Organizing Response to Extreme Emergencies:

The Victorian Bushfires of 2009

Herman B. Leonard

George F. Baker, Jr. Professor of Public Management
John F. Kennedy School of Government

and

Eliot I. Snider and Family Professor of Business Administration
Harvard Business School

Harvard University

and

Arnold M. Howitt

Executive Director, Ash Center for Democratic Governance and Innovation

John F. Kennedy School of Government

Harvard University

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Herman B. Leonard and Arnold M. Howitt[1]

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How can people and organizations best respond to emergency events that explode significantly beyond the boundaries of what they had generally anticipated and prepared for – or even imagined? What forms of organizations are likely to cope best with such events – and what procedures and practices will aid them in doing so? Obviously, by definition extreme events – events that are in scope or scale or type beyond the range of ordinary experience and expectations – will occur only relatively rarely (and *very* rarely for a particular emergency organization). Nonetheless, when they do occur, they tend to be of defining importance to the people and institutions that are thrust into them and that must find their way through them. September 11, 2001 in Manhattan and at the Pentagon in Arlington, Virginia; the Indian Ocean Tsunami in 2004; Hurricane Katrina on the Gulf Coast of the US in 2005; major earthquakes like the ones in Pakistan in 2005, Wenchuan in 2008, Haiti in 2010, Chile in 2010, and Christchurch in 2010 – these and other catastrophic events catapult people and response agencies into a new, unfamiliar, and largely unexplored dimension.

The horrific events of Black Saturday (February 7, 2009) in Victoria, Australia, culminating in the appalling loss of 173 lives, constitute just such an extreme event. A large, complex, tragic event of this sort commands attention and demands consideration of the lessons that can reasonably be drawn in the hope that similar tragedies can be avoided in the future. Unfortunately, the scale and complexity of this event also imply that it will be difficult to extract the right lessons, because its precipitating causes and consequences are so numerous and so deeply intertwined.

This paper examines the challenges of designing response organizations (and collections of such organizations) in ways that will enhance their ability to cope effectively with extreme situations. The paper identifies lessons and effective practices from management theory in general and from

emergency management in particular that may aid in improving future performance on the day that extreme fire conditions – or other extreme events – again threaten a state, its communities, and its citizens. Focusing on the 2009 Victorian bushfires as a case in point, it argues that responses to extreme events are likely to be, of necessity, decentralized. Consequently, thinking of the problem as coordinating the efforts of a network of organizations may be a more useful and effective approach than trying to unify diverse response organizations operating across a wide geographic area into a single entity with centralized command and control.[2]

Decentralization and the history of fire-fighting

It is helpful to begin by examining the historical evolution of wildland fire-fighting. This has long been a highly decentralized process, and it is not difficult to discern why. People in wildland areas are generally widely distributed at low density. Until very recently, communication among different locations in the bush was difficult and slow, and transport of resources between locations was expensive and tedious. In isolated areas, fire-fighting was a community-level service, with fire-fighters working largely on behalf of their neighbors in their own communities. Communities were – or at least tried to be – self-sufficient. The ability to help others was limited. If the others who needed help were far away, then it was difficult to find out in time and get there; if they were close by, then it was likely that the responding community was simultaneously experiencing similar difficulties and could not spare resources. In either case, with the ability to provide aid significantly constrained, the likelihood of receiving significant aid from others was remote. As a consequence, wildland fire-fighting grew up as a largely decentralized function, with self-reliance a key virtue and distributed capability and training an important performance requirement (although one that was not always present).

More recently – roughly in the last 30 years or so – this situation has changed as a result of evolving technologies in communications and transportation. The ability to communicate quickly, accurately, and visually now allows – or seems to allow – central authorities to monitor more systematically and accurately what is happening at remote locations. Improved transportation – better roads, and especially the availability of airlift – now permits more rapid deployment of additional resources from more distant locations that may be not already be involved in responding to a different part of the same event, and may therefore have uncommitted resources to offer. This has led to the growth of more centralized functions and organizations in firefighting, and to a tendency to imagine that even more centralized command and control would be even better. Frequently, in the aftermath of major fire events, there is criticism that there was too little coordination and command from the center. Many believe that we should be able to build and operate a central command structure that can

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[2] This discussion is based on a variety of materials provided by the Royal Commission on the 2009 Victorian Bushfires, including papers outlining the structure of emergency services in Victoria and in other Australian states, together with statements by various participants in the 2009 bushfires and other relevant documents. These materials have been reviewed and drawn on here, but this paper does not present any judgment about the performance of individuals or organizations involved in these events. Such judgments lie well beyond the scope of this work; forming such judgments would require a deep body of comparative evidence of performance in these events as contrasted with other reasonably similar events – and no such body of comparative data exists.

effectively understand what is happening in each location, direct the overall response, and distribute resources appropriately. In this view, decentralization of fire-fighting is an historical compromise born of necessity – and is today a problem to be overcome.

The fact that new technologies might enable us to create a more centralized command structure to direct extreme fire events does not, however, necessarily imply that this is the only way they might be used or that it would be a good idea to use them in this way. These technologies could just as easily be used to provide greater coordination and support – the ability to move needed resources into action, while leaving distributed local teams in charge of directing the responses in their areas of operation – rather than to create a central command.

