Understanding how groups make strategic decisions in emergencies

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Summary

This thesis investigates how emergency response groups, specifically Strategic Coordinating Groups, make decisions in time-pressured, high-stakes environments. By analysing video footage of simulated emergency exercises, the approach taken combines the reproducibility of traditional decision-making studies with the realism advocated by the paradigm of Naturalistic Decision Making. The investigation of decision-making at a range of national and international exercises revealed systematic departures from the UK doctrine on making group decisions: The Joint Decision Model. Group decision-making did not follow the sequence of activities assumed by the Joint Decision Model or other normative models of decision-making. There were marked between-group differences in the process of decision-making: some groups can be characterised as information seeking (or explorers), others as action orientated (or exploiters). When making decisions, all groups rarely considered alternative courses of action or options. This thesis provides recommendations on the policy and practice of how Strategic Coordinating Groups train and exercise and make decisions in emergencies. These include a national programme of training for the Chairs of Strategic Coordination Groups, use of controls and tools to support decision-making, and use of external challenge and assessment in strategic decision-making.

Publications

Chapter 3 reports results that have been published in the article: Wilkinson, B., Cohen-Hatton, S.R., & Honey, R.C. (2019). Decision-making in multi-agency groups at simulated major incident emergencies: In situ analysis of adherence to UK doctrine. *Journal of Contingencies and Crisis Management*, *27*, 306-316.

Chapter 4 is based on the unpublished article: Wilkinson, B., Cohen-Hatton, S.R., & Honey, R.C. (2020). Variation in exploration and exploitation in group decision-making: Evidence from immersive simulations of major incidents (under review).

Presentations

Wilkinson, B. (2017). Multi-agency decision-making. National Fire Chiefs Council Command and Control Conference. Leeds.

Wilkinson, B. (2019). How SCGs make decisions in major incident emergencies: findings and implications. Strategic Coordinating Group (SCG) Chair training (pilot event). Carmarthen.

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Chapter 1

General Introduction

1.1. Context and overarching objective

At a Police Special Operations Room in central London a group of people wait anxiously to be ushered into their first meeting. In the large and windowless office space, the atmosphere is solemn and tense. A wall of TV screens shows grainy live CCTV footage of an underground station at London Waterloo. Ceiling mounted cameras display overturned trains buried in a sea of rubble. Through a fog of dust, a tunnel camera shows emergency responders treating wounded people. Much is unclear: Why did the trains derail and buildings collapse? How many injured people are trapped in the trains? How many people might have died?

Amid this uncertainty, one thing however is clear: the group of people waiting to meet need to make urgent decisions to save lives and protect the city. To do so, they will become members of a Strategic Coordinating Group (SCG).

In fact, the scenario just described was taken from a large-scale 4-day simulated exercise (Exercise Unified Response) that took place in London in 2016 (pictured below).

Exercise Unified Response involved 100 organisations, 10 countries, 4000 responders and 2,500 casualty volunteers. This exercise, together with a series of 18 other national exercises over a two-year period, formed the basis of the research reported in this thesis. The central concern of this thesis is to understand the process of how SCGs make decisions in major incidents of this kind.

Real major incident emergencies were commonplace in the UK between the point at which this research was initiated in 2014 (e.g., Grenfell Tower fire, Manchester Arena bombing, London Bridge attack) and when this thesis was completed in 2020. In the United Kingdom, the SCG is the nationally required executive body for making decisions in an emergency (Cabinet Office, 2013a). The group is made up of emergency services, health and government agencies and civil resource organisations. The SCG decides the strategy for dealing with an

emergency: what to communicate to the public; how to manage deaths and casualties; and how to control economic and environmental effects. In any major emergency, the group in overall charge of decision-making is the SCG.

Government commissioned reports have highlighted a recurring need to improve multi-agency decision-making (Kerslake, 2018; Pollock, 2013). To address the persistent need to improve group decision-making, all responding agencies in the UK are given guidance in the form of a normative model, known as the Joint Decision Model (Joint Emergency Services Interoperability Principles, 2016). While there have been studies of group decision-making in a variety of contexts - e.g. cockpit flight crews (Stout, Cannon-Bowers, Salas, & Milanovich, 1999) and nuclear operations personnel (P. O'Connor, O'Dea, Flin, & Belton, 2008); for a review, see Flin (1996); and post-event interview data from members of SCGs (Power & Alison, 2017), what is lacking, and what this thesis provides, is a detailed analysis of the current practice of SCGs in situ. Specifically, there is a research gap in using replicable and realistic scenarios to provide an in situ and unobtrusive analysis of the real-time process of how groups strategic make decisions. It was envisaged that this type of research would increase understanding of how decisions are made by multi-agency groups in emergencies, and help inform and improve the policy, guidance and training for multi-agency groups charged with making life-saving decisions.

This chapter begins with a brief history of how research and theory in the area of individual decision-making have developed, and proceeds by examining what laboratory and studies 'in the wild' (cf. Hutchins 1995) have revealed about group decision-making. The chapter then describes the context in which SCGs make decisions, by outlining how emergencies are dealt with in the UK. Finally, the

methodological approach taken in this thesis is presented, together with the specific objectives it is intended to address.

More specifically, this chapter will:

i. Define decision-making
ii. Briefly summarize the history of decision-making research by outlining:
   a. Theoretical approaches to individual decision-making, and
   b. Group decision-making
iii. Present the contemporary context of major incident emergencies including the normative model for making decisions in the UK: the Joint Decision Model
iv. Develop the case for using a quantitative approach to study the process of group decision-making, using realistic and reproducible emergency contexts

1.1.1 Defining decision-making

A decision is a choice of action: of what to do, or not do. A decision is a commitment to a course of action that is intended to produce a satisfying state of affairs (Yates, Veinott, & Patalano, 2003). Decisions are made to achieve goals, and are based on beliefs about what actions will achieve those goals (Baron, 2000). Psychological models of decision-making, largely applied to safety critical settings, posit that decisions are made through establishing situational awareness, identifying options, evaluating options and choosing a response (Lipshitz & Bar-Ilan, 1996; van den Heuvel, Alison, & Crego, 2012). Situation awareness consists of both understanding the current situation and predicting the situation in the future (Endsley, 2017). The plan formulation phase includes identifying the problem, generating possible solutions, and selecting an appropriate course of action. The final phase of plan execution involves implementing the plan. However, such

models are only one expression of a long history of decision-making theory and the research that underpins it.

1.1.2 The origin of studying decisions

The study of decision-making can be traced back to the mathematicians Pascal and Fermat in their 1654 correspondence on a game of chance introduced by the Franciscan monk Pacioli in 1494 (Almy & Krueger, 2013). To illustrate Pascal and Fermat's considerations on what constitutes a rational decision, consider which of the following two gambles you prefer:

1. A 75% chance of £100, or nothing
2. A 35% chance of £250, or nothing

Do you prefer the greater probability of gaining £100 in option 1, or would you choose the riskier option of an increased chance of winning nothing but gaining £250?

A mathematical approach to choosing the best option above, is to calculate the predicted or expected value of each gamble. This is achieved by taking the monetary value of each gamble and multiplying it by the probability of occurring. For gamble 1 the expected value is £75 (0.75 x100), for gamble 2 the expected value is £87.50 (0.35 x £250).

Therefore, although you may prefer the more probable chance of winning in gamble 1, if you want to decide in a manner that maximises expected value, gamble 2 should be chosen. To accept this mathematical account of making decisions, where calculated probabilities determine rational choices, is to tacitly agree that decisions should be made to maximise expected value. The axiom to maximise expected value in decisions can be both *descriptive* and *prescriptive* – it can seek to

explain the process of both a) how decisions are made, and b) how decisions should be made.

The history of decision-making research can be characterised under these two broad approaches: descriptive and prescriptive. Descriptive models explain the decision-making process, while prescriptive models identify the requirements for making good or correct decisions under normative standards (Baron, 2000; Katsikopoulos & Lan, 2011). As will be outlined below, throughout the history of decision-making research, there is an ongoing distinction about how decisions should be made, and how decisions are actually made.

1.1.3 A brief history of decision-making research

The heart has its reasons which reason knows not

Blaise Pascal

An early challenge to the view that rational decisions maximise expected value came from a gambling game, known as the St Petersburg Paradox. The crux of the game is that in a one-off decision a player chooses either tails or heads before a sequence of tosses of a fair coin. If the player chose heads and the first toss of the coin is heads, they win £1, if the second toss is heads, they win £2, if the third toss is heads, they win £4, and so on in increasing multiples. The game ends when a tail turns up, and the player wins whatever has been accrued up until that point.

Bearing in mind that the potential winnings in this game are infinite (tails may never turn up), and therefore the expected value for the player is also infinite, how much would players be willing to pay to play the St Petersburg paradox? People will pay only small amounts of money to play. George-Louis Leclerc, Comte de Buffon, observed that in 2084 games an average of less than 5 dollars per game was paid

(Nelson, 2013). This answer is at odds with the account of decision-making that requires maximising expected value (Gigerenzer & Selten, 2001). Indeed, it indicates that decisions are made not solely by calculating probabilities, but instead involve emotive factors.

To account for this paradox in behaviour – people should pay large amounts of money to play a game of potentially infinite value, but they do not - Daniel Bernoulli (1738) proposed replacing the idea of expected monetary 'value' with expected 'utility': a type of pleasure or usefulness. In making this proposal, Bernoulli recognised that the usefulness of money declines with increasing gains. Utility depends on the amount of money a person already has. Consider wining either £10, £100 or £110. In terms of utility value winning £100 or £110 is very similar, however, winning just £10 when you have nothing has very large utility value (despite it being the difference between £100 and £110).

Although the expected value of the St Petersburg gamble is infinite, its expected utility is not infinite as the very unlikely outcomes (a long run of heads before the first tail) have diminishing utility. The relationship between monetary value and utility is therefore concave – more wealth is always better, but an increase in wealth for a poor person has much greater utility value than for someone who is already rich.

As will be seen below, in the uncertain world of emergency response, where lives are stake, decisions are determined not solely by rational calculations of probability, but also by emotions – the reasons of the heart.

1.1.4 Expected Utility Theory

The earliest theorem for testing the logic and rationality of decisions was proposed in the *Theory of Economic Games and Behaviour* (Von Neumann & Morgenstern, 1947). This provided a set of prescriptive axioms for assessing decision-making, according to the principle of maximising expected utility (EUT). Von Neumann and Morgenstern stated that decision makers should seek to maximise utility (outcomes) through the rational calculation of expected (predicted) utility. The expected utility of an act is a weighted sum of the utilities of its potential consequences, where each weight is the probability that the consequence will occur as a result of the act. Savage (1954) incorporated the notion of subjectivity into EUT, by proving that subjective probabilities can be assigned by decision makers to the possible outcomes of a choice, whilst still satisfying the axioms of the theory.

The following six key axioms underlie EUT (Plous, 1993). Rational decisions are based on the principle of: i) Ordering alternatives (two options should be able to compared and the best picked); ii) Dominance (if prospect A is at least as good as prospect B in every respect and better than B in a least one respect, then A should be preferred to B); iii) Cancellation (if someone would prefer option A to option B if X occurs, they should also prefer option A to option B if X does not occur); iv) Transitivity (if a person prefers A to B and B to C, they should prefer A to C; v) Continuity (preferring an optimising gamble to a sure gain); and vi) Invariance (ignoring the way that alternative options are presented)

As Von Neumann and Morgenstern specified the rules for rational decision-making, the mathematical predictions of expected utility theory can be compared with the behaviour of real decision makers. Simply put, does what is *prescribed* as rational decision-making actually *describe* what people do?

A key challenge to the central claim of EUT - that decision makers always choose the option that maximises expected utility - is apparent in the following choice paradox (Allais, 1953). Using experiments on choices in gambling scenarios with specified probabilities, Alias found that decisions made by participants violated the cancellation principle of EUT. For example, faced with a choice in two differently phrased gambling scenarios, which nonetheless contain two identical outcomes, participants' first decision was frequently inconsistent with their second decision. Despite making a choice to prefer the outcome of one gamble in the first decision, if the same consequences were attributed with less certainty, people would typically change their preference. Allais proposed that EUT was not a consistently normative predictor of decisions and that rather than decide according to predicted consequences people favour certainty over risk.

Building on these findings is a further choice paradox, termed 'ambiguity aversion' (Ellsberg, 1961) in which people again violate the cancellation principle. In a gamble of choosing a coloured marble from urns, people consistently preferred betting on known probabilities (an urn with 50 black or 50 white balls) even though the unknown probabilities (an urn with where the ratio of 100 black or white balls is unknown but any combination is equally likely) was as likely to maximise utility. This is the paradox: even though either urn is as likely to maximise utility, the clear preference to bet on the urn with known probabilities, from the viewpoint of EUR, is irrational.

The findings presented so far share the characteristic of being decisions under conditions where probabilities are either known or can be calculated. Emergency situations however, are inherently uncertain and ambiguous - the full picture of the incident is often unknown, information can be inaccurate and situations

change. In emergency contexts is it in fact possible to calculate the probability of predicted consequences, or do the boundaries of people's cognitive limitations and computational capacity require a different approach?

1.1.5 Bounded rationality

Herbert Simon (1956) proposed that decision makers have 'bounded rationality' that is limited by the information they have, the cognitive limitations of their minds, and the finite amount of time they have to make a decision. Instead of knowing probability distributions of outcomes, decision makers introduce estimates, or look for strategies for dealing with uncertainty that do not assume knowledge of probabilities. Rather than maximising a utility outcome, decision makers may use a strategy that will satisfy and is sufficient - a 'satisficing' strategy.

Building on Simon's concept of bounded rationality, Kahneman and Tversky (1979) proposed that decisions are often made by using heuristics (mental short cuts or rules of thumb) and by employing mental biases.

1.1.6 The Heuristics and biases approach

It's difficult to make predictions, especially about the future

Danish Proverb

An origin of this heuristics and biases approach, which has a sceptical approach to expert judgement, can be traced back to the psychologist Paul Meehl. In a review of studies that compared the accuracy of predictions made by expert clinicians and those forecast by statistical models, experts were often less accurate than simple statistical models that used the same information (Meehl, 1954). Related findings demonstrate how people fail to accurately revise their predictions of probability. For example, rather than examine whether the normative approach of

EUT was being violated by decision makers, Edwards compared people's judgements to those mandated by normative mathematical laws of probability. It was found that people were insufficiently responsive in updating their beliefs about the probability of an outcome when faced with new evidence (Edwards, Phillips, Hays, & Goodman, 1968). In mathematical terms people fail to adjust their beliefs in ways dictated by Bayes' Theorem – a formal theory of how beliefs should be updated in the light of new evidence.

