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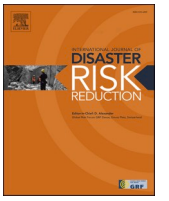

Enacting safety: Firefighter sensemaking of entrapment in an Australian bushfire context

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ABSTRACT

How do firefighting teams achieve safety when entrapped by flame? My case analysis of firefighting crews during the Black Saturday bushfires of 2009 in Victoria, Australia, examines the ways that teams can negotiate and renegotiate safety when they encounter danger, through a social process of sensemaking and sensegiving. This study has important implications for fire crews that work in dangerous circumstances who have hitherto been found to struggle to negotiate safety when entrapped by flame in bushfire events.

1. Introduction

> *'Mayday, overburn'. Then it came again, 'Mayday overburn'. Nine times a desperate firefighter made the chilling call for help. It was the Kinglake West Tanker* [1]*:16)*.

On Saturday February 7, 2009, at c.1530hrs, two volunteer firefighting teams onboard Kinglake West Tanker 1 (KWT1) and Kinglake West Tanker 2 (KWT2) left their station to investigate smoke sightings on Coombs Road in Kinglake West, Victoria, Australia. The crews were expecting to attend a local fire, which is a normal event during bushfire season between the summer months of December and February in Victoria. However, 13 years of drought, a heatwave in January, and 3 consecutive days of temperatures over 43 °C in February meant that fire crews like KWT1 and KWT2 were concerned that normal fire risk could quickly escalate. On Saturday, temperatures had soared to an unprecedented (and unexpected) 47 °C, with winds gusting at storm force from early morning. Fire risk was extreme across the State as lightning strikes, arson attacks and sparking power lines ignited multiple fires, which quickly burned out of control. As KWT1 and KWT2 arrived at Coombs Road, they found themselves increasingly mired in dangerous and unpredictable circumstances, as they became entrapped by flame and struggled to make sense of some of the most volatile and complex firestorms ever witnessed in Australia and, arguably, the world.

Firefighting crews like those onboard KWT1 and KWT2 often find themselves in dangerous and equivocal circumstances where they become entrapped by fires that are novel, discrepant and unorthodox [2–5]. Such circumstances require firefighters (and other emergency responders) to engage in *sensemaking*, where they seek to understand what is happening and *sensegiving*, where leaders seek to shape, influence, and adapt the sensemaking of their followers [1,6,7]. This sensemaking is critical to manage threats to their wellbeing [8,9] as they confront the risk of "heat illness, smoke inhalation, significant burns and even death" [8]; p.38). Previous studies have found that those who work in such circumstances struggle to organize and make sense of safety rules [6,7,10,11] because environmental cues – the signifiers of what is occurring in the present – are discrepant, and therefore cannot be organized into frames – the interpretive schemes constructed from past experiences which provide a basis for meaningful action [1]. Accordingly, "disruptive

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ambiguity" takes hold and the ability to make sense is lost [12]; p. 414). This has seen firefighters fighting bushfires injured or even killed [13,14].

While bushfire shapes, rejuvenates and renews the Australian landscape, it also causes significant economic and social losses to communities [15]. It is "a conspicuous feature of the contemporary Australian environment and a significant feature of the national psyche" [16]: 86). With the effects of climate change as well as an ever-increasing movement of populations into the natural environment, bushfire poses an increasingly significant threat to communities [17]. Communities continue to be characterized by different levels of awareness and preparedness planning; this has seen circumstances where people leave it too late to evacuate their place of shelter or underestimate what is required to defend against a bushfire [18]. Such circumstances have been found to create a risk of entrapment for firefighters as they seek to save lives and property when responding to incidents [8,19].

This paper extends recent studies that bring attention to the importance of social processes and the way they enable teams to enact safety routines during a crisis or disaster [20–22]. I do so by examining a case study of firefighting teams onboard two tankers that became entrapped by flame on one of Australia's worst days of bushfire – Black Saturday – where 173 people lost their lives, over 4000 homes and businesses were razed, and an estimated 8000 people were left homeless. Despite the challenges, the firefighters were able to survive and save lives which otherwise would most likely have been lost. My study makes several contributions.

First, I find that when firefighting teams (such as those onboard Kinglake West Tanker 1 (KWT1) and Kinglake West Tanker 2 (KWT2) featured in this study) interpret discrepant cues on an ongoing basis, they can use problems, predicaments and paradoxes as a basis for negotiating safety during bushfire disasters prompted. Second, I show how frames are created intersubjectively within firefighting teams. This brings attention to the important role of *sensegiving* – the process by which individuals and teams redefine each other's meaning and reality [23,24] when faced with "situational complexities" [2]; p. 695) prompted by volatile bushfire behavior. Third, where studies to date have focussed on the ways that sensemaking and sensegiving collapse during crises (e.g. [5,7,25]: my study shows that the interplay between retrospective and prospective sensemaking and sensegiving can enable firefighters to enact safety in present moments when facing danger. Collectively these contributions open up new ways for firefighting teams and those who lead them to become more multifocal when they encounter environmental change in their operating conditions.

My article is organized as follows. First, I review the literature on the social processes of sensemaking and sensegiving as a basis for exploring my research question: how do teams that work in disaster contexts *make sense*? This question focuses my study on how crises can be averted in the most dangerous circumstances. Following my methods section, I present my qualitative and interpretive case study analysis, before identifying contributions to theory and practice before concluding with implications for future research.

2. Sensemaking, sensegiving and equivocality

In this section, I introduce *sensemaking*, which is the way that individuals and/or groups attach meaning to experiences in their world [7]. I examine its key concepts and show how it emerges from equivocal circumstances, such as crises and disasters, which by their very nature prompt ambiguity, discrepancy and confusion. I also examine sensemaking's relationship with sensegiving. *Sensegiving* is the way that individuals and groups seek to influence and redefine each other's sensemaking as circumstances change in their environment and new circumstances emerge [24].

Equivocality is part of everyday life as individuals and groups encounter different meanings or multiple interpretations within their environment, which prompt them to begin sensemaking about what is occurring at any given time [26,27]. Firefighters operate in environments that are particularly equivocal and where conditions can rapidly change, such as when a wind shift turns a fire flank into a head in an instant; this can put crews at risk if they are engaging in a parallel attack or if they have no access to shelter [28,29]. Studies have shown that in an Australian context, wind direction change as well as its interaction with steep sloping topography can entrap firefighters because of an unexpected fire spread [9].

Equivocality arises in various ways, many of which are relevant to firefighting. It may emanate from events in an individual or group environment that are very different from what has previously occurred (e.g. Ref. [7], or it may occur because of disagreements about each other's interpretation of symbols and artefacts relating to safety rules (e.g., Ref. [11]. It can also result from rapid changes in weather which can quickly change the behaviour of a fire which can put firefighter's lives at immediate risk (e.g., Ref. [14]. Firefighters can experience stress as a result of anxiety and fear in anticipation of what may occur, and worry as risks materialize in their environment [30–32]. Hence, equivocality will prompt actors such as firefighters to begin to inquire and probe themselves and each other to create a shared understanding about what is occurring in their environment [33,34], through a social process of sensemaking. This is particularly relevant for firefighters who work in the natural environment; if they do not remain situationally aware, they "may be lulled into a false sense of security if they base their actions only on the appearance of the fire and do not take account of likely future changes of wind and particularly its direction in relation to the slope and the resulting headfire width" [14]: 49).