The key question should be which approach – centralized command, on the one hand, or centralized coordination and distributed command, on the other – is likely to prove more effective under the conditions that prevail in extreme fire (and other) events. To explore this, we pose and examine a working hypothesis that runs counter to the preference for centralized command. *Instead of trying to "fix" the "problem" of decentralization, our hypothesis is that it makes more sense to embrace the necessity and reality of decentralization – and to dedicate ourselves to the task of making decentralization work more effectively rather than to the task of overcoming it.*

To consider these ideas, we will first examine some general management concepts and then turn back to the specific challenges of wildland fire and other extreme emergency events.

General lessons from management and emergency management theory

In the wake of the 2009 bushfires, a number of questions were raised about the best organizational designs and best practices for management in general and for emergency management in particular. In a closely related discussion, Professor Paul 't Hart has ably summarized what is known from the general literature and what can reasonably be said in general on this subject, and we will not repeat what he has presented; his summary of the general principles is one of the best and most succinct available ['t Hart 2010]. Instead, we will add a few observations about the nature of organizations and the tasks they confront and then relate this to the challenges of emergency management in extreme situations, and especially to the difficulties – and the virtues – of a multi-agency response.

First, as Professor 't Hart has observed, there is no one form of organization that is best in all settings – either in general management or in emergency management. We have many kinds of tasks to manage, and correspondingly many forms of organization and varying practices that are effective in managing them. Non-hierarchical, networked organizations handle complex software projects by operating in parallel, while manufacturing organizations with established technologies produce efficiency through hierarchical command and control discipline. Each is an effective form of organization (and bundle of associated practices) for a different challenge or task. Effectiveness depends on matching the characteristics of the organization (or network of organizations) with the functions to be performed.

In considering the redesign of an organizational system that deals with emergency operations rather than regular and routine production, the problem of selecting an appropriate form is greatly complicated by considerable uncertainty about the demands it will have to meet in the future. Ideally, the system design will be robust enough to satisfy conditions that will prevail under a range of predictable and unpredictable contingencies. Inevitably, the system design will seek to optimize for a wide but likely range of contingencies of varying degrees of severity, while building in the capacity to adapt as quickly and effectively as possible to unanticipated demands.

What does it take for an organization to produce a good outcome? While there is no single answer, we can identify the main *elements* that produce effective performance. Each of these elements matches organizational characteristics with features of the "task environment" (i.e., the set of demands for performance) with which it must deal:

(1) *Goals, values, and priorities – and motivation to achieve or advance them* (on the part of those involved in the decision-making and work of the organization);

(2) *Decision-making and authority* located together with *accurate information* about the situation, task, and alternatives – so that good decisions can be made and then carried out;

(3) *Skills and resources* matched geographically and functionally to the *task* – that is, implementation capability located where the task needs to be performed; and

(4) *Communication* between the point of decision-making and the point of action.

When general management is viewed in this way, it is clear that different forms of organization can (and do) assemble these elements in entirely different ways and produce good results. For example, could a highly-decentralized volunteer organization handle an event that varies dramatically across space? It could, if it has both well-defined goals and members highly-motivated to advance them. The members must also be geographically distributed where the tasks need to be performed, have the skills to recognize and cope with the situation they confront, be given the authority and discretion to act on the basis of what they see, and receive any additional resources needed to achieve the desired results. (If this sounds like the description of an effective volunteer wildland fire-fighting organization, that is not a coincidence.) Alternatively, a highly-centralized organization could be effective in this same task environment if it is able to motivate its employees, centrally assemble the information about the needed action in each distributed location, and then communicate instructions and resources back to the point of action.

Many of the issues involved in deciding on an organizational design approach are captured in the choice of the overall method of *coordination*. Henry Mintzberg has suggested a framework for understanding the alternative ways that organizations can coordinate the work of their members as the nature and volume of environmental demands and the operational tasks required to deal with them become increasingly complex.[3] (See Figure 1.) Simple coordination tasks among relatively small numbers

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[3] Henry Mintzberg, *The Structuring of Organizations* (Englewood Cliffs, NJ: Prentice Hall, 1979), pp. 7-9.

of individuals are accommodated by *mutual adjustment,* with few or no formal rules or authority relationships. As the task environment becomes more complex, organizations coordinate by *direct supervision* – putting an individual or individuals in charge and having them oversee the actions of others. One or more layers of direct supervision can accommodate increasingly complex coordination functions, but this method can falter when people at higher levels of organizational authority cannot get sufficient information to make good decisions or are too slow to take account of rapidly changing circumstances. Organizations then have several parallel (and not mutually exclusive) ways of coordinating. They can *standardize work*, establishing more or less elaborate protocols for carrying out defined tasks under specified contingencies. Or when the detailed practices for carrying out a task cannot be defined precisely, organizations can *standardize output*, establishing clear expectations about the features that a finished task or product will exhibit, while leaving discretion about how to achieve the required results to those actually carrying out the tasks. Or, when neither the practices nor the outcomes can be specified with sufficient clarity, organizations can *standardize skills*, putting in place individuals who have been sufficiently trained and socialized to organizational purposes and values (i.e., professionalized) to be trusted with discretion to select means and achieve goals independently.