Buildings on these studies, Tversky and Kahneman investigated probabilistic judgements and identified three heuristics (judgemental shortcuts) employed under conditions of uncertainty (1974). These heuristics include:

i) *Representativeness*: the likelihood of an event is judged by comparing it to an existing mental stereotype;

ii) *Anchoring:* initial exposure to a number serves as a reference point that influences subsequent judgements about value;

and

iii) *Availability:* the judgement about the likelihood of an event is based on how easily an example comes to mind.

In formalising this early work on heuristics, Prospect Theory was advanced as an account of how people actually make decisions (Kahneman & Tversky, 1979). A key premise of Prospect Theory is that choices are evaluated relative to a reference point, such as the status quo for example. A second assumption is that people are risk-adverse about gains (relative to the reference point) but risk-seeking when facing losses. The third characteristic is about *loss aversion*: people are much more averse to losses than they are attracted by corresponding gains. Potential losses loom larger in the mind than potential gains. For example, the pain of losing £5 is

greater than that utility/benefit of gaining £5, therefore decision makers are averse to taking risks if loses could be incurred. Studies in neurology support this assertion that emotions guide or bias decision-making (Bechara, Damasio, & Damasio, 2000). To put this colloquially - the emotional tail wags the rational dog.

Whereas the heuristics and biases approach defines reasoning errors as deviations from maximising utility, there is an established contrary view. For instance, the use by decision makers of 'fast and frugal' heuristics such as simple and efficient rules of thumb to 'take the best and ignore the rest', when faced with complex problems or environments, have been found to be as effective, or outperform, estimating probabilities and utilities of all possible outcomes (Gigerenzer & Goldstein, 1996). Proponents of this approach claim that heuristics are more effective than mathematical optimisation techniques because they exploit evolved mental capacities and environmental structures (Gigerenzer, 2008).

To summarise the above, decision-making research has progressed from the study of mathematical models of pure rationality such as EUT to acknowledge the role of people's cognitive limitations. Information processing limitations require decision makers to use cognitive biases and heuristic short cuts. Decision-making biases and heuristics can produce 'errors' or deviations from the normative expectation to maximise utility. However they can also, especially when used by experts, prove to be adaptive and effective in complex and uncertain environments. Therefore turning to the environment in which decisions are made, it is apparent that decisions can occur under objective conditions of risk, as in gambles or games of chance, or under conditions of uncertainty where the numerical probabilities are not known, such as emergency environments. With this in mind, it should be noted that Simon's notion of bounded rationality includes not just the computational limitations

of the decision maker, but also the ecological constraints of the real world. Indeed, Simon describes how “human rational behaviour is shaped by a scissors whose two blades are the structure of task environments and the computational capabilities of the actor" (Simon, 1990). This observation, that to fully understand decision-making, requires recognition of both the limits of human computational ability and the environment in which decision-making occurs, is a cornerstone of Naturalistic Decision Making.

1.1.7 Naturalistic Decision Making (NDM)

The NDM approach is particularly relevant to the study of decision-making in emergencies as it emphasises the context in which decisions are made. The naturalistic context includes ill-structured problems with multiple participants, time pressure, uncertainty, high stakes, competing goals, and unstable conditions (e.g. Klein 1993, Klein, Ross et al., 2003, Klein 2008; see also, Orasanu and Connolly 1993, Cannon-Bowers, Salas et al., 1996, Gureckis and Goldstone 2006, Gigerenzer 2007, Doya 2008, Hodgkinson and Healey 2008). It is exactly this type of context in which Strategic Coordinating Groups (SCG) make decisions.

Zsambok (1997) identified four features of Naturalistic Decision Making that contrast with more traditional types of decision research: i) it is context rich, ii) usually includes experts, iii) describes the decision strategies people use, and iv) is often concerned with pre-choice processes such as Situational Assessment (SA). In contrast to laboratory based research, NDM has focused on ‘real teams performing real tasks in real settings’ and more specifically, the process by which decisions have been made (Lipshitz, Klein, Orasanu, & Salas, 2001).

The NDM approach, which focuses on the successes of expert intuition rather than biases or deviations from normative standards, grew out of research on chess grand masters who, in comparison to average players, quickly select the most promising moves (de Groot, 1946) and rapidly recognise the dynamics of complex positions (Chase & Simon, 1973). An archetypal model in the NDM paradigm is the Recognition-Primed Decision (RPD) making model (Klein, 1993). The RPD model was proposed following a cognitive task analysis (i.e., structured interviews based on memory recall) of how experienced Fire Service Commanders handled time pressure and uncertainty in challenging circumstances (Klein, 1998; Klein, Calderwood, & Clinton-Cirocco, 1986; Klein, Calderwood, & Macgregor, 1989). These post-incident interviews indicated that in most cases Fire Service Commanders were not evaluating options in order to make a decision, but were typically carrying out the first course of action they identified. In the initial study, from 156 decision points in only 28 was more than one option identified. In only 16 decision points did the Fire Commander report evaluating one option against another (see also, Cohen-Hatton & Honey, 2015; Cohen-Hatton, Butler & Honey, 2015).

There are three types of RPD (Lipshitz et al., 2001). In its simplest form the decision maker 'sizes up' a situation using their expertise, recognises an initial appropriate course of action and responds with the initial option. It is proposed that a skilled and experienced decision maker will usually generate a first option that is a feasible course of action. In the second variation of RPD the decision maker relies on a story-building strategy to mentally simulate (using expertise) the events leading to the observed features of the situation. This is used in situations that are unclear and a diagnosis of the situation is needed. Finally, the third variant explains how

decision makers evaluate a single course of action by drawing on their expertise to mentally simulate the proposed action, in a process De Groot termed ‘progressive deepening’, to see if and how the action could work. Simon (1992) provides a succinct description of this intuitive process:

‘*the situation has provided a cue; this cue has given the expert access to information stored in memory, and the information provides that answer. Intuition is nothing more and nothing less than recognition’*

The RPD model has been found to apply in a variety of different contexts including naval surface ship commanders, tank platoon leaders and commercial aviation pilots and has been claimed to be the most common decision-making strategy in these environments (Lipshitz et al., 2001). However, it has been argued that RPD strategies are less likely to be used in situations where justifications are required, and where the views of different stakeholders (as in a Strategic Coordinating Groups) need to be considered (Klein,1998).

Whilst RPD was initially based on introspection and recall from memory where recollection is limited and not wholly accurate (Omodei, McLennan, & Wearing, 2005) it has also been observed through real time footage from head mounted cameras, in situ, at real emergencies (Cohen-Hatton, Butler, & Honey, 2015; Rake & Njå, 2009) and at simulated incidents (Cohen-Hatton & Honey, 2015).

The preceding sections focussed on individual decision-making, yet as the central research question of this thesis concerns the process of how teams make strategic decisions, some features of group decision-making research will now be outlined.

1.2 Group decision-making

The widespread use of decision-making bodies such as juries, committees and boards across societies, reflect the assumption that many heads are better than one. Indeed, the formation of the key group studied in this thesis – the Strategic Coordinating Group – is based on the explicit assumption that a group or team, rather than an individual, is best suited to make decisions on how to respond to a large scale, wide-impact emergency (Cabinet Office, 2013a).

1.2.1 Defining Teams

A team is a group of individuals working interdependently to complete a task (Hackman & Oldham, 1980) with shared values and goals (Dyer, 1984). Teams can bring more knowledge, skills and experience to solving hard problems than any single individual (Hackman, 2011). Teams are more suitable for complex tasks as they allow members to share the workload and develop and contribute expertise (Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000). When the complexity of the task exceeds an individual person or organisation – as with major incident emergencies – teams such as the Strategic Coordinating Group, are used in these ambiguous and stressful situations to make multiple decisions when the lives of others depend on the collective insight of the group (Eduardo Salas, Cooke, & Rosen, 2008). But, to what extent is there evidence to support the idea that the decision-making wisdom of the crowd exceeds that of the individual?

1.2.2 The wisdom of the crowd?

In a review of over 50 years' of research on group decision-making, Hill concluded that the judgement of groups, on most tasks, is about as accurate as their second best member (Hill, 1982). Across three types of judgement (namely quantities, logical problems and general knowledge questions) groups make more

accurate judgements than average individuals, but the best individual often outperformed the group as whole (Hastie, 1986). Similarly, groups performing 'eureka' tasks, with demonstrable solutions, tend to outperform their average members and approach the performance of their best members (Laughlin, VanderStoep, & Hollingshead, 1991). In judgemental tasks (sales forecasting for instance) group interaction and discussion can sometimes lead to improvements in judgement accuracy, at least to a level that is better than the collective mean (Sniezek & Henry, 1989). In both these types of tasks, identifying the best group members is a method for generating the best decisions. In eureka tasks the correct answer of the best group member can be demonstrated to group members - simply put, "truth-wins" (Hastie & Kameda, 2005) . In judgmental tasks (such as general knowledge quizzes), as a normal part of the group judgement process, groups typically identify their best members at levels far above chance expectations (Henry, 1993).

If groups are effective at identifying their best members, they may avoid group polarisation: a reported tendency for groups to make more extreme decisions than the initial inclination of its members. For instance, people are more willing to advocate risky actions (a 'risky shift' in behaviour) after participating in a group discussion (Stoner, 1961). However, other research has found that that groups sometimes recommend more cautious options that those initially identified by individual group members (Moscovici & Zavalloni, 1969).

1.2.3 'Groupthink'

Paradoxically, the best way for a group to be smart is for each person in it to think and act as independently as possible.

James Suroweicki, The Wisdom of Crowds, (2005)

Linked to the polarisation effect of groups suggested above, a related characteristic, based on conformity, is apparent in 'groupthink' (Janis, 1972). Groupthink has been described as:

'*A quick and easy way to refer to a mode of thinking that people engage in when they are deeply involved in a cohesive in group, when the members' strivings for unanimity override their motivation to realistically appraise alternative courses of action'* (Janis,1982, p.9)

Indeed, it seems plausible to suppose that groupthink might play a role in decision-making in SCGs. Chapters 3 and 4 provide evidence from direct observation of SCGs relating to this possibility.

1.2.4 Decision inertia and accountogenic decisions

Thematic analysis of interviews with multi-agency group members, after they have participated in simulated major incidents, suggests that timely action can be constrained by *decision inertia* (e.g., Alison et al., 2015; Power & Alison, 2017; see also Janis, 1972; Janis, 1982; Janis & Mann, 1977). Here, decision inertia refers to 'a process of (redundant) deliberation over possible options and in the absence of any further useful information' (Power & Alison, 2018); which could interact with whether a group is tolerant of uncertainty or not (e.g., Frenkel-Brunswik, 1949 ; see also, van den Heuvel, Alison, & Power, 2014; for reviews, see Furnham & Marks, 2013; Hillen, Gutheil, Strout, Smets, & Han, 2017). Bringing together a recognition of the interpersonal, social and organisational context of decision making, as well as the influence of emotions, Alison et al., (2011), have coined the term 'accountogenic decisions'. Based on a qualitative analysis of over 80 operational debriefs of more

than 4,000 police officers form lowest to highest rank, accountogenic decisions are proposed as judgments that are derailed or unduly influenced to be risk-adverse or displace risks. This is because individuals try to protect themselves from the consequences of actions for which they will be held accountable by their organisation and the public. This can lead to acting to soon (premature decisions), acting too late (overdue decisions), or failing to act for fear of blame.

1.2.5. Heuristics and biases in groups

Whilst further research is needed (Plous, 1993), individual level heuristics and biases continue to operate in group judgement and decision-making and these biases are sometimes stronger in group settings (Argote, Seabright, & Dyer, 1986; Tindale, Sheffey, & Filkins, 1990). However, because group performance can depend on so many different factors (tasks, group sizes, members) drawing general conclusions from specific studies in group decision-making is difficult (Plous, 1993). These considerations suggest that in order to understand decision-making in Strategic Coordinating Groups, it is important to study decision-making in situ rather than extrapolate from studies of group decision-making more broadly.

1.2.6 Studying groups in their natural environment

The preceding sections highlight the fact that group decisions are related to but distinct from individual judgements, and that studying decisions in naturalistic contexts requires a specific focus on the environment in which they occur. Simply put, teams need to be studied by understanding the problems they confront in the environment in which they encounter them (Cannon-Bowers & Salas, 1998; Orasanu & Fischer, 1997; Salas, Cannon-Bowers, & Johnston, 1997). With this in mind, the emergency environment of the SCG will now explained before outlining the normative framework for responding to emergencies: The Joint Decision Model.

1.3 Emergency environments: The response to major incidents

Examples of events in the United Kingdom (UK) that could give rise to a large-scale emergency include severe adverse weather, flooding, terrorism, major industrial accidents and pandemic disease (Cabinet Office, 2017). Organisations legally required to train for and respond to such incidents include the police, fire and rescue services, local government, health agencies, the military and the private and voluntary sector (Cabinet Office, 2004, 2012). The response to a large-scale emergency requires decisions on the deployment and coordination of many organizations and resources (Cabinet Office, 2013a).

In the UK, an emergency is legally defined as an event or situation that threatens serious damage to human welfare or the environment, or war or terrorism that threatens serious damage to the security of the country (Cabinet Office, 2004). The complex nature of large-scale and high-impact emergencies requires that high stakes decisions are taken by teams of personnel (Janssen, Lee, Bharosa, & Cresswell, 2010) who operate under time pressure, with uncertain information, and conflicting goals (Orasanu & Connolly, 1993).

A consistent lesson that has been identified from recent analyses of major incident emergencies is the need to develop interoperability: 'the capacity of organisations to exchange operational information and to use it to inform decision-making', (National Policing Improvement Agency, 2009, p14); for a recent review, see House, Power, & Alison, (2014); see also, Alison & Crego, (2008); Comfort, (2007), and Pollock, (2013). In a review of persistent areas for improvement identified in the review of 32 major incident emergencies in the UK from 1986 to 2010, the failure of different agencies (e.g., local emergency services, civil resource organizations, health boards, and government) to work together at a strategic level

was a recurring theme (Pollock, 2013). One important component of the approach to improving interoperability in the UK is embodied in multi-agency groups - such as SCGs - who are convened and charged with making decisions that help to minimize the societal and economic impacts of major incidents. Similar regional approaches have evolved elsewhere in Europe (Palm & Ramsell, 2007; Wimelius & Engberg, 2015) and in the United States (Federal Emergency Management Agency, 2018).