Sensemaking is a social process which seeks to create meaning and order through "language, talk and communication" in such a way that it brings meaning and understanding into existence [12]: 409) between individuals and groups who encounter equivocality when their circumstances change and become discrepant or ambiguous [7]). Scholars have suggested that sensemaking is retrospective by its very nature, and is shaped by identity construction, founded on the premise that people construct cognitive schemes from previous lived experience, which they use to make sense [35–37]. Questioning, framing and storytelling enliven the social processes at the core of sensemaking [34,38–40]. These bring new understandings of situations into existence [12]) from cues that are then used to develop frames as a basis for action. Such cues and frames provide a basis to enact sensible environments, through "conversational and social practices" ([41]: 1469) about specific events to arrive at an understanding about what is plausible, rather than objectively accurate. In other words, through the social process of sensemaking people seek to plausibly understand what they are facing in their

environment as a basis for meaningful action [42].

Face-to-face interaction is an important part of sensemaking, as individuals engage in ongoing interactions until plausible meaning is made of a stimulus. This is prompted by noticing, framing and bracketing cues emerging from within their organization and its environment as these change as a result of emergent equivocality [1,12,34,37].

Studies have found that human error, entrenched habits and routines often give rise to disasters because they conspire to constrain people's ability to engage in meaningful sensemaking during events (e.g. Refs. [5,7,25,43,44], as individuals fail to observe cues and generate plausible meanings about what may be unfolding [7,39,41,45–48]. For example, Perrow [49], using the example of an accident at a nuclear power plant, shows how centralised authority stifles people's ability to pick up on cues and enact sensemaking behaviors that may avert a crisis. Weick's [25] case study of a collision between two aircraft at Tenerife Airport in 1977 shows how interruptions to routines generate false hypotheses about situations; this may create a disaster as people fail to make sense about what is happening [25,50,51]. In the case of the NASA space shuttle Columbia, Vaughan [52] shows that an absence of sensemaking can result in errors and misconduct, with disastrous consequences.

Furthermore, during disasters or times when equivocal cues are high, individuals and groups often become so overwhelmed that they lose the ability to enact and interpret equivocal cues that would, under normal circumstances, enable them to make and give sense [12]. This has been shown to "bring events … into existence and set them in motion", which sometimes exacerbates an escalating crisis or even brings a new one into existence [5]: 306; [3]. The majority of studies of crises and disasters have found that when individuals and teams fail to make sense, the outcome can be tragic [7,53–55]. However, there is some evidence to show that teams such as firefighters have been able to adapt safety rules through *ventriloquization* insofar as they interpret, pass on and/or are intermediaries of information that facilitates sensemaking when circumstances become dangerous [11,56,57].

Scholars have suggested that sensemaking gives rise to sensegiving, as individuals attempt to influence the sensemaking and meaning construction of others towards a preferred redefinition of a "new organizational reality" [24]: 443). Sensegiving is also an interpretive process [24,58]; in which individuals – possibly from different hierarchical levels of the organization – influence each other through persuasive or evocative language choices [59]. Scholars have shown that sensegiving is used by leaders [24,58,60], those who report to them [38], and other specialists and/or employees in organizations [34]. Sensegiving has also been shown to influence the way in which sensemaking occurs [34] as individuals, usually those in leadership positions, disseminate new understandings to individuals at lower levels of the organizational hierarchy – information which ultimately shapes how they understand themselves, their work and that of others, as well as their perceptions of emergency phenomena in their environment (cf [24]. However, there have been few studies of sensegiving in crisis or disaster settings that examine how leaders have influenced the outcome of sensemaking to build support for a particular perspective about what is occurring; and whether such action has either prevented a disaster from coming into existence or ameliorated the effects of one which is unfolding [21,43].

Studies to date have focussed on the failures of teams and those who lead them in crisis contexts (see Ref. [20]. There has been less focus on instances where teams working within crisis and disaster environments have found a way of coping with dangerous circumstances which has enbaled them to interpret cues and take meaningful action to avoid exacerbating crises (see Ref. [61]. Specifically, scholars have neglected opportunities to examine the complementary social processes [62]) of organizing within disaster management teams, where they develop a collective and shared sense of action [42]). Where studies do exist, sensemaking by leaders and their teams have been found to occur in a retrospective and reactive manner which has emphasized their failures to plan for equivocal circumstances [33,63]. Fewer studies have focussed on the way that teams prospectively and proactively engage in sensemaking and sensegiving before and during equivocal crisis environments [21]. Yet recent studies using the example of the 2009 Black Saturday Bushfires have shown that firefighters (and other emergency management practitioners) through coping have been able to interpret equivocality in a prospective and proactive manner [61]. Despite the intensity of the fires no firefighter lives were lost during fire suppression efforts. With this in mind it is somewhat surprising to that so few studies examine instances of when teams *do* make and enact sense in the specific context of teams that plan for and respond to disasters. Studies to date have focussed on sensemaking failures by teams in such environments [7,48], suggesting that teams are routine-producing and unable to functionally make meaning and take meaningful action when environmental conditions change [48,64,65]. Accordingly, the focus of this study is to explore how teams working in disaster contexts make sense. This is important because teams will continue to face crises and disasters that will expose "the … flawed assumptions on which yesterday rested"; this means they must instigate a search for meaning in present moments which will ameliorate the effect of crises and disasters in the future [66,67]; p. 4). Given that scholars have recently noted that there is considerable scope for more research into the ways sensemaking and sensegiving as social processes provide a basis for action during crises [6,21], I conduct an exploratatory study which is qualitative and interpretive to facilitate new insights into ways that firefighters can survive an entrapment.

3. Research design

In this section I introduce the qualitative and interpretive methodology which I used to conduct my study. I explain how I collected my data and how I coded for sensemaking and sensegiving as the firefighters faced increasingly equivocal circumstances on the February 7, 2009.

3.1. Case study

I examine a case study of an instance when two firefighting teams working within a dynamically complex environment [3] were able to enact safety routines which gave rise to action that saved lives in the community of Kinglake West that would otherwise have been lost. A case study approach enabled me to collect rich data to explore sensemaking and sensegiving processes through research

methods that were flexible, sensitive to the social context, and concerned with understanding complex issues that gave rise to highly equivocal circumstances [68,69]. I show how cues from the past, reinterpreted in present moments, gave rise to phases of sensemaking and sensegiving within frames, which enabled the crews to take action in a future-oriented way as danger became imminent.

4. Method

My study is qualitative and interpretive, insofar as it reflects the way that teams used cues and frames as part of a social process of sensemaking and sensegiving to enact meaning when they became entrapped by flame [68]. Despite 9 entrapments with '*mayday*' emergency calls coming from fire crews on Black Saturday, all returned to their station, albeit with physiological and psychological injuries. My previous training and experience as a firefighter and the fact that no firefighter lives were lost on Black Saturday suggested to me that the KWT1 and KWT2 case study would offer insights into how crews made sense in highly equivocal and life-threatening circumstances.

4.1. Data collection

Authoritative accounts from organizational and public review processes were the source of my primary data. Such accounts are well established in empirical studies as "locales for the conduct of primary research" [45]; p. 95). I also used secondary sources, where investigative review teams had interviewed the crews onboard KWT1 and KWT2 to inform their accounts of what occurred on the day. I also used non-fictitious accounts by authors who had interviewed the crew members of KWT1 and KWT2. While acknowledging that I would be unable to capture the "dynamism and complexity" [70]: 694) that the firefighters faced on Black Saturday, my sources enabled me to identify the key events before, during and after the entrapment that occurred on Coombs Road. Table 1 shows the sources of data at the empirical core of the study.