Which of these approaches will prove more effective depends on the feasibility and relative costs of training and communication in the specific environment in question. If it is difficult and very
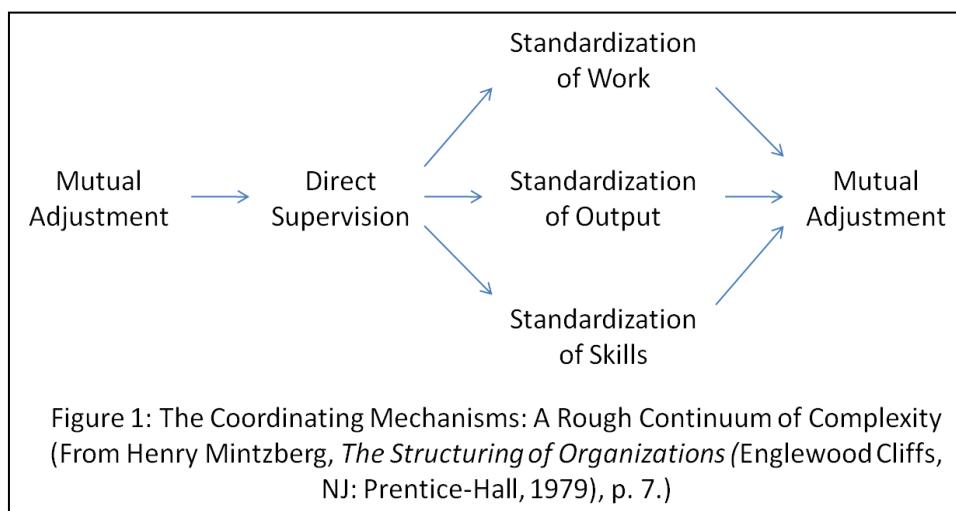
Figure 1: The Coordinating Mechanisms: A Rough Continuum of Complexity (From Henry Mintzberg, *The Structuring of Organizations (*Englewood Cliffs, NJ: Prentice-Hall, 1979), p. 7.)

expensive to train people to recognize what actions are necessary to accomplish a given task, and it is relatively easy and inexpensive to transfer accurate information to the center and detailed instructions back to the scene of action, and if the central decision-making group can quickly make a large number of decisions about different circumstances in different locations, then the centralized model will be preferable. If, by contrast, it is relatively easy and inexpensive to train many different people to recognize tasks and to give them the skills and resources to accomplish them, and quite difficult and expensive to develop and transmit accurate information to the center and instructions back to the points of action, or difficult for the central group to make customized decisions fast enough to stay ahead of the flow of demands for guidance from the distributed workers, then the decentralized organization will be more efficient and effective.

What this discussion emphasizes is that instead of searching for general lessons that will apply broadly, we need to look in more detail at the nature of the task environment for the relevant events, and design organizations and procedures with specific reference to the key features of the challenge. It is to this that we turn next – with reference to the nature of extreme emergencies.

Response to extreme emergency events

Fire conditions in Victoria in January and February 2009 – and especially during the days running up to the Black Saturday events – were significantly beyond the worst previously experienced in modern Australian history. The central question these events focus us on with regard to organizational form and procedures, then, is that of how to construct organizations capable of coping with extreme events – events beyond the range of our routine experience.

The distinction between routine events and extreme events has crucially important *operational* implications – that is, it suggests that we need to organize and operate in different ways in routine events as contrasted with extreme events. Extreme events are not simply overgrown routine events; they are different in kind, and they require a materially different approach. This distinction is discussed in detail in Howitt and Leonard [2009] and in Leonard and Howitt [2007].[4] The central observation is that for routine events, the nature of which we can anticipate and prepare for, we can build organizations that have optimized the expertise, equipment, and procedures necessary to accomplish necessary tasks. For routine events, the main task is to execute solutions already designed and trained into the organization; a hierarchical command-and-control structure and centralized authority-driven leadership structure can be efficient at supporting the work of execution.

By contrast, extreme events, are characterized by important elements of *novelty* -- whether because such an event is a completely new phenomenon to the organization and individuals experiencing it; or, though familiar, because its scale substantially exceeds what they are ready for; or because two or more serious threats unexpectedly occur simultaneously. By definition, extreme events exceed ordinary capabilities and routines – that is what makes them "extreme." The defining operational demand characteristic of extreme events is the necessity for *improvisation*. Effective leadership in such situations requires creative, improvised actions to cope as well as is reasonably possible with an event for which there is no full precedent, and for which there is therefore no fully developed action script.

What kind of organizational structure, then, is likely to be most effective in an extreme fire event? Should we rely on centralized organizations (as we do, for the most part, in routine events)? Or is decentralization more promising? ***While there is no definitive answer, decentralization tends to offer significant advantages in such situations***.

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[4] Leonard and Howitt (2009, 2007) label these as "true crisis" emergencies.

To see why, we need to examine the nature of extreme events more closely. Extreme events are generally highly variable – that is, their nature and intensity varies greatly from one location to another within the overall event. This implies that a high degree of customization is necessary in the response. But how should the need for customization, that variety in approach, be accurately diagnosed, appropriate responses developed, and actions then executed?