1.3.1 The Strategic Coordinating Group

The purpose of the SCG is to take overall responsibility for the multi-agency management of the emergency and to establish the policy and strategic framework within which lower tier command and coordinating groups will work (Cabinet Office, 2013a). The overarching command structure for responding to emergencies in the UK is shown in Figure 1. Within this structure, management of the emergency response and recovery responsibilities are undertaken at one or more of three ascending levels: Operational, Tactical and Strategic. SCGs consider the incident in its strategic wider context, define and communicate the overarching policy and strategy for the emergency response, and monitor progress towards defined objectives. This strategy-setting role extends beyond the initial response to the incident and includes formulating a media and communication strategy as well as horizon scanning to facilitate the recovery stage of an incident. For example, in a large-scale fire that generates a toxic plume of smoke with the potential to harm the health of nearby residents, the SCG decide the overarching strategy to protect residents. The SCG will consider issues such as how predicted weather will affect the direction and toxicity of the smoke plume, the resources available and required to move and shelter people, and more generally, the longer-term outcomes of actions in terms of risks and benefits. If the SCG decide to evacuate affected

properties, the Tactical Coordinating Group (TCG) decide how this evacuation is implemented in terms of practical arrangements to transport, shelter and look after the welfare needs of people. At the operational level, responders near the scene of the fire, would knock the doors of affected residents to alert them to the evacuation and direct and help them to transport to take them to a place of safety.

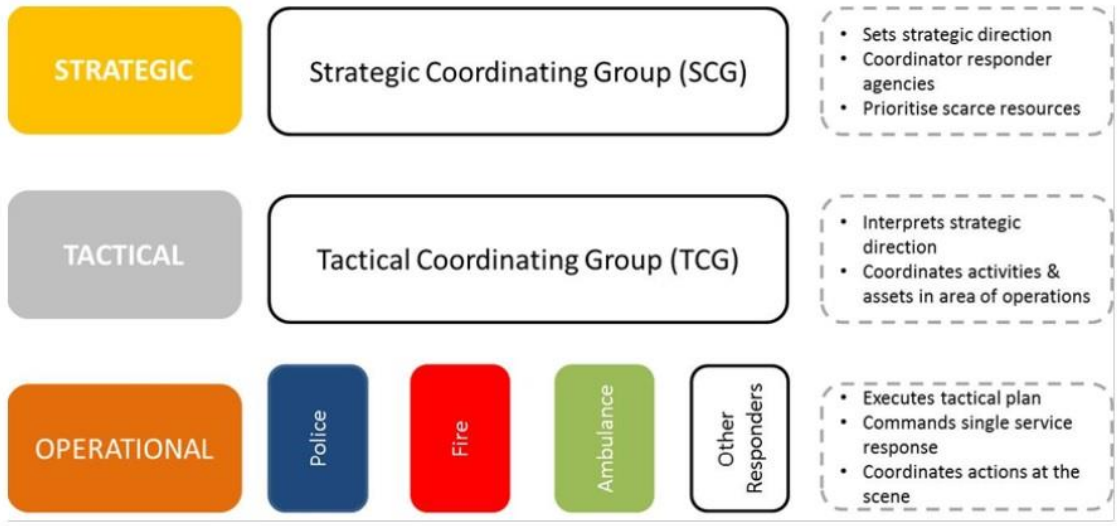


Figure 1. Overarching emergency response structure in the UK; where strategic, tactical and operational levels are mapped onto the strategic and tactical coordinating groups, and frontline responders. Each level has associated responsibilities (shown in the right-hand column).

Explaining the role of the SCG and its place in the overall response structure is only a first step in considering how decisions are made in a large-scale emergency. The way in which a diverse group of experts in specific domains work toward a common goal or set of goals needs to be specified. The approach

developed in the UK is for responders to be trained on and use the Joint Decision Model (JDM) (Joint Emergency Services Interoperability Principles, 2016).

1.4 The Joint Decision Model

A detailed and well-practised understanding of the Joint Decision Model will help commanders to think clearly and in an ordered way when under stress

Joint Emergency Services Interoperability Programme Doctrine

1.4.1 Introduction and use

The JDM was introduced in 2012 (Her Majesty's Inspectorate of Constabularies (HMIC), 2015) and is the fundamental cornerstone of the doctrine that sets out the process of how responders should work together and make decisions in response to an emergency (Joint Emergency Services Interoperability Principles, 2016). The JDM is the normative decision-making framework that is used to guide the response to major incidents in the UK. Agencies expected to use the JDM include legally defined 'Category 1 responders' such as local authorities, Police forces, Fire and rescue services, the National Health Service (NHS) and environmental agencies. 'Category 2 responders' are also expected to use the JDM and include large-scale transport providers such as road, railway and airport agencies, as well as essential utility providers such as electricity, gas, water, and telecommunication companies.

To respond to emergencies cohesively and effectively, SCGs receive nationally endorsed guidance and training, a central pillar of which is the Joint Decision Model (JDM). This UK practitioner model was introduced to support the capacity of multi-agency groups to work together. The model was based on the Police National Decision Model, and before that the Conflict Management Model

(https://www.app.college.police.uk/app-content/national-decision-model/the-national-decision-model/#application). The graphic that is routinely used to illustrate the JDM is shown in Figure 2. The JDM describes five categories of decision-making activity, which support the superordinate goals of working together, saving lives and reducing harm. These activities are: (1) gather information and intelligence; (2) assess risks and develop a working strategy; (3) consider powers, policies and procedures; (4) identify options and contingencies; and (5) take action and review what happened. The five activities can be broadly aligned to the more generic decision-making processes of *situation assessment* (activity 1), *plan formulation* (activities 2-4), and *plan execution* (activity 5); e.g., (Lipshitz & Bar-Ilan, 1996; van den Heuvel et al., 2014). The JDM also describes a consistent sequence in which these activities should occur, moving from gathering information to taking action through the three intermediate activities. One feature of the JDM, which I will have cause to return to in Chapter 5, does not sit well with more conventional analyses of decision-making processes: namely, the separation of the development of a working strategy from the identification of options and contingencies – which are both 'plan formulation' - in the proposed sequence of activities. However, the status of the JDM as the default decision-making model within UK doctrine on emergency response is clear and evident (Joint Emergency Services Interoperability Principles, 2016) and will be further explained below.

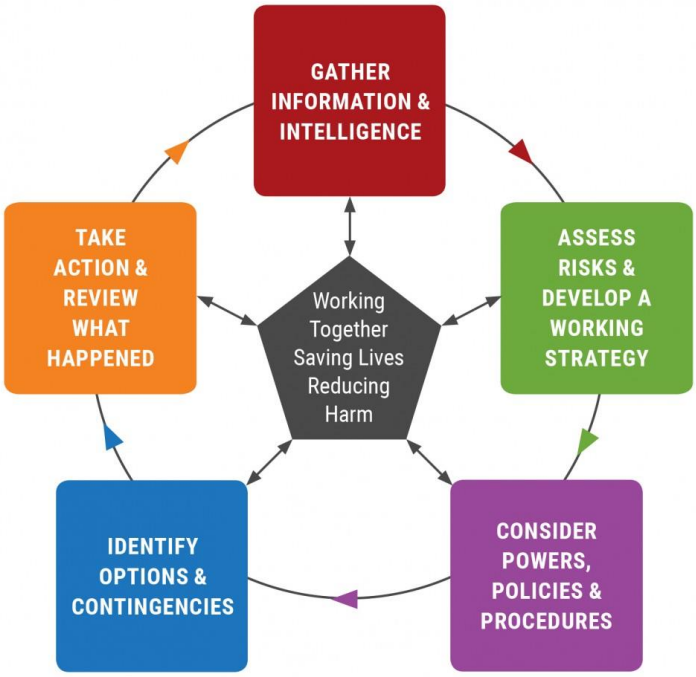


Figure 2. The Joint Decision Model identifies five categories of activity: gather information, assess risks and develop strategy, consider powers, identify options, and take action. The central ethos of the model is: Working Together, Saving Lives and Reducing Harm. [Adapted from: http://www.jesip.org.uk/joint-decision-model].

The approach to group decision-making embodied in the JDM mirrors the normative models of individual decision-making by operational commanders in a single agency settings such as the Police service (College of Policing, 2014). In this case of individual decision-making, it is also assumed that there is an orderly progression between a limited set of phases: situation assessment (SA), plan formulation (PF) and plan execution (PE) (Cohen-Hatton et al., 2015; van den Heuvel et al., 2012). For example, an emergency responder at a road traffic collision involving multiple vehicles would initially be expected to survey the scene

and gather information on casualties, fatalities and immediate risks (SA); consider options of how to protect and assist affected people, and deal with any hazards (PF); and then implement decisions such as requesting medical assistance, road closures, and cutting or extraction equipment (PE).

SCG members come from a range of organizations and major incident emergencies are infrequent, which means that these groups face issues that differ from those faced by expert teams, who frequently work together on familiar tasks: e.g., cockpit flight crews (Stout et al., 1999) and nuclear operations personnel; for a review, see Flin (1996). The ad hoc nature of SCGs allows them to rapidly assemble in the affected location with key local knowledge, but it also means that they might not have worked together at a major incident (cf. Rouse, Cannon-Bowers, & Salas, 1992; see also, Canon-Bowers & Salas, 2001), which could reduce their capacity to develop a coordinated plan of action (Stout et al., 1999). The JDM was adopted in an attempt to meet these challenges: to enhance interoperability, engender a shared representation of an incident (cf. Hutchins, 1995a, 1995b, Nickerson, 1993) and enable a coordinated response through shared superordinate goals (cf. Power & Alison, 2017; Rouse et al., 1992; Stout et al., 1999). When used in multi-agency team environments, the JDM can be seen as a way to reconcile the fact that SCGs are composed of individuals with a great deal of experience in dealing with isolated components of a large-scale emergency, who need to develop – as a group - an overarching response structure and coherent strategic oversight to make collective decisions on the response. The next section outlines the need for the research reported in this thesis, the research questions posed, and the methodology for understanding how SCGs make strategic decisions in major incident emergencies.

1.5 The approach: combining traditional and Naturalistic Decision Making methodology

There is great potential for synergy in a unified approach that uses observation and experimentation to study deliberative and precipitous decisions made by experts and novices in controlled settings and in the field.

Joshua Klayman, Ambivalence in (not about) Naturalistic Decision Making, Journal of Behavioural Decision-making, (2001)

Traditional decision-making research and the study of heuristics and biases, in contrast with NDM, has different interests (deliberative versus fast decisions), different methods (laboratory studies versus field observation), and even different values (methodological rigor and theory building versus realism and descriptive accuracy). Both of these approaches have generated relatively limited research on strategic decision-making by multi-agency groups responding to emergencies (Kapucu & Garayev, 2011) and psychological research on teamwork has been inconsistent and fragmented (Eduardo Salas, Sims, & Burke, 2005). There is a limited amount of research examining how emergency teams in general operate in naturalistic environments (Waring, Moran, & Page, 2020) and a scarce amount of research on SCGs. As traditional research on teamwork is often based on more artificial and low-stakes settings, this limits the application of the findings (Power, 2018). Moreover, the findings available from emergency management research are often not known or used by decision makers in actual incidents (Piotrowski, 2010).

The principal objective of this thesis is to understand the process of group decision-making by SCGs. One clear imperative – from a policy and practitioner perspective – is to assess the extent to which SCG decision-making processes adhere to UK doctrine in the form of the JDM. In spite of the importance of the JDM

in the UK public sector and its integral role in responding to major incidents, there has been no research on the way that the JDM is used by SCGs to support decision-making.[1] This is perhaps unsurprising because such emergencies are relatively rare, heterogeneous, and there are attendant logistical difficulties with studying SCGs in operation. Moreover, as with the study of any single case, there is the risk that what is observed reflects the specific composition of that SCG rather than a general feature of the operation of such groups. Recognising the need to study many SCGs rather than a single group, this thesis examines the response of twenty-four SCGs, at simulated large-scale emergency exercises. Of course, the need for reproducibility and the forms of analysis and conclusions that it affords, has an associated cost: simulated emergencies might not be representative of real emergencies. I will have cause to return to this compromise at several points during this thesis.

It is also important that in studying group decision-making, unobtrusive, real-time measures that are sensitive to team performance in context are used (Salas et al., 2008). For these reasons, in the research reported in this thesis, SCG meetings were video recorded and the use of the Joint Decision Model was studied in the context in which the model was intended to be used.

Under these conditions, one theoretically tractable issue is whether or not the different groups approach an emergency in a consistent fashion (e.g., with respect to the sequences of phases identified in the JDM). Systematic deviations in either the frequencies of the phases used, or their sequencing, will be of fundamental

[1] The research published since my PhD was initiated included the results described in Chapter 3 (Wilkinson, Cohen-Hatton & Honey, 2019), and research using a similar approach and reporting broadly consistent results (Waring, Moran & Page, 2020).

relevance to training and strategic guidance for the response to large-scale emergencies.

The approach outlined above can be summarised as aiming to combine the reproducibility of traditional decision-making studies with the realism advocated by the paradigm of Naturalistic Decision Making.

Chapter 3 uses this approach to examine the responses of two sets of 9 SCGs (total 18) to identical simulated emergencies and also included a succession of 6 SCGs responding to a large-scale simulation (Exercise Unified response), which took place over a four-day period in London. As already noted, given the fact that the categories and sequences within the JDM sometimes cut across natural decision-making categories (e.g., the plan formulation phases of 'assess risks and develop a working strategy' and 'identify options and contingencies' are separated in the JDM), Chapter 4 coded the responses of the SCGs using more generally applicable decision-making categories of situation assessment, plan formulation and plan execution. In this way, the adherence of the SCGs to the JDM could be investigated (in Chapter 3), and the generality of the conclusions based on that analysis could be assessed (in Chapter 4). Before moving to these empirical chapters, Chapter 2 describes the timeline of the development and scale of the simulations that formed the basis of the research, as well as the context within which those scenarios were developed.

Chapter 2

Development of major incident emergency scenarios

2.1 Introduction and context

This chapter outlines the three exercises that provided the basis for the research reported in Chapters 3 and 4. The exercises, year and locations in which data was gathered were as follows:

Study 1:

Exercise Wales Gold 1, 2015, Mid and West Wales, South Wales, East Wales,

and,

Exercise Wales Gold 2, 2016, Mid and West Wales, South Wales, East Wales.

Study 2:

Exercise Unified Response, 2016, London.

My interest in group decision-making at major incident emergencies reflected my professional role within emergency planning. I registered for a part-time PhD on the 1st October 2014. During the first 4 years of registration I was employed as a Civil Contingencies Coordinator at the Dyfed Powys Local Resilience Forum (LRF). The purpose of an LRF is to provide, for legally defined agencies required to respond to emergencies, a systematic, planned and coordinated approach to: risk; planning for emergencies; coordinating multi-agency training and exercise events, and learning and implementing lessons (Cabinet Office, 2013b). LRFs are based on the geography of police force areas and there are 4 LRFs in Wales and 39 in England.

The research reported in this thesis is linked to this position, where my role enabled me to record SCG meetings during exercises over a two-year period. In 2016 my position and research interests, coupled with Dr Sabrina Cohen-Hatton's role within London Fire Brigade, facilitated involvement in Exercise Unified Response. The data analysis for the three exercises was completed by the end of 2018. Since January 2018 I have been employed as the Emergency Planning and Business Continuity Manager at Public Health Wales with responsibilities including National Health Service (NHS) and multi-agency planning for Brexit and the response to COVID-19.