I then constructed a timeline of key events in chronological order to guide my coding and analysis. This meant that my study remained sensitive to the context of the flame entrapment and ensured that I was able to problematize the underlying issues embedded in the data [70–72]. Table 2 shows the timeline of the key events surrounding the entrapment of KWT1 and KWT2.

Given the circumstances faced by the firefighters, I avoided interviewing both crews because I was concerned that questions might evoke painful memories and exacerbate or even prompt post-traumatic stress amongst participants. Recent studies of Black Saturday have shown that firefighters who responded to the bushfires on the day felt blamed and even scapegoated by the media for the damage and losses that occurred (see Refs. [56,61]. Accordingly, media accounts were not used as data sources in this study. I concentrated on accounts and texts that sought to report on events as described by those who lived through them, which I felt would be more likely to offer meaningful insight into circumstances surrounding the flame entrapment of the tankers which meant I was able to draw inferences of sensemaking in the way that different texts related to and cited each other in relation to the entrapment. Such intertextuality is an important part of working with secondary data as "texts draw on, react to, and transform other texts", which enables researchers to draw conclusions about phenomena under investigation [1]: 49).

I also accessed a detailed submission on behalf of the Kinglake West Fire Brigade to the Royal Commission made by Karen Barrow who was a key leader on the day as the driver of KWT1. This approach, as in other studies (e.g. Refs. [1,73], meant that I was able to get closer to the experiences, as well as the talk and vocabularies, of the firefighters to discern how sensemaking occurred between KWT1 and KWT2.

While these accounts remain sensitive to the social context from which they emerged, they are themselves forms of artefacts and individual interpretations which are developed from a variety of authorial strategies which select and omit materials to present a certain understanding and/or truth about events [39]. Accordingly, I infer instances of sensemaking and sensegiving from accounts emerging from the "language, text and discourse" of documents [73]; p. 588) to gain insight into how meaning was made among the crews as they became entrapped by flame. While those who collected the data did not interrogate the meanings embedded in the text, I was able to structure accounts from multiple sources into a synthesized understanding of how multiple phases of sensemaking and sensegiving occurred amongst the crews; an understanding that is theoretically grounded in the richness of the context from which it emerged [70,74,75,74].

4.2. Analysis

Like other scholars who have used an interpretive approach to their data analysis, I assumed that "we can figure out patterns in the data enabling us to surface concepts and relationships that might escape the awareness of the informants, and that we formulate these concepts in theoretically relevant terms" [76]; p. 17) within an environment. By reading the accounts of the entrapment and relating them to my understanding of sensemaking and sensegiving from the literature, I was able to identify "themes, meanings and patterns in textual data" [73]; p. 585), which I used to create descriptive and analytical codes [75]. I further developed these codes by regularly revisiting literature relating to sensemaking and equivocal environments until I had a robust and meaningful basis for exploring my

Table 1
Sources of data.

Accounts and narratives	2
Investigation report	2
Non-fictitious accounts	3
Submission to Royal Commission	5
Transcript from Royal Commission cross-examination	6

Table 2
Timeline of key events.

1149hrs: Brigade Captain prepares crews	Kinglake West's proximity to national park means it is a very fire-prone area. The brigade captain (who was also a crew leader of one of the teams) formed two crews of six firefighters with an appropriate blend of experience and set about planning and organizing the teams' activities in anticipation of a call out. Smoke columns signify fire in the landscape 30 km north-west of Kinglake West.
1300hrs: Conditions worsen	Local Incident Control Centre at Kilmore struggles to establish itself with qualified incident control staff, as the fire situation becomes a serious threat.
1340hrs: Breakdown in communication flows	Fire prediction map developed from aircraft linescan did not reach Kilmore Incident Control Centre from the State Emergency Control Centre in Melbourne.
1358hrs: Fire danger escalates	3 km-wide firefront crosses the Hume Highway (one of Australia's most significant roads), at Heathcote Junction about 25 km from Kinglake West.
1415hrs: Atmospheric conditions signify danger	Burnt leaves fall at the Kangaroo Ground Fire Tower, to the south of Kinglake, about 50 km from where the blaze began, suggesting that a major blaze was approaching. Kangaroo Ground Incident Control Centre fire officer concluded that Kinglake and nearby communities were in the path of the fire. 'Urgent threat' messages were prepared but warnings were never sent because protocol meant the warnings could only be sent from Kilmore Incident Control Centre.
1530hrs: Entrapment on Coombs Road Kinglake West.	Fire begins to surround Kinglake West from the south, south-east, and north-west. KWT1 and KWT2 set out to investigate smoke between 290 and 430 Coombs Road in Kinglake West on the afternoon of 9 February. The Kilmore East fire (which claimed 119 of the 173 lives on Black Saturday) is also moving towards their location.
1627hrs: KWT1 Entrapment	As tankers advance along Coombs Road the escalating danger is apparent. Crew Leader onboard KWT2 that was traveling ahead advises KWT1 to return to base. KWT1 began the arduous task of exiting Coombs Road. Cabin visibility became extremely poor. All radio communication was lost. Crew members in the rear of the truck, which did not have a roof, doused themselves with water from handheld hoses. Despite poor visibility and being surrounded by flame, the driver and the crew leader engaged in ongoing dialogue about the conditions in their environment while driving, slowing and letting fire pass them by before quickly moving the vehicle to safer ground when the firefront had passed.
KWT2 Entrapment: 1627hrs – c.1800hrs	KWT2 had become entrapped by flame on Coombs Road. Trees falling across hoses and failing water pumps meant the crew's ability to create safe places of shelter in their environment was endangered. The crew leader instructed firefighters to shelter in a nearby house. Firefighters intermittently re-entered the fireground to move the tanker and firefighting appliances to a safe place. After 60 minutes an opportunity presented itself for the crew and two residents to board the tanker to drive to safety, albeit under very hazardous conditions. Ember attack and fires remained active and falling trees were an ongoing hazard. Poor visibility meant firefighters removed their eyewear, causing flash burns.

research question. I then checked that these codes were relevant to my context by seeking feedback from emergency management officers who were active on Black Saturday and familiar with the safety procedures the Victorian firefighters enacted on the day when they became entrapped by flame. Accordingly, these codes became the emergent theory of how the crews onboard KWT1 and KWT2 made sense of their experiences [69]. Fig. 1 shows the codes that I used to analyze my data.

There were several stages to my analysis. First, I descriptively coded my data for evidence of a changing environment by searching for references to 'conditions', 'flame', 'fire', and 'fire behavior'. It was clear from the talk and text in my data that both crews noticed changes in their environment, which they used to guide them in their actions.

Second, I examined my data for evidence of sensemaking and sensegiving amongst the crew members and their leaders. I did so by descriptively coding for references to 'feeling', 'monitor(ing)', 'predict(ion)', 'plan(ning)', 'forecast', 'training', 'leaders(ship)', 'talk-ing', 'help(ed)', 'decision', and 'teamwork'. By further examining passages of talk and text containing these references I was able to ascertain the different ways that the teams and their crew leaders engaged in sensemaking and sensegiving. Table 3 shows how sensemaking and sensegiving occurred at different times throughout the day.

This was an important part of the theory-building process. By coding different sections of talk and text from multiple sources, I was able to describe a process of sensemaking and sensegiving that was used by the crews at different times to interpret cues within several frames, from which they negotiated action to construct an intersubjective meaning. Table 4 shows the emergent cues and frames and how they prompted action across and between KWT1 and KWT2 at different times during the day.