A centralized response works on multiple, distributed challenges through a central decision-making individual or group to whom information from the distributed task sites is communicated. The information is then processed, decisions are made about what the response should be, and this is communicated back to the point of action, where the differing instructions in each location are carried out. Centralization offers the advantage that fewer decision-makers need to be thoroughly trained in assessment, analysis, and decision-making – the great expertise of the few is shared across the many disparate action sites. If this expertise is difficult and expensive to build, then the ability to concentrate it in a few people who can drive the whole organization is a virtue of a centralized system.

But making a centralized system work well puts major burdens on the central assessment, analysis, and decision-making group and on the internal communications systems. These stresses are major indicators of the increasing complexity that Henry Mintzberg points to in suggesting that "direct supervision" will be superseded by other forms of coordination. Effective work through a centralized organization relies on the ability to transmit large volumes of accurate information to the central group, on the ability of that group rapidly to assess the different situations in each location, conduct the necessary analysis, and choose the appropriate action for each site, and then on the ability to communicate those rapidly-made decisions about what to do back to each of the decentralized locations. In routine events, these conditions are often met. The system is designed to transmit information and instructions, and the central group is large enough and skilled enough to keep up with the flow of decision-making demands. When the system is operating below its maximum design load, it should be able to function effectively. Information flows smoothly to and from the central decision-making group so long as they are able to keep up with the pace and flow of decision demands communicated to them from the field.

Consider what happens, however, in an extreme event. Highly variable conditions in the field must be perceived and communicated swiftly and accurately to the central staff and processed quickly into decisions. Quite variable and specific instructions have to be communicated back out and delivered correctly to the distributed action locations. The central team is vulnerable to being buried under a flow of widely varying problems coming to it for resolution, with too little accompanying information, so that its decision making may not be able to engage in the full range of needed customization. A system built on centralization is thus vulnerable when confronted by a larger-than-normal, highly variable event that is outside of its normal operating range. If the system is overloaded, it is potentially subject to breakdown as central decision-makers become overwhelmed with analytical and communications tasks, and errors in both inbound and outbound data transmission increase.

In such an environment, a **_decentralized_** response structure may offer considerable advantages. Assuming that it is possible to train a larger number of individuals or teams to make good assessments

and decisions in the face of a task in their (distributed) areas of operation and that it is also possible to distribute the other necessary resources for action, distributing the assessment, analysis, and decision-making tasks multiplies the number of eyes and brains working on the myriad challenges to match resources and actions to the highly variable tasks that arise in an extreme event. Communication lines are shorter, information is not lost or confused in transmission, and the organization can move both more quickly and more accurately.

Accordingly, effective fire-fighting organizations (and military organizations, which face a similarly highly variable and rapidly evolving battlefield situation) tend to **de**centralize knowledge and resources, operating through decentralized teams that are supported, coordinated, and resourced through a centralized oversight organization.[5] In military circles, this is described as sending "power to the edge [of battle]" [Alberts and Hayes, 2005].

Making decentralization work: the theory of emergence

As we have observed, decentralization in wildland fire-fighting may offer considerable virtues as compared to a more centralized system. Extreme fire events, by their nature, begin as highly decentralized and variable phenomena. Responding to them on a centralized basis requires overcoming the difficult challenge of assembling a vast array of data, processing it into understanding of a myriad of different individual situations, figuring out how to respond to each sub-event, and distributing the instructions accurately to the respective action locations. This is a recipe for overloading central authorities and experiencing breakdowns in the ability to respond quickly and to customize effectively. This is the point, Mintzberg argues, as described earlier, that direct supervision of subordinate units of an organization breaks down because of complexity and needs largely to be replaced by some form of standardization – of work processes, outputs, or skills – so that many problems can be dealt with or solved at lower levels. The question, then, is not **whether** to have a decentralized response – more or less by their nature, extreme fire events will almost surely and necessarily be responded to in significant part on a decentralized basis. Instead, we might ask this question: ***given that decentralization will be the reality and is in most cases also the best alternative, how do we structure fire-fighting organizations so that decentralization will be most effective***?

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[5] Intriguingly, the idea of a centralized command process for emergency management is often referred to as the "military model." This is a misinterpretation of the military approach. Effective military organizations do not operate on the basis of detailed centralized commands – they operate instead through decentralizing discretion and authority to permit more nimble decision-making and action. What is centralized is coordination and resourcing of field units. Military organizations that are highly centralized are regularly defeated by those that operate on a decentralized basis. While we offer this analogy to illustrate how operations can be effectively decentralized, there are important and distinctive features of the military theater that may allow for a greater degree of autonomy – and considerably less transparency– of action than in other contexts. For instance, during recent armed conflicts involving the U.S. military, the media has not had full access to on-the-ground operations; yet during domestic disasters, first responders and public officials are frequently held immediately accountable by on-scene journalists and other civilians. Moreover, some actions that may be permissible (or at least overlooked) in battle may not be as acceptable in a domestic setting, no matter the type or scale of the emergency.

There are several keys to effective performance of decentralized organizations. First, we must be able to train local leaders and teams to recognize the situations they are in and to respond effectively to them without having to transmit information and await guidance from their remote supervisory organizations – that is, they must have and be willing and trusted to operate on their own discretion. Second, we must build centralized structures through which we can coordinate, support, and resource the actions of these distributed teams.