As already noted, the results from Chapter 3 were reported in Wilkinson, Cohen-Hatton and Honey (2019), and some of the principal results and conclusions have received independent support from an analysis of SCG meetings, and Tactical Coordinating Group (TCG) meetings from two simulated major incident emergencies using very similar methodology and analysis to that reported in this thesis (Waring et al., 2020).

2.2 Development of Exercise Wales Gold 1

A key purpose of Exercise Wales Gold 1 was to establish a training and exercise package that would prepare attendees to participate in a Strategic Coordinating Group (SCG) as specified in national guidance (Cabinet Office, 2013a) and occupational standards (Skills for Justice, 2008). This exercise was developed in 2011 by a team of emergency planning specialists (including myself) from Welsh Government, the Emergency Services, the National Health Service (NHS), environmental agencies and local government. This team was part of the Wales Learning and Development Group which is chaired by the Joint Emergency Services Group Coordinator for Wales. The Joint Emergency Services Group is a collective

of the senior levels of all the emergency services and the armed forces in Wales. It agrees a strategic approach across all organisations to meeting the requirements of the Civil Contingencies Act 2004 and enhance civil protection in Wales.

The scenario of Exercise Wales Gold 1 (henceforth Wales Gold 1) was based on a real-life major incident fire in 2011, in Swansea, South Wales. The fire began on 16 June and involved about 5,000 tonnes of smoldering tyre waste. In order to extinguish the fire, the factory building housing the waste was demolished, the burning material was removed in sections and placed in large water-filed tanks and temporary dams created on site. The fire took 23 days to put out. This event was declared a major incident emergency, and an SCG was established to make decisions on: the ongoing potential for evacuation; impacts on the health of the population; economic and transport disruption, warning and informing the public, and the strategy for recovery.

I was commissioned to undertake the multi-agency debrief report of the response to this fire (Wilkinson, 2011). The debrief report required facilitating detailed discussions that reflected on the response at all tiers or command: namely operational, tactical and strategic. Undertaking this work provided a comprehensive understanding of the decisions faced by responders in this real-life incident and informed the development of the scenario for Wales Gold 1. An aerial picture of the early stages of the fire in 2011 is shown below.

As Wales Gold 1 was delivered within the geographic borders of the four police force areas in Wales, the content of the scenario such as locations and media clips were localised to reflect the region in which it was taking place.

2.2.1 Exercise Wales Gold 1 Overview

Below is the summary and overview of the exercise that was used by staff running the events. The scenario and decision sections (pages 45-46 and 47-48) are intended to be read side-by-side.

Exercise Wales Gold

An overview of the purpose and content of Exercise Wales Gold which is taking place in the Gwent, South Wales and Dyfed Powys LRF regions in 2015

WALES LEARNING AND DEVELOPMENT GROUP

Overview v1.0

Aim

To train and exercise senior personnel from organisations that may chair or be a member of a Strategic Co-ordinating Group (SCG) on their roles and responsibilities.

Objectives

1. To strengthen strategic multi-agency working relationships and provide a realistic learning environment
2. To train and exercise personnel on the Joint Emergency Services Interoperability Principles (JESIP) doctrine
3. To create multi-agency discussion and reflection on how to improve collectively planning for and responding to 'Major Incident' emergencies

Format

Training followed by multimedia exercise play in 3 separate SCGs.

Regular 'break out' plenary sessions will discuss responses to the 'Major Incident'.

A 'Diamond panel' of subject matter experts will give observations on good practice and areas for improvement.

Pre-exercise training

A 2 hour interactive training presentation on how to participate in an SCG. The Joint Decision Model (JDM) will be introduced and should be used by SCG members in collectively agreeing decisions.

Scenario | Day 1

SCG 1 - Fire

The facilitator notes that an SCG has been called to deal with a fire in two adjacent units on an industrial estate.

The dual carriageway and railways have been closed due to smoke. There are concerns that burning chemicals may pose a health risk.

- As the first inject the SCG members receive a video update from the Police Silver Commander. The fire will not be extinguished before 8pm today

SCG 2 - Chemicals, environment, media

- Chromium trioxide identified, dead fish in nearby stream, hospital admissions are taking place due to the incident, a CHEMET report is delivered, sensitive environmental receptors are affected
- Media interest expressed via two video injects - i.e. Dr. Dianne Dexter (alarmist portrayal of events) and Bruce Mantrap (explaining Command and Control structures) - what is the SCG's media strategy?

SCG 3 - Evacuation

- Should Ty Cwm vulnerable residents be moved?
- MET Office update - factors for and against evacuation requested
- Advice received from STAC to evacuate
- Silver update notes that an evacuation has taken place

Decisions | Day 1

Initial Scenario

Plenary 1

- Notification, activation and triggers, SCG Chair
- What are the individual agency priorities and strategic priorities?
- What are the consequences of closing the road and railway?

CHEMET example

Plenary 2

- How did the new information at the start of SCG affect the response
- What is the direction to Silver?
- What is the media strategy?
- Impact on community
- Should evacuation be a priority?

Should responders evacuate residents?

Plenary 3

- Factors for and against evacuation?
- What would have been done if STAC advised against evacuation—how would the SCG communicate this to Silver?
- Facilitator to highlight the role of STAC from within Diamond panel

Scenario | Day 2

SCG 4 - Welsh Government, media

- First Minister briefing request (delivered by Welsh Government Liaison Officer within SCG)
- Reality radio, and social media comments
- Deaths reported, Secretary of State interest and Wushi electronics

SCG 5 - Moving to Recovery

- Day 2 SitRep video from Silver Commander - LRF recovery plan issued
- Task: Organisational priorities, agenda, joint priorities and actions for the next 3 days, what organisations are missing from the group?
- Political visits by First Minister and Secretary of State

RCG 1 - 1 week later

- Situation update 1 week on
- Councilor offering help
- FOI in relation to STAC guidance
- Questions regarding decontamination and cost recovery

RCG 2 - 3 months later

- Future health risks highlighted
- 12 families still in temp accommodation including an Assembly Member
- Cockle beds condemned but Wushi opened
- Businesses have lost money, insurance claims yet to be settled
- Requests for a public inquiry

Decisions | Day 2

Plenary 4

Social Media praise and criticism

- Review of communications strategy
- Impact of political interest
- Wider economic and UK interests and impacts

Plenary 5

Recovery document

- How to manage engagement with those most affected ?
- What is the process for deciding when the SCG passes from the Police to the Local Authority?

Plenary 6


Horizon scanning

- Move to the Recovery phase. Appoint a Chair and decide your rationale regarding your short, medium and long-term recovery priorities

Plenary 7


Were decisions justified?

- What is the RCG's strategy to manage these developments?
- If there was an inquiry what would SCG and individual agency decision logs demonstrate?

Closing actions

Accreditation

Delegates will complete a reflective learning journal during the two days of the event.

Post-exercise each delegate must write a substantial written report to be accredited

Further resources

The plans, documents and training events of the LRF area should be outlined.

The JESIP and Resilience Direct websites should be noted.

Any relevant handouts such as the Joint Decision Model, SCC activation documents and so on should be distributed.

'A detailed and well practised understanding of the JDM will facilitate clear and ordered thinking under stress.'

Closing address - Feedback and review

Open forum discussion about the event and what needs to be done in terms of plans, training and future exercises both within organisations and through the LRF.

Further resources (above) should be noted.

Feedback forms to be handed out.

2.3 Development of Exercise Wales Gold 2

By 2015, Wales Gold 1 had been delivered annually for four consecutive years, and members of the design and delivery team acknowledged that the scenario of the exercise should be changed to reflect other emergency risks faced by responders in the UK. This instigated the design and build of Exercise Wales Gold 2 (henceforth Wales Gold 2) by a planning team that I chaired which included members of the Wales Learning and Development Group. Rather than focus on a specific real life incident, as in Wales Gold 1, Wales Gold 2 used the National Risk Register to build its scenario (Cabinet Office, 2015). By identifying the recurring consequences of the risks faced by the UK - fatalities, casualties, social disruption, and economic and psychological impacts - the key themes of decision-making topics in Wales Gold 2 were identified. The research reported in this thesis was based on the final Wales Gold 1 exercise (2015) and the first Wales Gold 2 exercise (2016); and was complemented by research from Exercise Unified Response (see below).

A fundamental consideration in developing Wales Gold 2 was to ensure the scenario prompted multiple opportunities for collective decision-making. Specific events and decision dilemmas were included to replicate the 'wicked problems' (Rittel & Webber, 1973) of real-life emergencies and to include incomplete and ambiguous information where decisions nonetheless have to be made in time-limited circumstances. In contrast to Wales Gold 1, the scenario for Wales Gold 2 was based in a fictional location called 'Anytown'. The rationale for choosing a fictional location was to seek to remove the differences in prior knowledge and experience of site-specific locations amongst participants in the exercise. By having a level playing field amongst the participants in terms of the knowledge of the demographics, geography, resources and infrastructure of the location in which they

were responding as an SCG, it was presumed this would help engender collective responsibility for decision-making.

2.3.1 Exercise Wales Gold 2 Overview

Below is the summary and overview of the exercise that was used by staff running the events. The scenario and decision sections (pages 54-55 and 56-57) are intended to be read side-by-side.

Exercise Wales Gold 2

An overview of the purpose and content of Exercise Wales Gold which is taking place across the LRF regions in Wales from 2016-19

WALES LEARNING AND DEVELOPMENT GROUP

Overview v1.0

Aim

To train and exercise staff from organisations that may chair or be a member of a Strategic Co-ordinating Group (SCG) on their roles and responsibilities.

Objectives

1. To strengthen strategic multi-agency working relationships and provide a realistic learning environment
2. To train and exercise personnel on the Joint Emergency Services Interoperability Principles (JESIP) doctrine
3. To create multi-agency discussion and reflection on how to improve collectively planning for and responding to 'Major Incident' emergencies

Format

Training followed by multimedia exercise play in 3 separate SCGs. Group decisions are recorded by a Loggist.

Regular 'break out' plenary sessions will discuss responses to the 'Major Incident'.

A Diamond panel of subject matter experts provide constructive observations relating to good practice, areas for improvement and lessons from their own experience of emergencies.

Pre exercise training | Joint Decision Model

An instructive presentation and group activity on how to participate in an SCG. The Joint Decision Model (JDM) should be used by SCG members in collectively agreeing decisions.

Scenario 1 Day 1

SCG 1 - HGV, Train Crash, People, Environment

SCG members receive individual agency updates prior to this meeting.

INJECT: videoconference from the Tactical Coordinating Group (TCG):

- An HGV and train crash has occurred, casualties and fatality numbers are indicated
- The HGV was carrying a substance that may be hazardous
- Crash site access is limited, 2 hours daylight remains

SCG 1 - People, Environment, site access

INJECTS : An urgent teleconference update and CHEMET:

- Teleconf: Toxic substance has caught fire there's a plume of toxic smoke and responders are in danger.
- CHEMET: sent to the Fire service rep —the burning substance is hazardous to health and the environment.

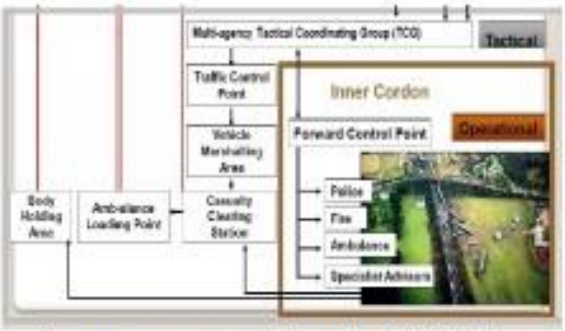
SCG 2 - Evacuation, horizon scanning

Individual agency updates are provided to attendees prior to this SCG.

- **INJECT:** TCG teleconference update reports that they have resources to remove and transport majority but not all caravan residents— tell us in the next 30 mins, do you want us to evacuate or not?
- **INJECTS:** update from Fire Service on Tolulene and Air quality monitoring info provided to SCG. The health of caravan site residents is at risk
- **INJECT:** phone call from TCG chair - give us your decision and rationale on whether or not to evacuate residents. How are you going to communicate this decision to residents?

Decisions | Day 1

Plenary 1



The METHANE mnemonic is used in the initial SitRep from the TCG

- How was SCG Chair appointed?
- What are the Strategic objectives and has a Major Incident been declared?
- Was Horizon scanning, mutual aid and Recovery considered?
- What other resources or agencies could the SCG request?

Plenary 1

CHEMET example

- Are responders and the public safe?
- Was mutual aid requested?
- Was a temporary mortuary considered?
- Was STAC requested?

Plenary 2

Should responders evacuate residents?

- How was the JDM used to decide whether or not to evacuate?
- Were longer term issues considered? (e.g. health, environment, transport, economy)

Scenario | Day 2

SCG 3 - The next day

INJECT: Generic update provided to all SCG members

- The fire has been extinguished, a significant amount of toluene is in the immediate environment. No drinking water for at least 36 hours. Major fish kill confirmed on the tributary. Media presence intrusive.
- Majority of traveller site residents were evacuated (either by responders or by their own choice). Air quality monitoring in place
- Identification of deceased, injured and missing is becoming a key issue
- Friends and Family Reception Centre established but overwhelmed

RCG 1 - Recovery Coordinating Group

Micro teach: Recovery Coordinating Group presentation given to attendees

INJECT: Timeline of last 7 days outlined by facilitator

RCG meeting starts with a template agenda, RCG Terms of Reference and RCG Sub Group update.

A prompt is given to appoint a Chair and ensure all decisions and rationales are logged.

Decision logs

All attendees are given a print out of the decision logs of their SCG records.

A collective discussion will be facilitated by Solicitor Advocate Mark Scoggins to review the decisions taken by SCGs.

Issues such as documenting the rationale for decisions and the importance of accurate and timely log keeping will be covered paying reference to lessons identified and the review of recent emergencies in the UK and abroad.

Decisions | Day 2

National media interest

Social Media praise and criticism

Plenary 3

- What were the short, medium and longer terms decisions made by the SCG?
- Key issues include: drinking water impacts, environment concerns, Media coverage, welfare of evacuees, identification of deceased, injured and missing, friends and family reception Centre

Recovery documents to be noted

Plenary 4

- Bearing in mind recovery requirements, what changes would attendees make to how their SCG operated in the exercise?
- What is the role of Welsh Government and how does the Emergency Financial Assistance Scheme (EFAS) work?

Were decisions justified?

Judicial Review

- What would the SCG do differently having reviewed their decision log?
- Does the SCG decision log support the judgment regarding evacuation?
- What is the collective feedback and learning from the event?

Closing actions

Closing address

A video of thanks from Chief Constable Peter Vaughan, South Wales Police, acknowledging the previous successful and collective response to emergencies and the value of agencies in Wales training and exercising together.