Once I was able to describe my research environment, I used analytical codes related to the landscape, weather conditions, communications and their previous firefighting experience to identify cues that the firefighters interpreted through multiple frames over the course of the day as the environmental conditions changed. My analytical coding identified that sensemaking and sensegiving occurred in both a retrospective/reactive manner and a prospective/proactive manner as the crews interpreted what was unfolding in their environment, giving rise to meaningful action that ameliorated the effects of the bushfire.

5. Findings[1]

I now present my findings which show how different types of sensemaking and sensegiving were present as the firefighters prepared for Black Saturday, fought fires in dangerous and volatile conditions, and sought to protect their ability to enact safety while they were entrapped by the fires. My findings which have been abstracted from Tables 3 and 4 provide the basis for a model of sensemaking and sensegiving (Fig. 2) which shows how the firefighters were able to enact safety in dangerous and difficult circumstances.

[1] Quotes in this section are from interview transcriptions from Ref. [81]: 3–16.).

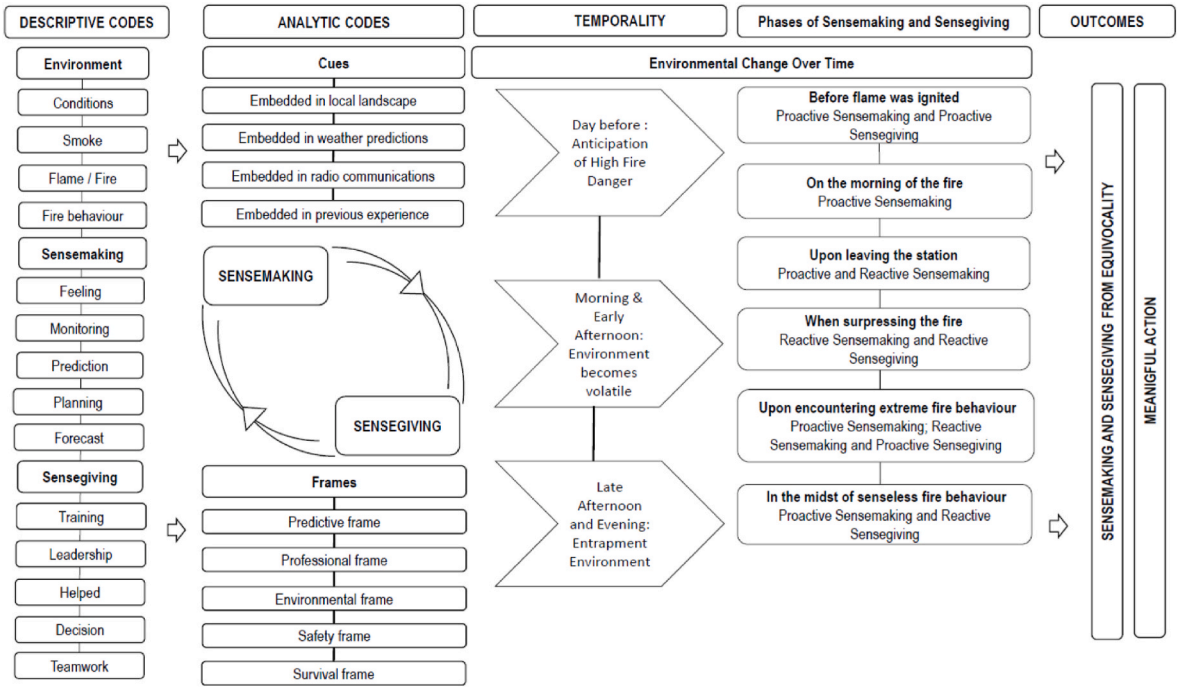

Fig. 1. Coding used to analyze data.

Table 3
Examples of sensemaking and sensegiving at different times.

Before the flame was ignited	**Illustrative quote**
Firefighters understand their circumstances through proactive sensemaking and proactive sensegiving.	Saturday February 7, 2009 was likely to be a day of extreme Fire Danger Index and [we were] to expect extreme fire behavior with long distance spotting of 6 – 8 km [77]: 1).
Action: Firefighters observe weather forecasts before 7 February.	
On the morning of the fire	**Illustrative quote**
Firefighters understand their circumstances through proactive sensemaking.	We looked at some maps and tried to predict the path of the fire. Consideration was given to ensuring an even distribution of experience and abilities [77]: 2).
Action: Brigade captain form teams with complementary skills.	
Upon leaving the station (early afternoon)	**Illustrative quote**
Firefighters understand their circumstances through reactive sensemaking and reactive sensegiving.	I walked outside saw that this smoke was much closer than Jacks Creek Road. I confirmed to Captain Grover that this smoke was separate and was in fact in the vicinity of Coombs Road [77]: 3).
Action: Interpretation of environmental cues.	
When suppressing fire (mid-afternoon)	**Illustrative quotes**
Firefighters understand their circumstances through reactive sensegiving and reactive sensemaking.	We were able to cut off the fire but the truck's water level was down to 750litres, which is the level that must be retained for basic minimum crew protection [78]: 4).
Action: Fire suppression without their resources.	
Upon encountering volatile fire behavior (late afternoon)	**Illustrative quote**
Firefighters understand their circumstances through proactive sensemaking and sensegiving.	Captain Grover instructed KWT2 to leave the property. Lieutenant Allan responded that they had a swimming pool of water to use for asset protection and he thought they were safer staying. Lieutenant Allan instructed us to get out of Coombs Road as the fire was crowning [78]: 4).
Action: Organization for a worst-case scenario.	
As the fire behavior became more volatile (early evening)	**Illustrative quote**
Firefighters understand their circumstances through reactive sensemaking.	**KWT1:** I recall (as flames burned over) that even in the cab we had to yell at each other to be heard. Eventually we made it to the top of Coombs Road. The crew on the back were had been using their hoses to spray water to protect themselves from the heat and embers [78]: 5).
Action: Defensive tactics to protect team safety and wellbeing. Survival tactics to ensure to manage an extreme environment and prepare for the likelihood of something worse.	**KWT1:** At one stage the "West" crew huddled inside their truck and were separated from their captain by a sheet of flames. Miraculously they all survived [79]: 16).
	KWT2: Embers are raining down … the owner comes rushing out saying he is having difficulty caring for his elderly mother. They tackle the spot fires. Then they detect a shift in the wind. Frank as crew leader is acutely aware of his responsibility to monitor threats [80]: 72).
	KWT2: They haven't a hope in hell of stopping or controlling it. It comes rushing, crowning through the treetops, moving up the slopes, jumping gullies, swarming around outcrops [80]: 72).

Table 4
Emergent cues and frames from equivocality as a basis for action.