There has recently been a good deal of interest in the general management literature on decentralized approaches to problem solving, or to problem solving in a "network" environment with distributed agents operating in separate domains but in communication with one another.[6] The fundamental concept is that results "emerge" from the distributed action of independent agents rather than being "engineered" by a central command and control entity. The theory of emergence outlines the concept of "decentralized intelligent adaptation" – the idea that independent agents, each perceiving, considering, and reacting to the conditions that they encounter "locally" (that is, in their immediate vicinity) will, through their "adaptation" to the conditions as they see them, produce good results that "emerge" from their independent work (Johnson [2001]).

In our work at the Program on Crisis Leadership, we have termed the application of this general approach "fast and light." The idea is for response organizations to consist of distributed units, each capable of and authorized to conduct local response, with some standardization of approach, and for the central authority to act as a coordinator of and in support of (rather than as the command director of) these distributed units. We refer to this as "fast and light" to emphasize that response is likely to be more nimble if it is mobilized in more numerous and smaller pre-deployed units. This model applies quite directly to community-based wildland fire-fighting, as this approach draws on the historical realities in which fire-fighting units have been small, widely dispersed, and self-directed.

Embracing the decentralization of "fast and light" involves a shift in philosophy. Instead of extolling the virtues of centralized command and control, we value instead the virtues of a decentralized structure – its ability to respond more quickly and nimbly and with greater customization to a highly variable and complex event, without the need to arrange for capacity at the center to do all of the "knowing and telling" for units distributed across the entire event landscape. Instead, we rely on decentralized agents to intelligently assess and respond to the events local to them … and, out of their collective work, the overall response that emerges can then be highly customized and effective.

Shifting to this philosophy brings with it a substantially larger burden of preparing the individuals and units that will operate in decentralized fashion to carry out their responsibilities. In a

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[6] There has also been ongoing discussion within the smaller community of scholars of emergency management theory and practice regarding the advantages of decentralized and emergent forms of emergency response in comparison to heavily bureaucratic approaches that feature a high degree of centralized command and control. For a review of the literature on the topic, see Drabek and McEntire (2003). Among others, Boin and McConnell (2007), Comfort (1999 and 2007), Dynes (1994), and Neal and Phillips (1995) have all written convincingly about the need to accommodate emergent, adaptive, and decentralized action (and for emergency management to develop the appropriate organizational structures to support such forms of response) in the face of disruptive events.

centralized organization, a few well-trained and highly experienced people at the center are supposed to provide direction. By contrast, an organization that is relying on decentralized agents must ensure that the training and experience levels of those distributed agents are appropriate to the tasks they will confront. This may – and, indeed, should – produce better and more reliable results, but the training requirements necessitated by this shift should not be underestimated. As Mintzberg's framework suggests, this requires, in part, standardizing outputs – defining goals, objectives, priorities of values, and desired end-states – in wildland fire-fighting operations. It requires, too, a significant degree of standardization of work processes – establishing and practicing modes of decision making and operation under emergency conditions. And it requires widespread professionalism and the diffusion of high-level skills in fire-fighting to those who will be undertaking action in decentralized locations. These three methods of standardization help ensure that decentralized units and individuals will "intelligently adapt" to the conditions and problems of extreme events according to principles established at the center in advance but carried out independently during the extreme event with far less direction than would be necessary if direct supervision of these units were attempted.

The reliance on decentralized action also does not imply that there is no longer a role for the central organization and oversight structure – its work is transformed, but by no means eliminated. The central organization is relieved of trying to understand the myriad of different sub-events that are taking place in the field and of trying to decide how to direct the resources deployed against these sub-events. Instead, the role of the center in a decentralized model is, first, to set overall goals and priorities; second, to coordinate the actions of distributed agents, when necessary; and, third, to make decisions about the allocation of scarce resources so that, to the extent reasonably possible, it can provide the additional resources necessary for the decentralized units to do their work effectively. These functions are needed to compensate for two significant weaknesses of decentralized action. First, the central organization can seek to resolve conflicts that may arise when the actions of two or more independent units intersect (and potentially interfere with) each others' operations – or, more positively, can arrange collaboration and cooperation between units when they may mutually enhance one another's actions. Second, the central organization can use its superior ability to perceive the "big picture" of overall operations to make sure that critical dimensions of the situation are correctly diagnosed; set and periodically revise overall strategy; mediate the parochial perceptions of decentralized units in order to engineer tradeoffs if there is contention over objectives, values, or operations; and make decisions about strategy and allocation of scarce resources.[7]

It is worth noting that the reliance on decentralized intelligent adaptation instead of centralized command brings with it different risks. Facing an extreme, complex, varied, and rapidly unfolding event, a centralized command structure risks having the central analysis and decision-making unit be overwhelmed by the myriad details of the event that it is trying to manage, and risks slow decision-making and slow resource deployment as a consequence. By contrast, a decentralized system risks having inadequate training and experience at the many decentralized points of decision-making and

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[7] It is such potential conflicts that, in Mintzberg's view, require organizations facing high levels of complexity in their operating environments to utilize methods of mutual adjustment as a way of resolving conflicts that cannot be addressed by the standardization methods we have discussed.

risks having resources maldistributed (and not readily re-deployable) when viewed against the needs created by the event. Making a decentralized system work will require effort to minimize its accompanying risks – by providing adequate training to the distributed decision-makers on whom it will rely and by developing mechanisms for projecting resource needs as accurately as possible and distributing resources accordingly while also maintaining the flexibility in resource deployments necessary to adapt to the variety of events that may be encountered.[8]

In this model of decentralized intelligent adaptation, the center shifts, in short, from a focus on command and control to one of overall strategy setting, coordination, and support. It must still seek to understand the nature of events in the field (so that it can make decisions about resourcing them, for example) – but it does not require the detailed knowledge that would be required to direct operations effectively from afar.