Further resources

The plans, documents and training events of the LRF area should be outlined.

The JESIP and Resilience Direct websites should be noted.

Any relevant handouts such as the Joint Decision Model, Major Incident Plan and so on should be distributed.

'A detailed and well practised understanding of the JDM will facilitate clear and ordered thinking under stress.'

Accreditation

Delegates will complete a reflective learning journal during the two days of the event.

Post-exercise each delegate must write a substantial written report to be accredited

2.4 Exercise Wales Gold delivery

The scenarios used in Wales Gold 1 and Wales Gold 2 were delivered using Hydra simulation suites that consisted of a control room (left-hand photograph) and SCG meeting room (right-hand photograph).

2.5 Exercise Wales Gold recognition and accompanying events

In 2016, Exercise Wales Gold 2 was shortlisted by the Emergency Planning Society as ‘Emergency Planning Initiative of the Year’ and the team that developed the exercise were shortlisted as ‘Resilience Team of the Year’. In 2017 the same team that developed Wales Gold 1 and 2, the Wales Learning and Development group, produced an accompanying one-day long tactical level training and exercise package titled ‘Wales Silver’. In 2018 and 2019, Exercise Wales Gold 3 was developed (with my input as a member of the planning team) and includes, again reflecting the National Risk Assessment for the UK, a scenario based on terrorism and infrastructure/electricity failure.

2.6 Development of Exercise Unified Response

The main aims of Exercise Unified Response (EUR) were to: test the UK’s ability to activate the European Union Civil Protection Mechanism (EU CPM);

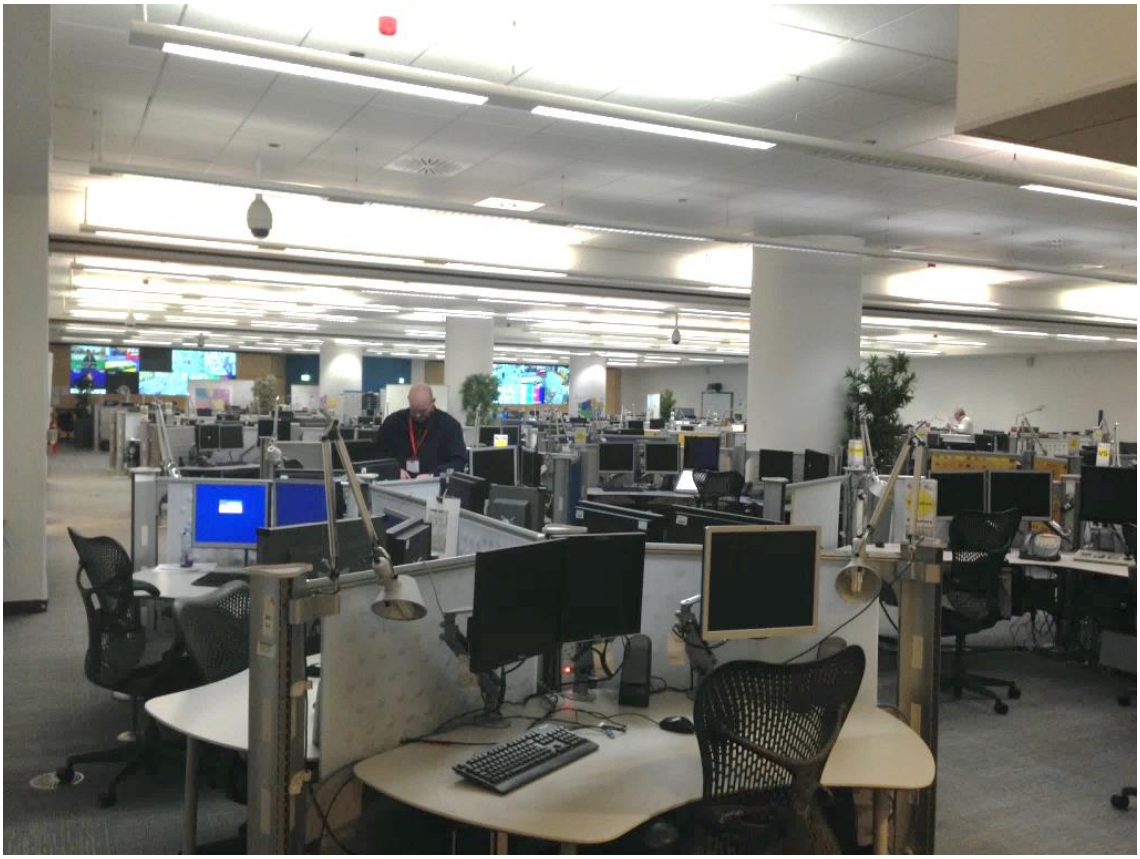
improve London's preparedness to respond to large-scale emergencies; and improve integration of emergency service personnel with colleagues from a wide variety of partners. EUR took two years to plan and deliver and was co-funded by the European Union. It was conducted simultaneously over four days in a number of locations across London, with its centerpiece being a building collapse at Waterloo train station. For the purpose of exercise 'play', Waterloo train station was re-created in a disused power station in Dartford. This scene, parts of which are depicted in the photographs below, became the focus for an event that was designed to test London's arrangements to respond to a large-scale emergency and ensure that these can be effectively integrated with support from elsewhere in the UK and Europe.

EUR involved 4,000 responders and 2,500 casualty volunteers. Approximately 1,700 'injects' depicted the wider effects of the emergency, such as those impacting on transport, health and the community. There were 2,500

volunteer casualties involved across the four days; each had an individual profile and was ‘tracked’ during the exercise through ‘the journey’ that affected persons will take following a major incident.

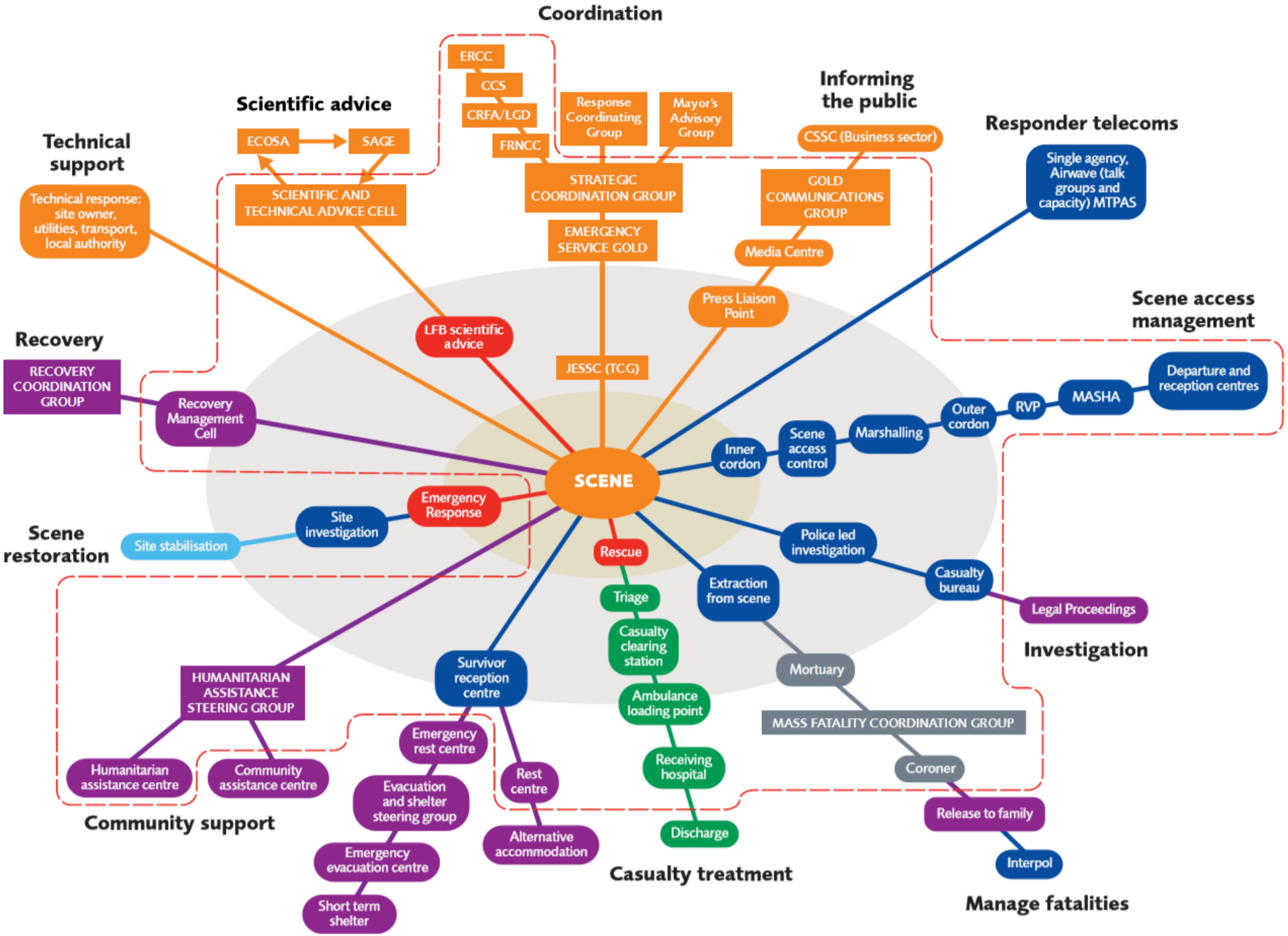
EUR resulted in the Fire service invoking national and international arrangements for search and rescue; the Ambulance service and the NHS activating arrangements for triage and casualty clearing; hospitals instigating their major incident plans to receive casualties from the scene; Police initiating investigative procedures and setting up a casualty bureau; and, with the support of local government, the establishment of a temporary mortuary and survivor reception centre. EUR delivered an end-to-end test of London’s resilience at all levels of response, from front line responders, up to central government and European coordination.

To coordinate this response, six Strategic Coordinating Group (SCG) meetings were held, and there was liaison up to central government (COBR). Unlike most emergency exercises, EUR went beyond the immediate dynamic phase of the incident to test aspects of the consolidation and recovery phases of response. (This is also true of exercise Wales Gold 1 and 2). The SCG worked from and met in the Metropolitan Police Service Special Operations Room facilities in Lambeth, Central London (pictured below).



Below is one of the SCG meetings from Exercise Unified Response.

On the page below are the command and control structures initiated during Exercise Unified Response over which the SCG had decision-making responsibility.


Coordination
ERCC
CCS
CRFA/LGD
FRNCC
Response Coordinating Group
Mayor's Advisory Group
STRATEGIC COORDINATION GROUP
EMERGENCY SERVICE GOLD
JESSC (TCG)
Scientific advice
ECOSA
SAGE
SCIENTIFIC AND TECHNICAL ADVICE CELL
LFB scientific advice
Technical support
Technical response: site owner, utilities, transport, local authority
Informing the public
CSSC (Business sector)
GOLD COMMUNICATIONS GROUP
Media Centre
Press Liaison Point
Responder telecoms
Single agency, Airwave (talk groups and capacity) MTPAS
Scene access management
Departure and reception centres
MASHA
RVP
Outer cordon
Marshalling
Scene access control
Inner cordon
Recovery
RECOVERY COORDINATION GROUP
Recovery Management Cell
SCENE
Emergency Response
Site investigation
Site stabilisation
Scene restoration
Rescue
Triage
Casualty clearing station
Ambulance loading point
Receiving hospital
Discharge
Casualty treatment
Police led investigation
Casualty bureau
Legal Proceedings
Investigation
Extraction from scene
Mortuary
MASS FATALITY COORDINATION GROUP
Coroner
Release to family
Interpol
Manage fatalities
Survivor reception centre
Emergency rest centre
Rest centre
Alternative accommodation
Evacuation and shelter steering group
Emergency evacuation centre
Short term shelter
HUMANITARIAN ASSISTANCE STEERING GROUP
Humanitarian assistance centre
Community assistance centre
Community support

2.7 Exercise Unified Response Delivery

The delivery of EUR relied on the successful coordination between a large number of different locations, including the four main exercise sites at Littlebrook power station, Woolwich Army barracks, the London Fire Brigade headquarters, and the Metropolitan Police Service Special Operations Room where SCG meetings were held. The exercise was facilitated by 300 staff representing all the organisations that had been involved in EUR's planning. Each of the four days was run in accordance with a structured daily rhythm, with exercise activity taking place between 10:00–20:00hrs.

2.8 Evaluation and methodology

An evaluation framework for the exercise was developed with input from the universities of Cardiff (Byron Wilkinson, with Philip Butler, Sabrina Cohen-Hatton, and Robert Honey), Liverpool and Portsmouth and the Cabinet Office Civil Contingencies Secretariat. During EUR, over 1,700 observations were recorded in 'real time' on tablet computers, by 30 evaluation teams who were deployed across all exercise locations. These observations were combined with information gathered from single service and multi-agency debriefs, participant surveys, video materials, interviews and the output from an evaluation conference to provide a comprehensive Evaluation report (London Fire Brigade, 2017). One facet of this was the availability of the video footage from the SCG meetings for independent analysis. The analysis of SCG footage that formed the basis for Study 2 in Chapter 3 matched the analysis that I had already initiated in the context of Wales Gold 1 and 2 (Study 1).

2.9 Funding and support for this coproduced research

I was supported by a part-time PhD studentship awarded by the School of Psychology, which also provided additional funding and resources (e.g., for the recording equipment used at Exercise Unified Response). The development of the research was also partly supported by an Economic and Social Research Council Impact and Acceleration Account fund, administered by Cardiff University (ES/M500422/1), which enabled my secondment to analyse the results and develop technical reports for the emergency services. I thank the participants from Exercise Wales Gold 1 and 2, the members of the Strategic Coordinating Groups at Exercise Unified Response, and our colleagues who contributed their time and expertise. I also thank the London Fire Brigade, who led Exercise Unified Response, and the European Commission, who co-funded this exercise. Specific thanks are reserved for Richard Abbot and Martin Corbett (London Fire Brigade) and Dave Musker (Metropolitan Police) who facilitated and supported my involvement in Exercise Unified Response at every point. Robert MacFarlane provided insightful comments on the research reported in Chapter 3.