Equivocality	Temporality	Cue	Frame	Action
Crews are uneasy about the weather before call out on Black Saturday.	Before the crews had left their station.	Crews notice weather conditions are likely to result in a day of high fire danger.	Predictive frame: Crews recognize cues because season outlook and weather forecasts predict extreme fire behavior.	Crew leaders and crews anticipate call out.
Crews notice smoke in the air.	As fire is ignited in the landscape.	Crews notice that fire is close to a number of communities.	Professional frame: Crews respond to sighting of fires.	Crew leaders to delegate specific roles within the firefighting crew.
Crews observe volatile fire behavior not previously experienced.	When crews reach the destination.	Crews notice that they were being surrounded by spot fires.	Environmental frame: Crews recognize that fire behavior is volatile.	Crews to extinguish spot fires.
Crews observe fire behavior that threatens their wellbeing.	After the crew arrive at call out destination.	Crews notice that spot fires are occurring at a rate that is quicker than they can extinguish them.	Safety frame: Crews recognize the fire behavior has become volatile.	Crews focus less on firefighting and more on safety.
Firefighting cannot prevent crews from entrapment.	After the crew had commenced firefighting.	Crews notice that spot fires have merged and are burning out of control along with a firefront directly in front of them.	Safety frame: Crews recognize the fire behavior has become volatile.	Crews reconsider their approach to managing their fireground.
KWT1 navigate their way through spot fires to leave the fireground.	As the KWT1 crew is advised by the crew leader of KWT2 that they should not progress further along Coombs Road.	Crew from KWT1 notices that a focus on firefighting may be futile as conditions deteriorate.	Survival frame: Crews activate emergency procedure and take action that protects their wellbeing.	KWT1 exits Coombs Road.
Crew from KWT2 prepare for flame entrapment on Coombs Road.	As a firefront approaches KWT2.	Crews notice that they are surrounded by flame and entrapped.	Survival frame: Crews activate emergency procedures and ensure that they remain sheltered from flames.	KWT2 seeks shelter and protects their firefighter tools from damage so they can fight fires when conditions are less dangerous.

5.1. *Before the flame was ignited*

In the first instance, the brigade captain engaged in proactive sensemaking and sensegiving insofar as he prepared two crews for a day of extreme fire danger on 7 February. Table 5 shows the experience levels of the crews as shown in my data sources.

Given the predicted outlook for the season, the captain and his crew had familiarized themselves with the latent risks in their community and made sure that on days of high fire danger crews were available that could respond in the event of a fire being ignited.

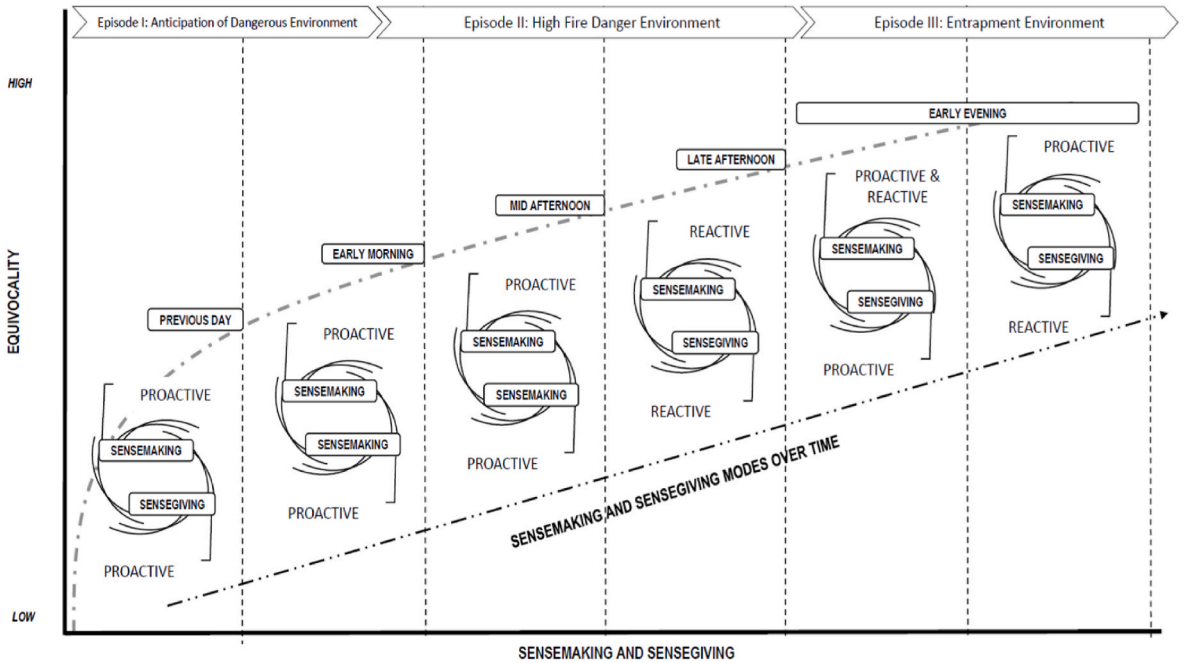

Fig. 2. Model of sensemaking and sensegiving.

Through proactive sensemaking, the brigade captain ensured that there was an appropriate blend of skills and experience in each of the teams. Proactive sensegiving was also present in that the crews knew in advance who would lead them and who they could seek advice from about plans for the day ahead.

> We had pre-planned the crews for the day ensuring a mix of experience and skills (to deal with the predicted fire weather) and also the physical strength. Also we had done an area familiarization exercise as part of the training (Firefighter 9, KWT2).

Sensemaking and sensegiving were used by the brigade captain to notice cues embedded in the local landscape and weather forecasts, which were showing that the conditions were likely to give rise to dangerous fire behavior if flame was ignited on 7 February. This prompted the crew leaders and their crews to adopt a predictive frame from which they made meaning about the risks they would likely face before any fires started. This frame became the basis for action carried forward by the individual crew members in each of the two teams. For example, in her submission to the Royal Commission, Karen Barrow commented:

> On this particular week, the weather / Fire Danger Index pager messages were providing information several days in advance. Further to this we received a Region 12 pager message which indicated that Saturday 7 February 2009 was likely to be a day of extreme FDI and to expect extreme fire behaviour with long distance spotting of (from memory) 6–8 km. This pager message also suggested that initial attack on fires were likely to be ineffective and that Crew Leaders were to make crew safety a priority [77]: 1).

It was also clear that the crews and their leaders needed to rely on leveraging cues using their own resources to ensure that they could plan ahead:

> The Kinglake West Fire Brigade does not have internet access, this is not provided for by the CFA, so one of our members, Glenn Sandford went home to retrieve his laptop which has wireless access so that we could monitor the CFA Incidents website. From this website, we presumed that the smoke column that we could see was from Kilmore [77]: 1–2).

5.2. On the morning of the fire

On the morning of Black Saturday, the crew on duty continued to proactively make sense by remaining alert about what might unfold. They did so by using available information sources within their station.

> It was a Total Fire Ban day. We were manning the station (and constantly monitoring what was happening). We were using a combination of information (to monitor the situation); radio; CFA website; and radio. There was no information from the CFA (Firefighter 1, KWT1).

Despite the extreme conditions on 7 February, the crews were not made aware of active fires in their community from any official source. However, given the high likelihood that fires would be ignited, the crews remained ready for deployment. On the morning of the fire, they made meaning through proactive sensemaking by noticing cues embedded in the local landscape and radio communications through professional and predictive frames, as they monitored multiple information streams through a firefighting lens so that they could respond to any mention of flame in the landscape. Ongoing sensemaking was facilitated by proactive sensegiving, as the crews and crew leaders continued to reflect on scenarios that might arise if flame were to be ignited on the landscape. For example, Karen Barrow commented in her submission:

> We continued to monitor the smoke and observed that the smoke was progressively growing and getting darker in colour - a sure sign that the fire was hot. The CFA website was indicating that an increasing number of appliances from Region 14 were on scene at Kilmore - a sure sign that the fire was "not yet under control". We looked at some maps of the area and tried to pre-empt the path of the fire. I could see that the fire was likely to have an impact on us but as far as we knew the fire was still in Kilmore. We did not know when the fire was likely to reach our area. My thinking at that point in time was that if the fire was still in Kilmore it might affect us either very late that night or possibly the next day depending on weather conditions [77]: 3).