Multi-agency response "organizations"

In addition to the intrinsic decentralization of response, extreme wildland fire events share another important feature: of necessity, response is a multi-agency effort, often including not only agencies from different disciplines (e.g., fire, police, public works, health, …) but also agencies from different jurisdictions (adjoining towns or states) and different levels of government. Moreover, response (and, especially, recovery) often involves non-governmental organizations (like the Red Cross and Salvation Army). As a consequence, extreme events involve very complex inter-organizational coordination and communication challenges. Moreover, since each event, and especially each extreme event, will have its own idiosyncrasies, the combination of agencies that will need to work together cannot be precisely specified in advance. The "team" – actually, generally, a collection of teams – that will be involved in managing and responding to an extreme event will typically be what has been referred to as a "hastily-formed network" (Denning [2006]). Such groups are not defined in advance of an event. They are drawn together on an ad hoc basis (often as a result of what is known in the early going about the event). They form suddenly and often must be augmented with additional participants as more becomes known about the event.

How can we best arrange for hastily formed networks to function effectively? They begin as teams in name only because they have not generally had the opportunity to develop the infrastructure and conditions that make teams effective. However, they will generally perform better if they take time at the outset to develop some of those conditions (mutual knowledge about the capabilities represented, establishment of goals, and so on) (Hackman [2002]).

Research and experience do suggest a set of best practices for making such networks function effectively. First, it is essential, if these disparate groups are going to be able to work together (in setting their course and planning, and in the field carrying out their respective work), that they be organized along similar lines. If organizations are set up with different structures or use different terminology to

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[8] We are grateful to an anonymous referee for suggesting that we take up the analysis of these differential risks.

describe their functions and operations under emergency conditions, they will naturally find it enormously difficult to coordinate effectively, especially during a rapidly-evolving, high-stress event. There are many possible general structures that could be used as the basis for the needed harmonization, but by far the most commonly used and effective way to do this is through application of the Incident Management System (IMS), which provides a scalable and practical structure and set of procedures for assessing and addressing evolving events.[9] Wisely, Australia was one of the early adopters of this general approach and has been one of the ongoing developers of the system as it has been updated and improved over time (Australian Fire Authorities Council [2005]). The system has been used repeatedly in Australia to good effect in fire-fighting and in other emergency circumstances (including, for example, the response to Cyclone Larry in 2006).

The key features of IMS are (1) an agreement among agencies that may come together in an event on an organizational structure for emergency operations and accompanying terminology to describe essential features; (2) a set of procedures for identifying challenges and priorities and for organizing planning and response; and (3) repeated practice in using the structure and processes, so that employing them in an emergency situation will not seem like a new and different set of organizational routines. The main structural elements of the system are its division of activity into three main functions, each with its own "chief:" the "operations chief" controls the current operations; the "plans chief" sees to planning for the next operational period; and the "logistics chief" organizes logistics functions to support current and anticipated operations. (A fourth section is generally established to track resource use and costs for purposes of after-action administration, but it is less central to the operations themselves.) Overseeing this work is an "incident commander" supported by a command staff, including safety and public information functions. One might argue about the details of this structure – for example, military organizations (which pioneered the overall approach on which incident management is based) generally have operations and planning more closely tied together – but the essential benefits come not from the precise elements of the system (or how they are defined or labeled) but instead from the fact that that all agencies use the same system and can therefore interface with one another rapidly and with minimal confusion.

Second, the presence of multiple agencies, jurisdictions, and levels of government – not to mention civil society organizations – in managing emergency response and recovery necessitates some form of integrated authority structure so that actions by disparate organizations can be coordinated effectively. This is challenging, because often at least some of the agencies involved cannot legally subordinate themselves to a suddenly-invented or imposed command structure. Police units, for example, report and must receive their authorization through the police command structure. It is

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[9] Howitt and Leonard have explored the advantages and disadvantages of the incident management system at great length in previous work, including: Arnold M. Howitt and Herman B. Leonard, "A Command System for All Agencies?" *Crisis/Response Journal* 1 (2), 2005; and Herman B. Leonard and Arnold M. Howitt, "Katrina as Prelude: Preparing for and Responding to Katrina-Class Disturbances in the United States," *Journal of Homeland Security and Emergency Management* 2 (3), 2006. Additionally, although some observers have criticized IMS as being too hierarchical in its structure, others, including John Harrald (2006), have provided thoughtful insight into how IMS can be used effectively to coordinate multi-organizational responses, noting that the discipline and structure offered by IMS do not necessarily preclude innovative and adaptive action on the part of responders.

neither a good idea, nor generally legally sustainable, to take police, fire, or emergency health system units and put them under the direction of commanders who are not deeply versed in their modes of operation and who may therefore not understand critical legal constraints and obligations. Thus, forming a "unitary" command – appointing a single commander who has authority to direct all of the relevant governmental units, across disciplines, jurisdictions, and levels of government – is generally neither possible nor wise. This usually applies with even greater force when non-governmental organizations need to be part of the mix.