Chapter 3

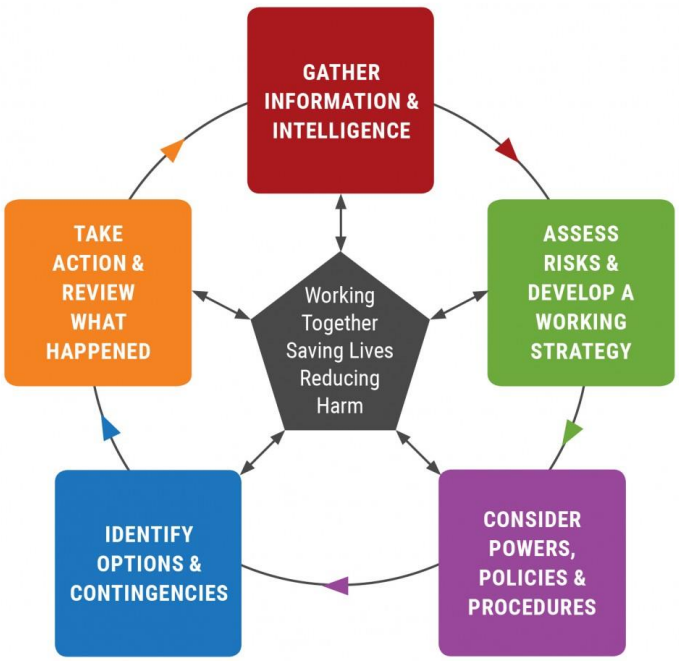
Strategic decision-making in multi-agency groups: In situ analysis of adherence to UK doctrine

3.1 Abstract

When there is a major incident emergency in the UK (e.g., a terrorist attack, a large-scale fire, or a natural disaster) a group of senior representatives form a Strategic Coordinating Group (SCG) from local emergency services, civil resource organizations, health agencies, and government. This group is charged with making decisions that help to minimize the immediate and ongoing societal and economic impacts of major incidents; and their approach to decision-making is supported by national doctrine – namely, the Joint Decision Model (JDM). Study 1 and Study 2 assessed the adherence of multi-agency groups to this decision-making model during simulated major incident emergencies. To do so, video footage was taken of 18 groups responding to a major incident during a single session in a simulation suite (Study 1), and from 6 groups responding over the course of an extended, large-scale exercise (Study 2). This footage was independently coded as sequences of decision-making activities. Analysis of the sequences revealed systematic departures from the UK doctrine, including marked between-group differences in the sequencing of activities and limited consideration of alternative courses of action. These results provide an impetus for future policy, guidance and training to address (i) between-group inconsistency in decision processes, and (ii) the lack of consideration of alternative courses of action.

3.2 Simulated major incidents

To provide a detailed (real-time) analysis of the use of the JDM, this thesis studied 18 multi-agency groups who faced simulated major incidents (Study 1) and 6 consecutive SCG meetings over the course of four days in response to a large-scale exercise. There have been previous studies of how multi-agency groups respond to simulated major incidents, which have made use of immersive simulation suites in which the groups are convened and respond to a virtual event (e.g., Crego, 1996; see also, Power & Alison, 2017; van der Haar et al., 2017; for a review, see Alison, van den Heuvel, Waring, Power, Long, O'Hara, & Crego, 2013). In Study 1, this approach was adopted in order to investigate the use of the JDM by 18 SCGs who were responding to the same simulated emergency within a single critical meeting. In this study, the meetings were recorded and the decision-making sequences, involving the five JDM activities (reproduced below), were derived from these recordings.



Coding the sequences using these five categories provides a common frame of reference for researchers and practitioners (see Appendix 1 for the Coding dictionary). If the provision of the JDM engenders similar processes of group decision-making, then the sequences of activities should be correspondingly similar across different groups and should match those described by the JDM. However, if there are *marked differences* in the sequences of decision-making activities between different groups or from those embodied in the JDM, then the nature of such differences will provide an important evidence base for future policy, guidance and training. To take one example, if decision inertia affects decision-making in an SCG then this might be evident in repeated cycles of transition between gather information and develop a working strategy, or a general reluctance to take action (cf. Alison et al., 2015; see also, van den Heuvel et al., 2014). Study 2 assessed the generalizability of important components of the results from Study 1 using the same methodology. It involved 6 successive SCG meetings that occurred over the course of a large-scale exercise that involved *live play* conditions and more closely matched a real major incident emergency. Here, the SCG meetings were an ongoing component of an event that included the recreation of a London Underground tunnel collapse, with the extended fallout that such an event would have on society and the economy.

The specific research questions and null hypotheses that underpinned the analysis of the use of the JDM by SCGs in Studies 1 and 2 were as follows:

1. What is the distribution of decision-making activities during independent SCG meetings? Null hypothesis: Each of the decision-making activities will be equally represented (given the assumption that the groups follow the sequence in the JDM).

2. Is the sequencing of decision-making activities consistent during independent SCGs? Null hypothesis: The sequence of decision-making activities will not differ across groups (given the assumption that the groups follow the sequence in the JDM).

3. What is the distribution of decision-making activities across successive SCG meetings? Null hypothesis: Each of the decision-making activities will be equally represented across successive SCG meetings (given the assumption that the groups follow the sequence in the JDM).

4. Does the sequencing of decision-making activities change across successive SCG meetings? Null hypothesis: The sequence of decision-making activities will not differ across successive SCG meetings (given the assumption that the groups follow the sequence in the JDM).

3.3 Method

3.3.1 Participants

Study 1. Eighteen multi-agency groups attended two-day national training and exercise events in Study 1 (9 groups from Exercise Wales Gold 1 and 9 groups from Exercise Wales Gold 2; see Table 1 for additional information). The total number of participants in Study 1 was 147. Each training event consisted of opportunity samples of participants who had applied and were selected by their agencies to take part on the basis of prior involvement in an SCG, having been on call to attend an SCG, or the possibility of future involvement in an SCG based on their rank. Participants were employed by the emergency services (Ambulance Service, Fire and Rescue Service, and Police), Health Boards, Local Government, Natural Resources Wales, and Public Health Wales, and ranged in seniority from

Chief Executive level to a recently promoted Police Chief Superintendent. The experience of participants varied considerably: some had served as a member of a SCG or had undertaken some relevant training to prepare them for such a role, while others had received no formal training for a role in SCGs. However, the groups were composed of participants who could, if an immediate need arose, be part of SCGs faced with a major incident. The participants from Study 1 provided informed consent for their participation in accordance with ethical approval through Cardiff University; and those in Study 2 (from Exercise Unified Response, EUR) provided informed consent through their agencies.

Study 2. The participants in the SCGs in Study 2 represented the emergency services (City of London Police, London Ambulance Service, London Fire Brigade, Metropolitan Police), Civil Contingencies Secretariat, City of London Corporation, Department of Communities and Local Government, Department of Health and Social Care, Environment Agency, Transport for London and London Underground Limited. They were selected on the basis of their seniority and experience. There was a core set of participants that attended each of the 6 SCG meetings, and there was some turnover in participants over the course of the exercise. For example, the Chair of the SCGs changed across the meetings: SCG meetings 1 and 2 (a male representative of the Metropolitan Police), and meetings 3-6 (a female and a male representative of the Local Government; see Table 1 for additional information). A majority of the participants in Study 2 participated in more than 1 SCG meeting; but the total headcount (including multiple attendances by the same person as part of the count) was 142.

Table 1: Group composition

	Mean (SEMs and ranges)	Female : Male
Study 1	8.22 (0.26; 6-10)	1 : 2.22
Study 2	23.67 (1.28; 20-28)	1 : 2.97

3.3.2 Procedure

Study 1. At the start of each event, all participants took part in an interactive training session that lasted for approximately one hour. This session covered the consistent and nationally recognized UK emergency command control and coordination structures (Cabinet Office, 2013a), the decision-making role of SCGs, and the use of the nationally endorsed model for making collective decisions in an emergency (i.e., the JDM). The virtual timeline of the scenarios extended from the afternoon of Day 1, when the incident was declared, through to 3 months later through intermediate time points (evening of Day 1, Day 2 and 1 week later).

Hydra simulations. The Study 1 scenarios were delivered using Hydra immersive simulation systems (Crego, 1996). Hydra provides a 'syndicate room' for each group, which was equipped with a large screen projector, PC, wireless keyboard and mouse, printer, and CCTV. Large posters of the JDM were displayed prominently on the wall of each of the syndicate rooms and were visible to all participants. The PC ran a communication interface that was permanently displayed on the projector screen and delivered information updates ('injects') and tasks to the groups. Exercise control staff also received and responded to all written communications sent by the groups using the Hydra communicator. GoPro cameras (GoPro Hero 3, Half Moon Bay, USA) and CCTV were used to record meetings in Studies 1 and 2.

Study 1 scenarios. Both scenarios were multi-faceted, dynamic, and involved time pressure, and were combined for the purposes of analysis (see Chapter 4 for a separate analysis of the two scenarios). The scenarios were developed so that there were not explicitly correct or incorrect critical decisions and that all agencies would be engaged. They were managed by control room staff who delivered scripted updates on the scenario at pre-defined times via tasks, video and audio clips, and printed documents. The first scenario began with a video update from the Police tactical commander. This update stated that there was a large-scale chemical fire at an industrial site and the nearby road network and railway line were closed due to the resulting plume of smoke. The scenario then developed into a serious environmental and economic incident with media impacts that required decisions on longer-term recovery issues regarding health impacts, housing, decontamination and economic recovery. The second scenario also began with a video update from the Police tactical commander, which included information about a crash between a passenger train and a truck carrying a hazardous substance. The crash caused many fatalities and injuries to passengers. Within the first hour of the incident a fire ignited, burning the hazardous substance and sending a toxic plume of smoke over a residential area. Across the two days of the event, the groups took part in meetings that were approximately 45-60 min, during which they made decisions in response to the evolving incident. The analysis for Study 1 was conducted on the critical second SCG meeting. In this meeting there was time pressure and the groups were required to make critical decisions involving providing direction to those involved in tactical operations, what their media strategy would be (Exercise Wales Gold 1); and whether or not to evacuate a nearby caravan site,

under conditions where the resources were not available to evacuate everyone and the toxic effects of the plume were unclear (Exercise Wales Gold 2).

Study 2 scenario. Study 2 was based on a large-scale exercise involving the collapse of the London Underground at Waterloo Station. Exercise Unified Response extended over four consecutive days and represented the largest emergency response exercise ever undertaken in the UK. It involved multiple sites and the SCGs met in one of the special operation rooms in a Police headquarters in central London. The 6 scheduled SCG meetings started at 1700 on Day 1, at 1200 and 1700 on Day 2, at 1200 and 1700 on Day 3, and at 1200 on Day 4; and the duration of the meetings ranged from 45 to 65 min. The SCGs interfaced with a tactical command group, a gold command group, and Cabinet Office Briefing Room (COBR). There was also a Media Cell, Recovery Group, Mass Fatalities Group, and Scientific and Technical Advice Cell (STAC). The SCGs received information from the site where the London Underground collapse was created, complete with buried carriages, over 4000 responders, and 2500 trapped casualties, many with realistic stage make up and injuries.

3.3.3 Coding of activity

The audio-video recordings were coded using the categories of activity from the JDM: gather information and intelligence (e.g., “We need more information about how injuries were sustained”); assess risks and develop a working strategy (e.g., “What is the risk of evacuating people?”); consider powers, policies and procedures (e.g., “Can we control the airspace to legally prevent helicopters from taking footage?”); identify options and contingencies (e.g., “If we move people out and the fire burns for two weeks where will they go?”); and take action and review what happened (e.g., “Initiate mutual aid plan”). These activities were coded directly from

the videos and the codes were accompanied by notes on the same spreadsheet, which described the content of the coded activities. The activities were scored at the level of the group, independently of the individual. The fact that the meetings were chaired meant that the meetings had a coherent structure that was readily coded as a sequence of activities. Isolated comments that were either irrelevant or were not part of the discussion (e.g., informal asides, which were infrequent) were excluded from the analysis. The coding was conducted on two separate occasions (by B.W.), which resulted in a small number of the activities (< 5%) being re-classified. An independent assessor (R.C.H.) then confirmed the reliability of the coding on a sample of 30 observations from each study (≈ 95% agreement with B.W.). A lag sequential analysis (B. P. O'Connor, 1999; Sackett, Holm, Crowley, & Henkins, 1979) was used to derive the primary data of interest: the sequences of transitions between different decision-making activities in the group meetings. In this analysis, the decision-making activities were coded as a continuous stream, with repetitions of the same category removed. The lag sequential analysis stopped at the end of the SCG meetings. The resulting sequence of decision-making transitions was then compared to the binary transitions within the JDM.

3.4 Results

Summary of the statistical analyses in Chapter 3 (and Chapter 4). Within-subjects ANOVAs, with post-hoc t-tests using a Bonferroni correction for multiple comparisons, were employed to assess whether there were differences between the frequencies of the different categories of decision-making activities. Lag-sequential analyses were used to characterise the transitions between these categories. Unlike a Markov chain, lag-sequential analysis ignores repeated activities from the same category, which can be difficult to discriminate between in the context of SCG

meetings. In order to assess whether there were relationships between the different two-step transitions (across the set of groups), principal components analyses were used. The latter analyses were complemented by bivariate correlations (parametric or nonparametric, as appropriate), given the fact that the number of groups (n=18) could be deemed too low to conduct principal components analyses. Binomial tests were used with nominal level data.

1. What is the distribution of decision-making activities during independent SCG meetings? Null hypothesis: Each of the decision-making activities will be equally represented (given the assumption that the groups follow the sequence in the JDM).

I first examined the frequency with which a given category of activity took place without consideration of what happened before or after that category of activity occurred. The overall frequencies are shown in Figure 3 in the form of stacked columns. The left-most column shows the mean number of each of these categories for the 18 groups in Study 1. Three categories of activity dominated: gather information, develop strategy and take action; while the frequencies of the remaining categories (consider powers and identify options) were low. These frequencies were analysed using a mixed ANOVA, with activity (e.g., gather information) as a within-subjects factor (with 5 levels), and study as a between-subjects factor (with 2 levels: Exercise Wales Gold 1 or 2). This analysis confirmed that there was a main effect of type of transition ($F(4, 64) = 72.97$, $p < .001$, $\eta p^2 = .82$), no effect of Wales Gold 1 or 2 ($F(1, 16) = 2.74$, $p = .12$, $\eta p^2 = .15$), and no interaction between these two factors ($F < 1$). Pairwise comparisons, with a Bonferroni correction, confirmed that there were significant differences between each pair of activities ($p < .005$) with the exception of between gather information and take action ($p > .50$). The pattern

of statistical significance was: develop strategy > gather information = take action > identify options > consider powers. Therefore, the null hypothesis can be rejected.