5.3. Upon leaving the station (early afternoon)

As the afternoon progressed, the firefighters became aware of smoke sightings at Coombs Road in the local community, and KWT1 and KWT2 responded. As the firefighters departed their station, they began to make meaning through proactive sensemaking as they anticipated the likelihood of facing a fire. Radio communication confirmed that fires were beginning to emerge on the landscape. This prompted reactive sensemaking, as the firefighters sought to understand the nature of the fire threat and the most appropriate way to respond.

> We heard something over the radio about a spot fire and noticed three smoke columns near Coombs Road so we responded (Firefighter 1, KWT1).

The crews noticed the cues embedded in radio communications and the local landscape through environmental and professional frames, which cognitively prompted them to prepare for deployment. However, the crews had not received confirmation of what was occurring in their area or region. For example, Karen Barrow in her submission to the Royal Commission commented:

> We still had not received any communication from any persons within the CFA at either Region 13 or Kangaroo Ground Incident Control Centre regarding the Kilmore fire - as far as we knew it was still in Wandong. We did not know if the Jacks Creek and Coombs Road fires were spot fires or separate incidents altogether. Further to this, the Murrindindi fire was also going by this stage, I and many other members were completely unaware of this fire [77]: 4).

Table 5
Crew experience.

KWT1	
Role	**Experience**
Crew Leader	12 years
Firefighter	8 years
Firefighter	5 years
Firefighter	5 years
Firefighter	18 months
Firefighter	3 months
KWT2	
Role	**Experience**
Crew Leader	13 years
Firefighter	12 years
Firefighter	6 years
Firefighter	3 years
Firefighter	2 years
Firefighter	1 years

5.4. When suppressing fire (mid-afternoon)

When the crews first arrived at Coombs Road they struggled to notice cues and make meaning in their environment. This prompted reactive sensemaking, insofar as both crews began suppressing spot fires while also discussing as a team what they thought was emerging.

> There is always confusion at the beginning of a job. We began putting out some spot fires. I don't know how you overcome it. We made decisions. We kept talking to each other, which really helped our teamwork, plus I had full trust in Tanker 2 crew leader (Firefighter 10, KWT2).

As the firefighters struggled to notice cues in their environment, they began to rely on reactive sensegiving, where ongoing communication between both teams was influenced by both the knowledge of the crew leaders and the crew members' existing levels of firefighting experience. Over time the crews began to notice cues embedded in the landscape and previous experience that suggested that the fire threat was becoming gravely serious, which prompted proactive sensemaking within a professional and safety frame.

> There was a North West wind. We were starting to see a bigger fire front (emerge) (Firefighter 1, KWT1).

The firefighters realized that they were likely to face a significant firefront, exacerbated by the intensity of the spot fires that were beginning to surround them. The crews engaged in proactive sensemaking by noticing cues embedded in previous experience in their present circumstances. The crews and their leaders were able to make decisions based on their sensemaking and sensegiving endeavors that prioritized maintaining their structure and ability to respond to and plan for fires. Accordingly, both crews maintained their capacity and capability to observe fire behavior in their vicinity and make sense of their environment on an ongoing basis. For example, as Karen Barrow commented in her submission to the Royal Commission:

> Kinglake West Tanker 1 drove down Coombs Road and was trying to ascertain the best access to the fire. We entered the property at 310 Coombs Rd as there was a running grass fire posing a direct threat to that property/house. We affected a grass fire attack with the crew members working from the back/deck of the truck whilst I drove the truck along the fire's edge. We were able to cut off the fire just below the house but in the process we had run out of water. The truck's water level was down to the crew protection level - 750L.

5.5. Upon encountering extreme fire behavior (late afternoon)

As KWT1 suppressed spot fires, the KWT2 crew began to interact with local residents,[2] who confirmed that there was a larger firefront threatening the area. The crew leader onboard KWT2 instructed his crew to support KWT1 while he followed a resident approximately 500m down Coombs Road. Both crews engaged in proactive sensemaking insofar as they noticed cues embedded in the landscape and weather conditions which signified that if spot fires were left unattended, they could form a firefront and threaten their safety. Both crews continued to extinguish spot fires as they arose and secured access to resources in the event of a more significant fire threat emerging. This meant that they were able to safely conduct firefighting operations before their environment became more equivocal and dangerous.

> When we got to the house which had a full swimming pool so that made a big difference because we had the floating pump on (device for pumping from a water source) (Firefighter 6, KWT1).

As the firefighters progressed along Coombs Road, the weather conditions were becoming more volatile and presenting the crew with new challenges, such as falling trees and equipment failure.

[2] Residents assisted firefighters and provided shelter in their home at different times. They left onboard KWT2 with the firefighters when conditions were safe to do so.

> We were under the illusion we could find the break-out point. We've pulled up There was a tree down on the hoses. The floaty pump failed (Firefighter 9, KWT2).

KWT2, which was further along the road than KWT1, continued to engage in proactive sensemaking by planning fire suppression for the likelihood of a firefront that was independent of the local spot fires. The KWT1 crew began to notice cues embedded in previous experience and changing weather conditions, which prompted reactive sensemaking insofar as they began to make sense with less emphasis on what might happen prospectively. This gave rise to KWT1 taking action within a predictive frame insofar as they recognized that there was a need to see beyond the risk in their immediate environment and ensure that if conditions threatened their wellbeing they would avoid coming to harm.

> The fire was all around us but not unbearable. On the way down (Coombs Road) the heat was OK. On the way back it was a different story. All the training we have done helped us a lot (Firefighter 4, KWT1).

> When we were driving further down Coombs Road and had gone past where Tanker 2 was, I saw the fire behavior up ahead and decided we shouldn't go any further. So we turned around to try and find Tanker 2 (Firefighter 5, KWT1).

Meanwhile, the driver and crew leader of KWT2 from their advanced position on Coombs Road had recognized that they were in danger and to attempt escape would most likely cause harm to their wellbeing. This prompted the KWT2 driver and crew leader to engage in proactive sensegiving as they sought to influence each other's perspectives to ensure that they made decisions based on the collective wellbeing of their crew. This process of sensegiving prompted an awareness of the dangers that were likely to face KWT1 if they sought to continue along Coombs Road.

> We could see the fire crowning further down so the crew leader (KWT2) contacted Tanker 1 and told them to go (to leave the area) (Firefighter 9, KWT2).

By noticing cues embedded in the local landscape that indicated danger, the KWT2 driver and crew leader were able to make decisions that did not exacerbate the risks facing their crew and those onboard KWT1. This resulted in proactive sensegiving from the crew leader of KWT2, who decided that trying to drive back through a firefront would most likely bring harm to him and his crew.

> I reckon the decision by the Tanker 2 crewleader to stay was an excellent one based on the situation at the time (Firefighter 1, KWT1).

The combination of proactive sensemaking and sensegiving meant that the crews in both KWT1 and KWT2 were able to make meaning as conditions worsened. Despite this, both crews were facing life-threatening danger. Unbeknownst to them, the fire behavior was at its most volatile in the mid to late afternoon across Victoria, and neighboring communities had already experienced significant damages and losses.

> Unfortunately, no support ever arrived. I have also seen VicFire records relating to the subsequent pager messages issued and it would appear as though there was an error in the system as the same brigades were repeatedly paged instead of the pager system casting a further net as should have happened [77]: 4).