Fortunately, IMS has a prescription for this, known as "unified command." The basic approach is to form a committee of command-level people from each of the organizations significantly involved in the event. Each organization continues to work under the authority and direction of its own command structure, but those structures are brought together around a table so that organizational leaders can jointly consider the best course of action. Once this is agreed, orders and directions flow back down to the field through the separate organizational channels of authority and direction. Commonly, the leader of one of the disciplines represented in the unified command will be *primus inter pares* (first among equals), and others in the structure will defer to his or her decisions; but unified command operates in most cases as a voluntary consortium because of the legal barriers to subordination just described.

Incident management, including the device of unified command, works surprisingly well even in large, complex events. For example, in the firestorm in southern California in October 2003, units from the California Department of Forestry, the United States Forest Service, the California Office of Emergency Services, state, local and county law enforcement organizations, and a host of other federal, state, and local agencies, together with a number of nonprofit organizations like the American Red Cross and other relief organizations, jointly responded to over 900 fires, about a dozen of which became major fires, quickly and relatively efficiently. When the fires first began, the "organization" that formed to respond do them went from having no one in the field to coordinating the work of 15,000 firefighters and other personnel in the space of about a week. There were many imperfections in the response to this event – which involved the loss of more than 20 lives and over 3000 homes – but the big picture was that a reasonably effective large-scale response was mobilized quickly in the face of extreme threats to life and property, and we do not have a better or more reliable approach to offer.[10]

Ex-ante structure versus _post-hoc_ criticism

To be ready to confront whatever routine and extreme events lie before us, society must make judgments about what structures and approaches will best serve our needs and then build and prepare those structures in advance. This creates the *ex-ante* reality of how we will be organized in our response to the next extreme event. For the most part, well-trained professional fire-fighting organizations – including those in Australia – are already organized to respond to extreme events through some version

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[10] For a detailed examination of the response to the 2003 wildfires in southern California, see: Kirsten Lundberg, *When Imperatives Collide: The 2003 San Diego Firestorm* (Cambridge, MA: John F. Kennedy School of Government, 2005).

of incident management and unified command. Some observers will, however, judge how they performed in the Victorian fires through the lens of 20/20 hindsight. Extreme events always involve significant disruption and turmoil; and it often seems, after the fact, that a more centralized response might have produced a better outcome. Looking backwards, we have a tendency to imagine the upside of more central command and control (greater precision in execution, for example) and to forget the likely downside (the inability of a centralized command staff to stay ahead of the overwhelming burden of detail flowing from myriad distributed events, and the inevitable delays and errors in providing direction that would result). Some commentaries about the Victorian fires of 2009 exhibit this tendency, and it is prominent in discussions about the response to the Haitian earthquake early in 2010.

Extreme events are, by nature, neither simple nor tidy, and no response structure yet invented will make them so. Although there is little evidence-based research that systematically demonstrates the superiority of decentralized coordination vs. centralized direction of emergency response in extreme events, we have many highly suggestive case studies of both effective and much less effective response to such events that suggest better results with the former.[11] A great deal of that experience arises in the success that wildland fire-fighting organizations have had utilizing IMS in simultaneously battling multiple fires. In the *ex-ante* design of an emergency response system capable of dealing with extreme events, therefore, it seems prudent to "place our bets" on making intelligent decentralized adaptation work. A forward-leaning organizational structure with authorization to operate locally but with the ability to request resources and assistance from a central oversight organization appears likely to be a much more effective approach – and likely to be comparatively more effective the larger, more complex, and more geographically varied is the event.

An even more decentralized system: Stay and Defend or Leave Early

Associated with the approach to bush fire-fighting in Australia is an embedded policy concerning whether citizens should evacuate in the face of a fire event (the so-called "Stay and Defend or Leave Early" policy). As a policy that has to operate on a highly decentralized basis (essentially, at the scale of individual households), there are aspects of this policy that are related to the discussion here about decentralized, coordinated action, and it may be helpful to explore briefly what those links suggest about how such a policy should be reviewed and examined.

First and most obviously, it is important to consider this policy not as its common reference ("stay or go") suggests, but under the more complete description ("stay and defend or leave early"). As

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[11] In particular, the Kennedy School case studies *Hurricane Katrina (A): Preparing for "The Big One" in New Orleans* and *Hurricane Katrina (B): Responding to an "Ultra-Catastrophe" in New Orleans* (Scott, 2006) detail the serious shortcomings of centralized and bureaucratic response efforts while also highlighting the successes of decentralized action. Especially noteworthy in regard to the latter is the performance of the U.S. Coast Guard in rescuing stranded residents from the disaster zone. For an exploration of why the Coast Guard performed better than other governmental agencies , see the U.S. Government Accountability Office's (GAO) report *Coast Guard: Observations on the Preparation, Response, and Recovery Missions Related to Hurricane Katrina* (Washington, DC: GAO, 2006).

the Royal Commission described in some detail in its interim report, both parts of the complete policy are complex and difficult to execute [2009 Victorian Bushfires Royal Commission 2009]. Under "stay and defend," a household generally has to make significant preparations long in advance to create a defensible space (building or retrofitting with fire-resistant construction and materials, removing brush and other flammable materials from around buildings that will be defended, providing means to suppress spot fires, constructing a safe refuge, and so on). This requires significant resources and knowledge of best practices – and a great deal of expense and effort. In the event, this approach then often also requires active defense – that is, the physical mobilization of fighting spot fires, wetting flammable surfaces, and so on. "Stay" is highly dangerous without the addition of "and defend." "Go early" also requires substantial contextual knowledge and real-time awareness, so that the action of leaving can be taken before evacuation routes are severed, endangered, or made hazardous by congestion.