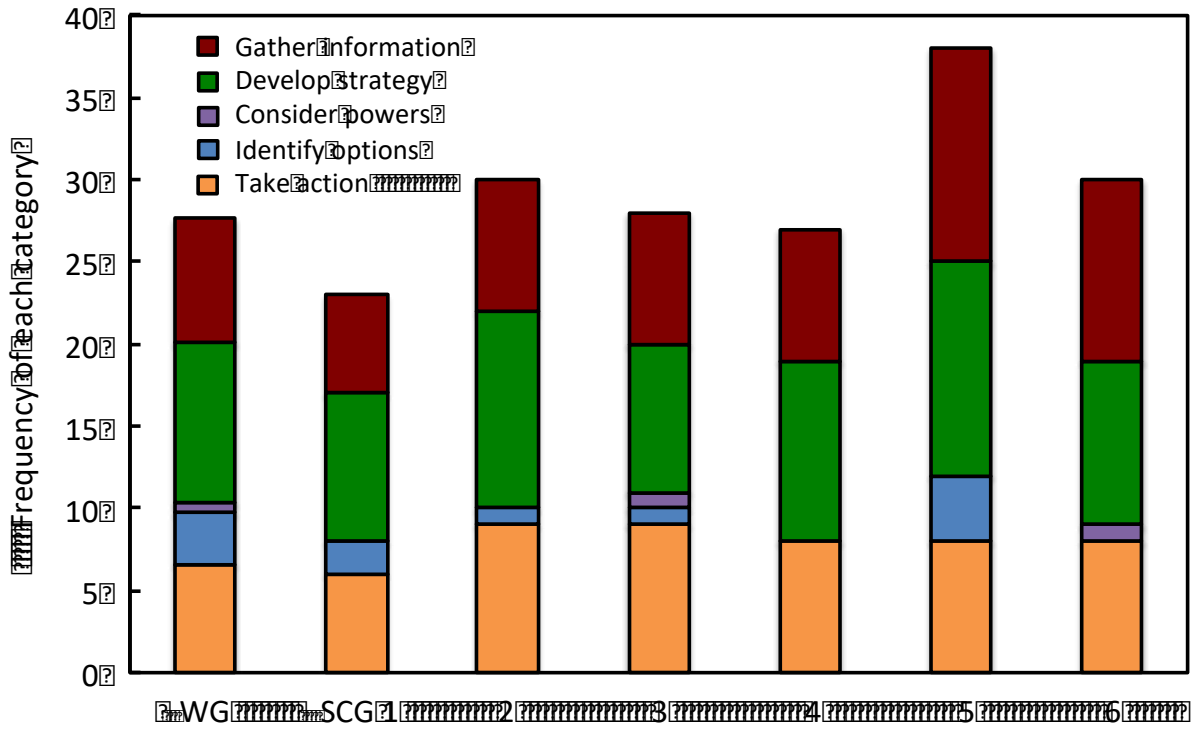


Figure 3. Study 1 and Study 2. Each bar indicates the frequencies of the five categories of decision-making activities in group meetings. The left-hand bar shows the mean frequencies for the 18 groups in Study 1 (SEMs = 0.70 (Gather information), 0.74 (Develop strategy), 0.18 (Consider powers), 0.58 (Identify options), 0.68 (Take action)). The remaining 6 bars show the absolute number of frequencies of these categories for the 6 meetings in Study 2 (SCGs 1-6).

2. Is the sequencing of decision-making activities consistent during independent SCGs? Null hypothesis: The sequence of decision-making activities will not differ across groups (given the assumption that the groups follow the sequence in the JDM).

The analysis of the results from Figure 3 showed that there was consistency across the SCGs in the overall frequency of categories and their distribution. However, this analysis does not establish whether the sequences of activities were consistent across the different groups. The mean frequencies of transition from one category to each of the other categories are shown in Table 2, together with the range of frequencies. Inspection of this table shows that the number of transitions involving the three main categories (gather information, develop strategy and take action) was higher than those involving the other categories (consider powers and identify options). This simply reflects the fact that these categories of activity were more frequent. Of more interest, is the fact that there was marked variability in the frequency of transitions involving the three remaining categories (i.e., gather information, develop strategy and take action) across the different groups; as is evident from the ranges (shown in brackets). For example, while the mean number of transitions from gather information to develop strategy was 5.39 the range was between 2 and 10 transitions across the groups. Therefore, the null hypothesis can be rejected. The basis of this variability is explored in the next section.

Table 2: Mean number of transitions in Study 1 (with SEMs and ranges in brackets)

	Gather information	Develop strategy	Consider powers	Identify options	Take action
Gather information	X	**5.39 (0.55; 2-10)**	0.22 (0.13; 0-2)	0.78 (0.22; 0-3)	**1.11 (0.30; 0-4)**
Develop strategy	**3.78 (0.57; 0-9)**	X	0.17 (0.09; 0-1)	1.05 (0.27; 0-4)	**4.67 (0.40; 2-9)**
Consider powers	0.17 (0.09; 0-1)	0	X	0.39 (0.14; 0-2)	0.05 (0.05; 0-1)
Identify options	0.83 (0.23; 0-3)	1.28 (0.30; 0-5)	0.17 (0.12; 0-2)	X	0.72 (0.21; 0-2)
Take action	**1.94 (0.36; 0-6)**	**3.00 (0.29; 1-5)**	0.05 (0.05; 0-1)	0.89 (0.28; 0-4)	X

Note: The scores represent the mean number (plus SEMs and ranges) of transitions between the 5 JDM categories; for example, the mean number of transitions from gather information to develop strategy was 5.39, whereas the mean number of transitions from develop strategy to gather information was 3.78. The bold values are those between the most frequent categories of activity (i.e., gather information, develop strategy, and take action).

A principal components (PCA) analysis assessed whether the variability in decision-making sequences was simply noise or had some underlying structure. PCA is a data reduction technique that identifies interrelationships (i.e., structure) between a set of variables, and through this process reduces the set to a smaller number of variables (called components or classes). For the three dominant categories (gather information, develop strategy, and take action) there are 6 possible binary transitions (e.g., develop strategy->take action). For each of the 18 groups, the frequencies with which each of the 6 transitions occurred are the primary data: a matrix of numbers with 18 rows (one for each group) and 6 columns (the possible sequences). PCA examines the extent to which any of the 6 sequence types (the columns) can be combined because the values in them are correlated. If the variability identified was noise, then this would be evident as the values being randomly arranged across the columns and no structure would be revealed by PCA. In fact, the PCA (which converged in 3 iterations, and used a varimax rotation and Kaiser Normalization) revealed two classes with eigenvalues of > 1: Class 1 can be labelled ‘action-oriented’ and involved 4 of the transitions: develop strategy->take action, take action->develop strategy, take action->gather information, and gather

information->take action (all factor loadings > .76). Class 2 can be labelled 'information-oriented' and involved the 2 remaining transitions: gather information->develop strategy and develop strategy->gather information (both factor loadings > .95; there were no cross-class loadings > ±.13). That is, the variability in the 6 sequences could be reduced to two components or classes, labelled 'action-oriented' and 'information-oriented'. These 2 transition classes accounted for 74% of the variance in the 6 transitions between the 3 activities. A schematic that presents the action-oriented and information-oriented classes of transition is depicted in Figure 4.

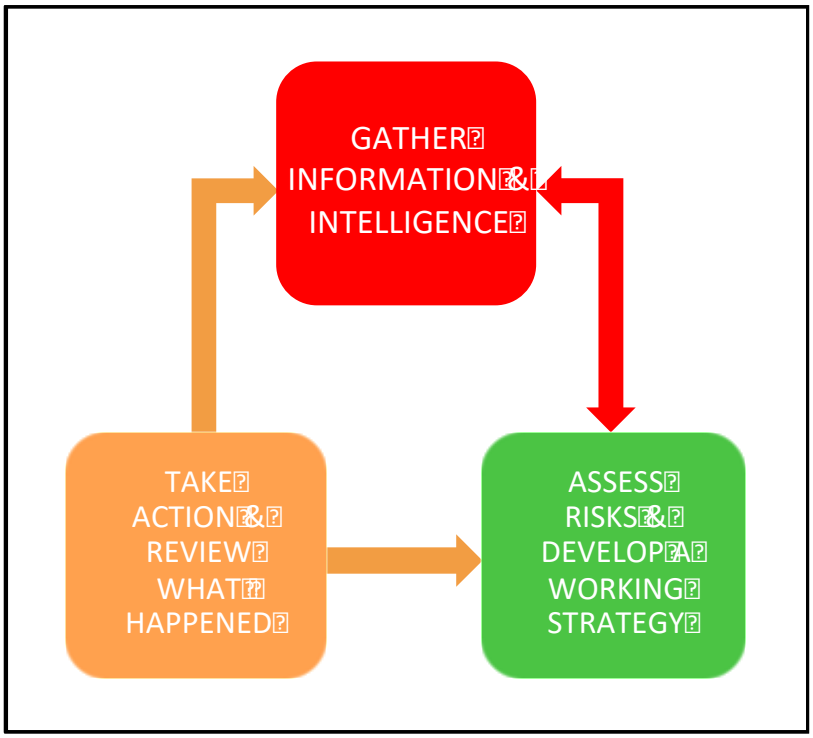


Figure 4. Study 1: Schematic of the two sequence transition classes involving the most frequent categories of activity. The groups differed in the extent to which their transitions were more or less action-oriented (tan arrow) or more or less information-oriented (red arrow).

Supplementary analyses. The sample size for Study 1 (n = 18) is low for a PCA, but complimentary analyses using simple correlations to assess relationships among the 6 sequences (for which the n is suitable) provided complimentary statistical support for the components derived from the PCA. Figure 5 depicts the correlations involving transitions between each pair of dominant categories (e.g., information to strategy and strategy to information). Spearman's (nonparametric) correlations were used because of the potential impact of outliers (see panels A and C of Figure 5). In each case, the frequencies of the transitions correlated (r_S > .69, p = .01), and it is clear that there was a wide range of values for each pair of categories; note that the number of data points is less than the number of groups (i.e., 18) due to the superimposition of identical values (the number of ties is shown within the symbol and was corrected in the analysis). This wide range of values did not merely reflect overall differences in the likelihood that the groups were cycling through the categories. Thus, while the combined frequency of transitions involving information and strategy was unrelated to either the combined frequency of transitions involving strategy and action or action and information (r_S = 0.10 and 0.01, and p > .69 and .98, respectively), the latter pairs of transitions were related (r_S = 0.58, p < .02). That is, the groups showed marked variation involving two transition classes: (1) Information-Strategy, and (2) Strategy-Action-Information. These two transition classes were unrelated to the overall tendency to evaluate options (Class 1: r_S = -0.014, p > .95; and Class 2: r_S = 0.26, p > .29).

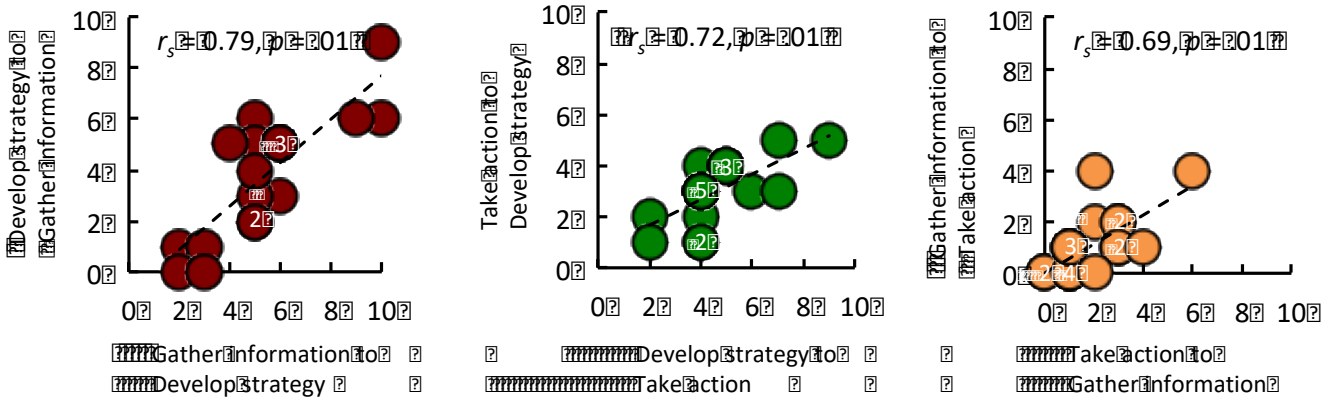


Figure 5. Study 1. The relationships between the frequencies of transition between each pair of the three dominant categories: gather information and develop strategy (left panel); develop strategy and take action (centre panel) and gather information and take action (right panel). Note that the number of data points in panels A-C is less than 18 because of the superimposition of identical values; the number of ties is shown within the relevant symbols and corrected in the statistical analysis.

3. What is the distribution of decision-making activities across successive SCG meetings? Null hypothesis: Each of the decision-making activities will be equally represented across successive SCG meetings (given the assumption that the groups follow the sequence in the JDM).

The overall distribution of activities across each of the six SCG meetings in Study 2 is also shown in Figure 3 (SCGs 1-6 from Exercise Unified Response). The distribution of the categories in these meetings was similar to those in the left-most bar (i.e., Study 1). In spite of the differences in the number of participants in the groups in Studies 1 and 2, and the different scale of the exercises, the dominant categories of activity in Study 2 were also gather information, develop strategy and take action; with the frequencies of consider powers and identify options being very low. ANOVA conducted on the scores from the six group meetings in Study 2, with

type of transition (with 5 levels) as the within-subjects factor, confirmed that there was a main effect of type of transition ($F(4, 20) = 67.56$, $p < .001$, $\eta p^2 = .93$). Pairwise comparisons, with a Bonferroni correction, revealed that the frequency of three activities (gather information, develop strategy, and take action) differed from the two other activities (consider powers and identify options; $p < .01$); and there were no differences between the frequencies of transition involving the activities within each of these two sets (i.e., gather information = develop strategy = take action > consider powers = identify options). Therefore, the null hypothesis can be rejected.

4. Does the sequencing of decision-making activities change across successive SCG meetings? Null hypothesis: The sequence of decision-making activities will not differ across successive SCG meetings (given the assumption that the groups follow the sequence in the JDM).

The analysis of the variability in the sequencing of decision-making activities that was performed in Study 1 cannot be conducted on the results of Study 2, because only one SCG was making decisions at a given time point, as the exercise developed. However, a complementary analysis can be conducted that allows the development of the transitions between the three dominant activities to be tracked across successive meetings of this large-scale exercise. Figure 6 depicts this evolution in the frequencies of transitions from: gather information to either develop strategy or take action (upper panel); develop strategy to either take action or gather information (middle panel); and take action to either gather information or develop strategy (lower panel). Inspection of the upper panel shows that during each SCG, gather information was more likely to be followed by develop strategy than take action (binomial test, $p < .05$). The middle panel shows that during each SCG,

develop strategy was more likely to be followed by take action than gather information (binomial test, $p < .05$). Finally, the lower panel shows that while in the first SCG, take action was more likely to be followed by develop strategy than by gather information, by the final SCG this pattern of transitions had reversed and take action was more likely to be followed by gather information than develop strategy (Fisher's exact probability test, $p < .05$). The final observation shows that the sequencing of decision-making activities changes over the life of an extended incident. Therefore, the null hypothesis can be rejected.

