained).

4.79, $p = .03$) whereas career firefighters did not. Figure 1 illustrates the mean risk ratings for all groups.

Overall, whether a fire was described as going or contained influenced firefighters' risk perceptions. Career firefighters did not show evidence of a framing effect, rating a going fire as equally risky as a contained fire. Volunteer firefighters perceived a fire described as contained to be significantly less risky than a fire described as going, despite the fact that the same fireground conditions were described in both cases.

Discussion

As hypothesised, career firefighters perceived a contained fire to be significantly more risky than did volunteer firefighters.

Research has indicated that experience and familiarity are important components to accurate situation awareness and risk perception (Barnett & Breakwell, 2001; Ericsson & Lehmann, 1996; Lewandowsky et al., 1997). The difference between career and voluntary firefighters' risk perceptions may have occurred because career firefighters have greater exposure to risky situations than do volunteer firefighters, thereby enhancing their cognitive skills of precarious situations. Based on this difference in firefighters' risk perceptions, how can fire brigades ensure that both career and voluntary firefighters exhibit high levels of situation awareness and risk perception in wildfire situations?

In an ideal world, both career and volunteer firefighters would undergo advanced risk perception training on a regular basis to improve their decision making skills on the fireground. Advanced training activities may include formal risk perception courses, role-play scenarios, group meetings, and simulated exposure to wildfire settings. For example, evidence has demonstrated the importance of experienced firefighters sharing their knowledge with others to assist in improving firefighters' understanding and awareness on the fireground (Fender, 2003; Klein, 1997). The key to these interventions would be regular training to provide firefighters with the cognitive skills to be aware and prepared for risky wildfire situations. This training routine would aim to make certain that firefighters' risk perception would not decrease when informed that fireground conditions are expected to remain stable.

Despite the proposed ideal training plans, time is a factor for voluntary firefighters because these individuals have other priorities such as family and work commitments. Therefore, risk perception programs for voluntary firefighters would need to be realistic and focused on enhancing their awareness and risk perception on the fireground. The current study has identified that a key message that fire agencies must instil into its volunteers is that no wildfire situation is ever safe, and that each fire involves a certain level of risk, which requires firefighters to remain alert at all times and constantly be aware of potential hazards (e.g. windchange).

Although the current study has provided central findings into how firefighters perceive risks when exposed to wildfire scenarios, the present research has room for improvement. Although a survey methodology is efficient for data collection, they in no way simulate real dynamic firefighting conditions.

Since the study of firefighters' risk perceptions is in its infancy, a pen and paper design is an important starting point because the findings from the current study should generate further research. It may be expected that differences in risk perception are likely to become more apparent in a wildfire situation when participants are under stress. Differences in risk perception between career and volunteer firefighters may be even more acute in research conducted under more realistic conditions.

It is recommended that future research concentrate on improving the methods of data collection to obtain firefighters' risk perceptions. Several studies that have investigated dynamic situations have demonstrated that the use of visual cues is more meaningful and realistic (Cannon-Bowers & Salas, 1998). For example, naval, military, and aviation fields have implemented a computer-simulated technique to assess and train marines, soldiers, and pilots in their respective dynamic fields. Greater use of computer simulated

wildfire scenarios could be made to assess firefighters' risk perceptions.

The current study has provided a platform for understanding how career and volunteer firefighters may perceive risks when exposed to wildfire scenarios. It was found career firefighters demonstrated a higher level of situation awareness than volunteer firefighters due to their heightened levels of risk perception when exposed to contained wildfire scenarios. As a result, firefighters' familiarity and expertise may have influenced how alert they were to potential risk of contained wildfire scenarios. Since voluntary firefighters demonstrated a lower level of situation awareness to contained scenarios, the current study highlighted the importance of further research and advanced training programs to help voluntary firefighters become more aware of risky situations on the fireground. A practical implication of the research is that those conducting firefighting briefings need to be aware of possible framing effects in the way information is presented to firefighters and need to ensure that all briefings make risks cognitively salient to firefighters. The evidence that has been discussed throughout the current study will allow for more advanced analyses in the future and make for improved firefighting on the fireground.

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