5.6. In the midst of a volatile environment (early evening)

As KWT1 began to exit Coombs Road, it was clear that conditions had further deteriorated and were becoming volatile. Spot fires had joined up and were now surrounding their tanker and using the tree crowns above them to entrap them. As Karen Barrow commented in her submission:

> By the time Kinglake West Tanker 1 was trying to depart Coombs Road, the road was fully involved (fully alight) on both sides, the smoke was dense and we were under ember attack, Initially the embers were small but soon we were being showered in embers approximately 30cm in length [77]: 6).

While the firefighters could not control their environment, and their situation was exacerbated by a loss of communication with any control center in the area, they did remain in control of their tanker and used their skill sets to defend their wellbeing. This eventually enabled them to navigate their way to safety.

> We couldn't get on the radio and we knew we can't rely on the radio (Firefighter 3, KWT1).

> The conditions were very hard to see in. I could only really see the gravel window right in front of the vehicle but my crew leader helped by talking to me (Firefighter 5, KWT1).

Despite this, proactive sensemaking and reactive sensegiving played a key role in ensuring that KWT1 never lost their ability to understand their situation and take action. By noticing cues embedded in the local landscape, previous experience and changing weather conditions from their front seat in the tanker, the crew leader and driver enacted a survival frame to exit the fireground after being entrapped by a fire; the firefighters on the back of the truck who defended themselves against embers with handheld hoses similarly enacted a survival frame.

> I continued driving up Coombs Road, having to stop on several occasions as I simply could not see the road. I tried to contact the crew on the back of the truck using the intercom but they did not respond. I was just hoping that they were OK.

> Eventually we made it toward the top of Coombs Road, for the last kilometre, the wind dropped and the ember attack disappeared. I said to Capt. Grover that we were out of water and that maybe we should set up the "quick fill pump" at the CFA tanks at the at the intersection of Coombs Road and Whittlesea-Yea Rd. Captain Grover, and the rest of the crew alighted from Kinglake West Tanker 1 and began getting the quickfill of the truck and removing the locked boss from the tank. I got out of the

> cabin briefly to check on crew welfare. Fortunately, they were all OK as they had used the fog nozzles and the remainder of the water as crew protection [77]: 5).

KWT1 had reached a place of relative safety. There was still considerable concern about the escalating fire danger. As Karen Barrow commented in her submission to the Royal Commission:

> I received a radio call from District Group Officer Lloyd asking for our location. I climbed back into the cabin and responded by telling him that we were at the water tank at the top of Coombs Road getting water. He instructed us to leave the area immediately. As this discussion took place, I looked through the windscreen of the cabin to see that the fire had escalated and was crowning not far away. The flame height appeared to be approximately 2–3 times that of the tree height. I yelled out to Captain Grover that we had to leave, he also realized the severity of our situation. All crew remounted the truck as quickly as possible, the quickfill was roughly restowed and we left Coombs Road entirely [77]: 5).

Cues continued to emerge from the environment that prompted a need for prioritizing safety:

> It was not long before we were stopped by a tree fallen across the road. This became a repeated pattern as only a few hundred metres up the road was another tree down and more chainsaw work required in order to get through. I am not sure of how long it took for Kinglake West Tanker 1 to travel the distance to Extons Rd but we had to clear 3 or 4 large trees. We did not make it far down the road (50m) when a woman ran in front of the tanker waving for us to stop. I wound down my window to ask what was wrong – she told me that they had a man in their back yard and that he had burns to 70% of his body [77]: 7).

While KWT1 managed to reach safety, there was grave concern for KWT2. As Karen Barrow mentioned in her submission:

> We had one tanker – Kinglake West Tanker 2 trapped – welfare of the crew still unknown [77]: 7).

The situation became very serious and threatening for KWT2. Karen Barrow described the situation KWT1 had left behind during cross-examination at the Royal Commission:

> Basically the air was just thick with embers. Some of them were up to around 30 cm in length. It was quite scary [78]: 11546).

The spot fires had now formed a firefront, blocking their pathway back onto Coombs Road, and in front of them a rolling firefront was now approaching their location. KWT2 and the residents were entrapped.

> The flame height of the fire coming towards us was at least 80 m (Firefighter 9, KWT2).

The situation was exacerbated when the crew lost all radio communications with KWT1. They were now very much on their own. Despite the challenges in their environment, the KWT2 crew and residents did not try to flee the fire. They remained as a cohesive team focussing on the aspects of their environment that they could control. Like KWT1, the crew engaged in reactive sensemaking by enacting their training to maintain safe spaces by defending the property and its shed. They made meaning through proactive sensemaking by observing changes in their environment that signified that they would at some stage need to shelter from the fire, which was now threatening to burn over the top of the fireground.

> We couldn't get on the radio. It was fully congested with other radio traffic and we knew that we can't rely on the radio (Firefighter 9, KWT2).

> We had just done a training session on the floating pump, which made a big difference when we really needed it (Firefighter 10, KWT2).

However, over time, their ability to maintain their organization as a team diminished. The nearby shed became engulfed with flame, which meant one source of shelter was lost; a felled tree damaged the fire hoses; and most worryingly, the floating water pump in the swimming pool ran out of fuel. The crew became absorbed in their environment but struggled to know what to do as their environment became more dangerous.

> We were mesmerized by the flames and got stuck in our own little world, we lost sight of the big picture and not having communications certainly didn't help (Firefighter 9, KWT2).

By noticing cues embedded in the local landscape, previous experience and changing weather conditions, the crews were able to enact meaning through reactive sensemaking and reactive sensegiving. Multiple cues signified a serious threat to safety; this gave rise to action within a safety and survival frame, as the crew did less firefighting and agreed on the most appropriate way of safeguarding their health, safety and wellbeing. To protect themselves from the embers, flame and radiant heat they (along with local residents) retreated to the house for shelter, where they continued to observe their environment and agree on the most appropriate actions. In doing so, they entered a more stable environment, which they left occasionally to move firefighting equipment to a safe space when the fire behavior was not a threat to their wellbeing.

> When it got too hot and we had fire everywhere we went back into the house with the owners and just sheltered there until the front passed (Firefighter 2, KWT2).

As the firefront passed, the fire activity became less volatile, and the crew was gradually able to begin to exert influence within their environment by repairing their firefighting appliances and resuming fire suppression activities. This enabled them to re-organize and make meaning through reactive sensemaking and reactive sensegiving.

> After 20 minutes the fire activity subsided. We restarted the tanker pump and floating pump, mended the hose with duct tape and continued to extinguish spotfires for about 20 minutes (Firefighter 9, KWT2).

> It was a good call when the floating pump stopped, to then go back into the house. We kept talking to each other and it kept us all together (Firefighter10, KWT2).

Although the firefront had passed, the environment was still dangerous. The conditions were so severe that the firefighters' protective equipment was starting to hinder their ability to make meaning.

> The goggles were no good. They filled with sweat and smoke and got covered in ash. I couldn't see a thing (Firefighter 2, KWT2).

Despite this, KWT2 continued to notice cues embedded in the local landscape, previous experience and changing weather conditions, which gave rise to meaning-making through reactive sensemaking and sensegiving. Accordingly, the crew continued to take action within a safety and survival frame, which meant that the owner of the residence and her son were eventually able to leave the property. On Black Saturday, 85% of the houses on Coombs Road were lost, as well as, six lives. While some suffered injuries, the firefighting of both crews prevented further loss of life. Matters would have been more serious had the crew leader of KWT2 not noticed cues embedded in the local landscape and changing weather conditions, which gave rise to proactive sensegiving all subsequent action being taken within a focus on safeguarding crew safety.

> I reckon the decision by the Tanker 2 crew leader to stay was an excellent one based on the situation at the time. There was no way they would have got back out plus the fact that he also warned us (Tanker 1) to get back because he could see the fire starting to crown (Firefighter1, KWT1).