Viewed as a decentralized process, making "stay and defend or leave early" work effectively involves considerable knowledge, resources, and mobilization by individual households – in the absence of which the policy will not work well and will in fact be an active invitation to disaster. As with any decentralized process, its effectiveness will depend on the capabilities and actions of the decentralized agents – in this case, households beyond the reach, for the most part, of the application of formal government authority. We may be able to enforce some ordinances (brush removal and building codes, for example), but it will be difficult to force compliance with the full suite of actions households must undertake in order to make this policy effective and safe.

The ultimate test of the "stay and defend or leave early" policy is not in its theory, but in its consequences. From a moral perspective, in our view, it is not enough to say that under this policy it is up to households to inform themselves and take the necessary actions, and, if they do not do so, the harsh (and perhaps disastrous) outcomes are self-inflicted, and not society's responsibility.[12] We firmly believe, that if, given reasonable efforts of society to help households to master the challenges of this policy (before and during active fire events), a sizeable number of households will not be both willing and able to master the skills and undertake the required actions – and/or if they cannot or do not, in fact, accomplish the required actions – then the policy cannot be defended by claiming that it would work in theory if everyone cooperated. The policy should be pragmatically evaluated in the context of empirical evidence about compliance with what is required for it to operate effectively without endangering the households and communities operating under the policy. If it does not, when operated as competently as we can reasonably expect, actually protect people in the real operating conditions of the fire ground, then it cannot be considered a good policy.

"Stay and defend or leave early" is an emergence-based policy. If it works, what will emerge from the policy are fire-adapted, resilient communities in which households make good investments in protection and good decisions about when to defend and when to leave. This, of course, is the ideal on

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[12] We well recognize that others may hold different views about households' personal responsibilities, the obligations of society to protect its members in the face of their shortsightedness or shortcomings, and the moral onus of society failing to do so.

which the policy is based and the hope on which it rests. But, as the adage says, hope is not a policy. Emergence-based policies depend on putting in place necessary pre-conditions for effectiveness. What this suggests is that in examining the "stay and defend or leave early" policy, we should examine it as an emergence-based policy and should focus on the empirical realities of what households need to know and do to make it work both in advance and in the moment of crisis. We should then compare these findings to what households seem reasonably willing and able to do, given the appropriate information and persuasive efforts that governments can and will make in implementing this policy. If the "stay and defend or leave early" policy does not work – if it does not actually succeed in mobilizing competent citizens to take the actions they need to take to protect themselves – then it will actively contribute to endangering households who leave too late or who stay to defend thinking they were prepared but who did not, in fact, understand or properly execute the advance preparations or the defensive actions in the moment.

Conclusions

This discussion has a number of implications for how we assess the events of January and February 2009 and, going forward, how we design individual emergency response organizations and networks of organizations against the possibility of future extreme events. As observed, no single organizational form suits all situations or even all emergency situations; but, empirically, the incident management system and unified command are widely used and have proven useful and flexible and robust in many situations. It probably makes more sense to harmonize on and practice making this system work than it would to redesign it significantly or adopt a completely new approach. We have also observed that the novelty of extreme events calls for customization and improvisation. This is probably most easily supported through a system that embraces decentralization – one of the design features and strengths of the incident management process.

The central questions about extreme emergencies raised by the events of Black Saturday with regard to the organization of organizations and networks of organizations that will respond to future extreme fire or other events thus appear to be:

(1) Whether the circumstances of such events will more closely resemble the conditions for effective performance by a centralized organization, or instead will more closely mirror the circumstances under which a decentralized organization that relies on the judgment, discretion, and capabilities of decentralized units will be more effective. We believe that the latter is more likely to be true. Hence, we advocate continued development of the appropriate role of central leadership under these conditions -- coordination and allocation of resources – rather than efforts to increase centralized command and control.

(2) Whether in a decentralized system the training and capabilities of the distributed units that will respond and the coordination and resourcing capabilities of their oversight structures are appropriate to providing the requisite level of excellence in task performance given the extreme situations that they will sometimes face. A system that works through reliance on decentralized

intelligent adaptation of units in the field must correspondingly address the needs for training for those distributed units. The more the system relies on decentralized discretion, the more the local teams need training and experience.

(3) Whether the appropriate degree of harmonization around, and training about, the use of the Incident Management System has been achieved. Going forward, we advocate continued support for integration around the concepts, practices, and structures of the incident management system -- across agencies, jurisdictions, levels of government, and among the public, private, and not-for-profit sectors.

(4) Whether the concept of unified command has been developed, trained, and exercised sufficiently to permit multiple agencies to come together effectively in extreme events. Smaller events and exercises provide an excellent opportunity to use unified command methods so that these practices are familiar and functional in larger, more threatening events.

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