In sum, my analysis shows that both teams enacted and moved between cycles of sensemaking and sensegiving before and during Black Saturday. This enabled them to take action that protected their wellbeing and saved lives as their environment became life-threatening. In the days before and on the morning of Black Saturday, the crews made meaning through proactive sensemaking and sensegiving, in a normal environment within their station. As the morning became the afternoon, the environment began to show signs of becoming extreme as the crews left the station to investigate smoke in the landscape. While both crews continued to make meaning through proactive sensemaking, their sensemaking and sensegiving activities became much more reactive as they encountered and sought to suppress flame in the environment. As the afternoon progressed and the environment continued to become more volatile, both crews continued to be proactive and reactive in the way that they engaged in sensemaking and sensegiving as they sought to survive highly dangerous circumstances.

6. Discussion

My findings allow me to present a general model of how different episodes of sensemaking and sensegiving emerged over time in my case study (see Fig. 2). My findings suggest that sensemaking and sensegiving intensified as equivocal circumstances increased. When the circumstances were normal, crews were able to engage in proactive sensemaking and sensegiving. However, as circumstances became more equivocal and cues became more ambiguous, the crews relied on sensemaking and sensegiving which was much more reactive. When KWT1 and KWT2 became entrapped by flame, they moved between iterations of both proactive and reactive sensemaking and sensegiving. With this model in mind, my study makes several important contributions to theory and practice about the ways in which fire crews can make sense of equivocal circumstances before and during a dangerous event such as entrapment. Fig. 2 shows how sensemaking and sensegiving typologies changed as circumstances became more equivocal over the course of the day.

Scholars have largely claimed that when teams encounter equivocality they tend to exacerbate dangerous circumstances by interpreting cues within past frames that are meaningless in the present moment [5,12,34,63]. However, I find that crews onboard KWT1 and KWT2 used cues to reinterpret past experiences through the lens of their present circumstances. In doing so, the crews made meaning, which not only prevented a crisis within from within a crisis from emerging but also ameliorated the harmful effects of the Black Saturday disaster. This is important because other scholars have suggested that the past has little bearing on meaning-making in the present when teams find themselves in a changing environment, particularly when circumstances are dangerous and hazardous [7, 54]. My study shows that the previous firefighting experiences of the crew leaders and members were enmeshed with their ability to notice cues and interpret them in frames in the present environment, which meant the teams never became disorganized. They were able to continue with sensemaking and sensegiving endeavors, even when their environment became increasingly dangerous in ways that have previously seen firefighters perish when entrapped by flame [7,14]. In this way, my study provides firefighting crews with a basis for collective sensemaking and sensegiving through cues and frames, even as their environment becomes mired in equivocality.

My study further shows that when we consider how teams make meaning in disaster environments, we must seek to understand the role of sensegiving *as well as* sensemaking. While sensegiving has been acknowledged as an important way in which different actors exert influence in the way that they make sense of equivocality [82] it has been largely overlooked by scholars in disaster and crisis response settings. My study shows that while sensemaking and sensegiving were often led by the crew leaders, these processes were also shared with other team members and open to ongoing reinterpretation based on emerging cues. This dynamic was particularly visible between the drivers and crew leaders of both tankers. This is interesting because most studies to date have equated sensegiving with singular frames from those who occupy leadership roles [34]. For example, Gioia and Chittipeddi [24]; p. 446) suggest that meaning, albeit in more mundane organizational change environments, is a product of negotiation, which stems from sensegiving where "the upper echelon members can dominate the definition of negotiated reality because of the influence they hold over possible visions of change". My findings reaffirm that meaning is a product of negotiation, but also suggest that the span of sensegiving in disaster contexts is far wider than individuals such as team leaders. My study shows that sensegiving can also stem from lower-echelon team members in a process of creating shared meaning to create multiple frames that provide a basis for meaningful action – even in dangerous circumstances. This finding provides an important and necessary basis for moving beyond the organizational defense

mechanisms and agendas [34] of different individuals within a team's hierarchy and to reinterpret hierarchy as "dynamic and enacted, rather than a rigid structure" as teams seek to make meaning in dangerous environments [83]; p. 357). This is important because it shows that maintaining safety while firefighting is a fluid and dynamic social process of sensemaking and sensegiving about what is and may unfold on a fireground, as much as is it about understanding fire behavior. By bringing attention to the social processes that were at the core of the firefighting in my case study, it is my hope that firefighters will be more mindful of what Fromm [84] refers to as the *having mode* (the training, knowledge, resources, tools, etc) and *being mode* (the emotions, language, values, teamwork, etc.) so that they can engage in sensemaking and sensegiving that provides a basis for actions which preserve their safety at all times when they face fires in the future.

While my study concurs with previous findings that leaders and teams struggle to understand what is occurring in equivocal circumstances [7,52,53], I find that collectively they can make and give sense when cues become discrepant. My study showed that this occurred as a product of retrospective and prospective sensemaking and sensegiving. Studies to date have emphasized that leaders and teams will make and give sense in such a way that it often gives rise to unintended, undesirable and tragic consequences as a crisis unfolds [44,63,85,86]. My study shows how leaders and teams work can work together to avert crises and disasters arising from events such as bushfires and by doing so begins to respond to recent calls from studies to understand the ways in which sensegiving can facilitate safety outcomes even when circumstances become equivocal and volatile [6,21,56].

Despite my contributions, there are limitations to my study. My findings are an individual reflection of my methodological interpretation. Other data may have told a different story. Furthermore, my study relied on interviews and recollections of firefighters who may well been selective with what they chose to share with their interviewers and may well have forgotten or even deliberately omitted certain details in their interpretation of events – such considerations also apply the interviewers who collected the data which sits at the core of my study. This means that my analysis and model can only infer insights and only propose relationships between different events over time that will require further research to confirm the sequencing and types of sensemaking and sensegiving which occur amongst firefighters as they seek to remain safe during an entrapment. Further research may offer new or even different insights particularly if the perspectives of other brigades are included.

Notwithstanding these limitations, my study provides a basis and direction for future research. Bushfire events present challenges for team-based sensemaking, where cues about what is occurring may not be immediately obvious as equivocality levels rapidly escalate. Scholarly work that examines the role of emotions in other disaster contexts would be valuable.

My study suggests that emotions surrounding fear may actually prompt meaningful action that saves lives. This is interesting because other studies have found that such emotions prevent firefighters from engaging in sensemaking and sensegiving when their environment becomes volatile, to such an extent that they bring harmful circumstances into existence (see Ref. [7]. Further studies may not only deepen our understanding of such events, but also provide a basis for strategies to enable teams to identify cues and develop frames so that their ability to engage in sensemaking and sensegiving is safeguarded as danger in their environment escalates. Sensemaking and sensegiving may also help fire crews to cope with the likely onset of post-traumatic stress after difficult experiences as they reflect on the cues for framing their discussion about what happened as basis for lessons learned.

Those who work in emergency response and crisis contexts will continue to face contradictory challenges (see Ref. [43], as summarized by Waugh and Streib [87]: 132):

> "On the one hand, emergency response requires meticulous organization and planning, but on the other hand, it is spontaneous" with emergency management workers being required "to innovate, adapt, and improvise because plans, regardless of how well done, seldom fit circumstances."

It is my hope that the social processes of sensemaking and sensegiving presented in this study can assist fire crews and others who work in emergency management to safeguard their wellbeing and the communities they serve as they respond to extreme and dangerous events.

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