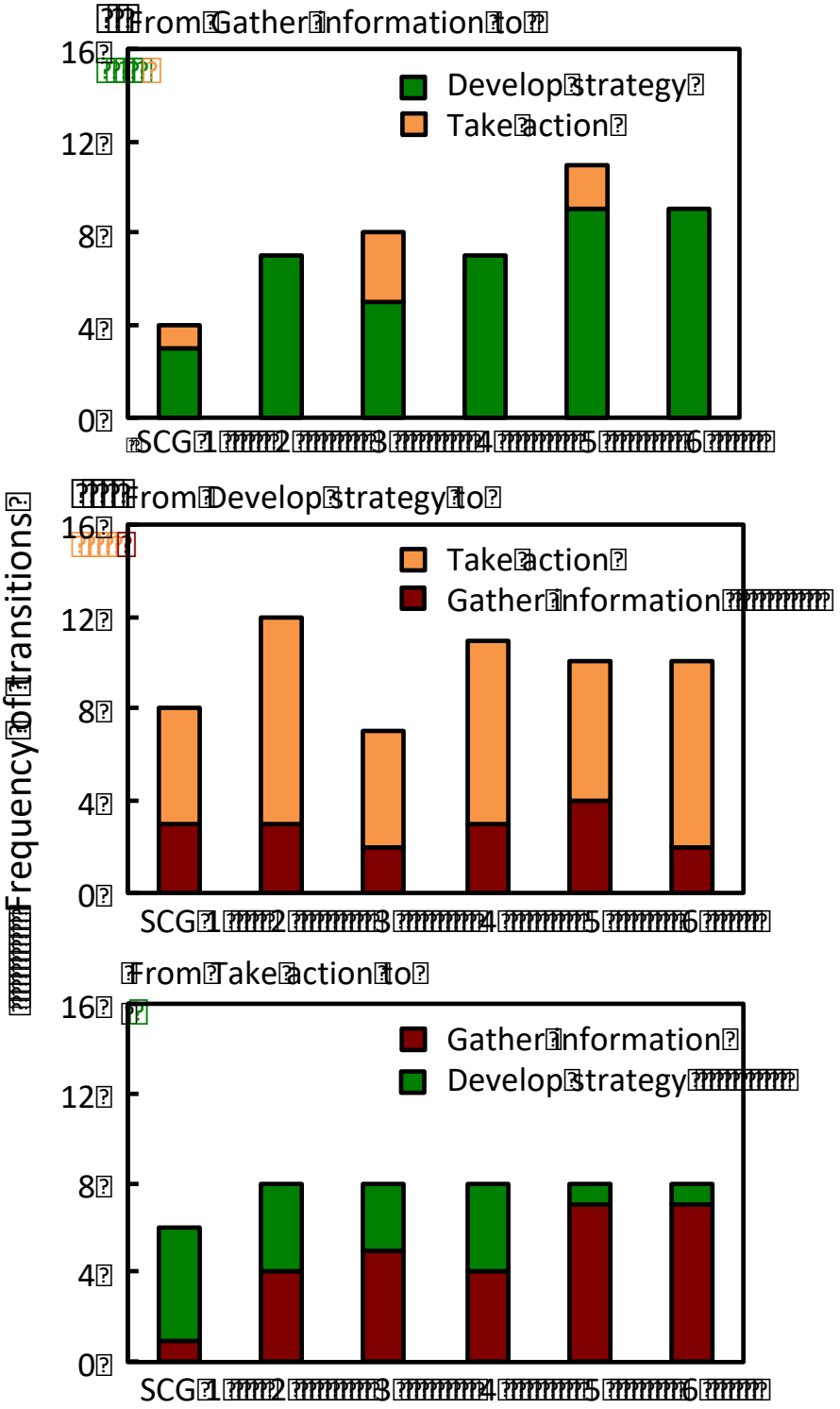


Figure 6. Study 2. Frequency of transitions from gather information to either develop strategy or take action (upper panel); from develop strategy to either take action or gather information (middle panel); and from take action to either gather information or develop strategy (lower panel).

3.5 Summary and principal results

Strategic Coordinating Groups play a central role in how the UK responds to major incidents. A pillar of UK national operational guidance is the Joint Decision Model (JDM). I investigated the use of the JDM in multi-agency groups in simulated major incidents created in Hydra suites (Study 1) and in a large-scale live-play exercise (Study 2). Decision sequences were generated by first categorizing group activities within the meetings in terms of the five categories that form the basis of the JDM (see Figure 2), and then examining the transitions between these categories. There was a consistent distribution of the five activities across the different groups, with three dominant activities (gather information, develop strategy, and take action), and two categories of activity that were relatively infrequent (consider powers and identify options). However, this consistent distribution belied marked between-group differences in the nature of the transitions between the dominant activities. There were two classes of decision-making transitions involving (a) develop strategy and take action, and take action and gather information, and (b) gather information and develop strategy. To give a concrete illustration, two SCGs might have a similar overall number of transitions involving developing a strategy, but for one group these based on transitions to-and-from take action whereas for another they might be based on transitions to-and-from gather information. Finally, the analysis of a series of meetings across an extended incident showed that the form of analysis was sensitive to changes in the distribution of decision-making activities across the event. Most notably, while taking action was most likely to be followed by revisiting strategy development in SCG meeting 1, it was most likely to be followed by gather information in SCG meeting 6. Further work involving extended incidents will be needed to understand the basis of this change, and whether it is a consistent feature

of different groups or is itself subject to variability between groups. For example, the change in decision-making sequences between SCG meetings 1 and 6 might reflect the changing nature of the issues faced early and late in a major incident, or an increasing need for gathering information about the immediate (or ongoing) consequences of actions. In the following discussion I focus on three facets of the studies: The variation in how the groups approached the simulated incidents (Study 1); the fact that there was limited consideration of powers or identification of options in all groups (Studies 1 and 2); and the nature of the methodology employed here. I conclude by examining the implications of the results for policy, guidance and training.

3.6 Discussion

This investigation provided the first analysis of the use of the JDM to support decision-making in multi-agency groups. The groups were faced with realistic, simulated major incidents. I did not evaluate the effectiveness of the different groups, including the decisions that they made (cf. van der Haar, Koeslag-Kreunen et al, 2017), but rather the process of decision-making (cf. e.g., Klein 1993, Klein, Ross et al. 2003, Klein 2008). The findings summarized in the immediately preceding section have clear theoretical and operational significance.

Between-group variability in transition sequences. There were marked between-group differences in the transitions between the three main categories of decision-making activity. The groups differed in the extent to which their sequences were ‘action-centred’ or ‘information-oriented’. These labels are not intended to describe a process of decision-making but are simply a convenient and theoretically neutral way of labelling the different classes of decision-making sequences that were evident across the groups. The basis for these group differences cannot be

determined from the present results, but some speculation can be offered. For example, thematic analysis of interviews with members of multi-agency groups, after they have participated in simulated major incidents, revealed high levels of decision inertia (e.g., Alison & Power, 2017; Alison et al., 2015; see also Janis, 1972, 1982; Janis & Mann, 1977). In Study 1, decision inertia might be reflected in high levels of the information-oriented component and low levels of the action-oriented component. The results thereby complement those based on thematic analysis of interviews with individual group members; but they also suggest that decision inertia differs markedly across different SCGs that are responding to the same incident. The same form of argument can be made about a given group's tolerance for uncertainty or ambiguity, which might be reflected in their tendency to exhibit frequent transitions between gather information and develop a strategy – e.g., Frenkel-Brunswik, (1949); see also, van den Heuvel et al., (2014); for reviews, see Furnham & Marks, (2013); Hillen, Gutheil, Strout, Smets, & Han, (2017). These group differences, whether they involve decision inertia or tolerance of uncertainty, are likely to be based upon differences in the composition and characteristics of the groups or the disposition of the chair (van der Haar et al., 2017). In this context, a recent analysis of the benefits and pitfalls of group decision-making is directly relevant.

Bang and Frith (2017) highlighted the possibility that differences in the tendency of individuals within a group to explore or exploit information could affect that group's overall tendency to continue to gather information rather than to act on the basis of existing information – see Tversky and Edwards (1966) and Frank, Doll et al. (2009). It seems plausible to link the information-oriented and action-oriented classes of decision-making sequences to group differences in exploration and

exploitation: Groups with many explorers being more likely to exhibit information-oriented sequences and those with many exploiters being more likely to exhibit action-oriented sequences. To test this analysis would require the decision-making styles of the individuals to be assessed prior their allocation to groups: Would groups that are composed of explorers or exploiters (or a mixture of the two) differ in their decision-making sequences, and if so would these differences impact on critical decision-making? I will return to this issue in the final section of the discussion, where I outline some specific suggestions about how the issue of the variability in the sequencing of decision-making activities could be addressed in future policy, guidance and training.

Limited consideration of powers or identification of options. A consistent feature of the SCGs was the limited consideration of powers or identification of alternative options. This finding might simply reflect that there was a shared understanding of the available powers for a given situation. However, this explanation is much less plausible in the case of the failure to identify different options. In Study 1, the numbers of actions taken were many and varied (e.g., to evacuate buildings, to activate the mass fatalities plan), and yet there was little consideration of alternative options. Moreover, in Study 2 the potential for identifying different options across the developing incident were manifold, and yet there was little or no attempt to do so in the 6 SCG meetings. This failure to explicitly identify different options has also been observed in studies of individual decision-making, where decisions have been characterized as being experience-based (e.g., Gigerenzer, 2007; Shafir, 1994; Tversky & Kahneman, 1974) or recognition primed (Klein, 1993, 2003; see also, Doya, 2008). The failure to consider alternatives has been associated with poor group decision-making (for a

review, Walker et al., 2004). In the context of SCGs, the limited identification of options and contingencies could be generated in a variety of ways. For example, a need to maintain group harmony could serve as a constraint on the evaluation of alternative courses of action and contingencies (Janis, 1972, 1982); and the extent to which the chair is perceived as inclusive and the environment psychologically safe might moderate the tendency of individuals to contribute alternative views or speak up (e.g., Bienefeld & Grote, 2014). There are a variety of ways in which encouraging the explicit consideration of alternative options could be addressed in future policy, guidance and training, which will be considered in the final section of the discussion.

Methodological considerations. Some of the results presented in the previous paragraphs were enabled by the fact that there was a relatively large sample of groups in Study 1 (i.e., 18) engaged in the same scenarios. However, one cost of the increased reproducibility that the use of simulations affords is that they lack some of the features of real major incidents; including the fact that group decisions at real major incidents have consequences (e.g., saving lives, preventing further casualties and damage to property and the environment). This is a limitation of Study 1. However, the close correspondence between decision-making processes in some operational and simulated environments, identified using similar methodology to the present studies (Cohen-Hatton & Honey, 2015; Cohen-Hatton et al., 2015), suggests that use of context appropriate simulated environments can reveal important similarities to real incidents (see Alison et al., 2013). Of more immediate relevance, however, is the close similarity between the overall pattern of results from Study 1 (Exercise Wales Gold 1 and 2) and Study 2 (Exercise Unified Response; see Figure 2). This similarity - across exercises of very different scales –

supports the view that the results are of relevance to real major incidents; but complementary analyses of real SCG meetings, dealing with a range of different major incidents, is the only way to determine whether or not this view is accurate. Analysis of real SCG meetings will be explored further in Chapter 5.

Implications for future policy, guidance and training. With the limitations noted above borne in mind, the results from Studies 1 and 2 do provide a context sensitive basis upon which to develop future policy, guidance and training. One obvious target is to modify policy and guidance to ensure that (1) options and contingencies are consistently explored, and (2) the rationale for prospective courses of action are routinely and explicitly assessed against goals, anticipated consequences, and a risk/benefit analysis (cf. Cohen-Hatton & Honey, 2015). Cohen-Hatton and Honey (2015) showed that training firefighters to use such explicit assessments (which they called 'decision controls'), before committing to a course of action, increased the use of reflective decision-making relative to recognition-primed or intuitive decision-making. The implementation of such decision controls in a group decision-making context might also yield greater reflective decision-making, involving appropriate consideration of alternative options and goals. However, the between-group variation in decision-making processes, coupled with the infrequent evaluation of options and contingencies, also highlights a need to consider the dynamics of group working rather than the development of prescriptive models of decision-making *per se*. In fact, there are relatively simple techniques (e.g., considering views from outside of the group; Janis, 1972, 1982) that enhance the quality of group decision-making in some contexts (Lovallo & Kahneman, 2003; Ministry of Defence, 2013; see also, Newell, Lagnado, & Shanks, 2015) and which could be integrated into how multi-agency groups respond to major incidents (cf.

Exercise Unified Response Evaluation Report, 2017, p. 142-143). Further consideration of these suggestions will be postponed until Chapter 5. However, there is another potential route to changing group dynamics that is based on a recent theoretical analysis of group decision-making that was briefly mentioned above.

Bang and Frith (2017) have presented an analysis of how the past experience of group members could be integrated with new information to affect group decisions, which is broadly consistent with the Naturalistic Decision Making approach. This approach too is concerned with how previous experience primes decisions in the face of uncertain information (i.e., recognition-primed or intuitive decision-making; Klein, 1993, 2003; see also Doya, 2008; Gigerenzer, 2007; Gureckis & Goldstone, 2006; Salas, Rosen et al, 2010; Tversky & Kahneman, 1974). Bang and Frith claimed that "A mixture of such diverse individuals [explorers and exploiters] can create advantages for the group." As already mentioned, this claim needs to be assessed experimentally, but it has clear practical implications for assembling effective groups in a variety of contexts, including at major incidents (cf. Polzer, Milton, & Swarm, 2002; Roberge & van Dick, 2010). At present, the selection of individuals that come together to respond to major incidents (simulated or real) in the UK is not based on any formal assessment of their individual approaches to decision-making. The foregoing analysis suggests that such selection might provide a means of increasing the consistency and efficacy of decision-making processes in multi-agency groups. One facet of the analysis presented in Chapter 4 is to begin to assess further how this analysis might apply to decision-making in SCGs.

To conclude: The results of Studies 1 and 2 suggest that future policy, guidance and training should focus on ways to enable the JDM to be used more consistently and effectively by SCGs. Greater consistency could be achieved by ensuring that SCGs include a balance of individuals with different decision-making styles (i.e., explorers and exploiters; see Bang & Frith, 2017), which might also reduce decision inertia (Alison & Power, 2017; Alison et al., 2015). However, there is a need to investigate whether the decision-making processes of SCGs, and groups more generally, are affected by the decision-making styles of their members. At a more specific level, our results suggest the need for SCGs to give more consistent and explicit consideration to alternative plans of action. The use of decision controls has proven effective in modifying decision-making in incident commanders (Cohen-Hatton & Honey, 2015), but this technique has yet to be formally assessed in SCGs or other groups. The implications of the results presented in Chapter 3 for policy, guidance and training will be elaborated further in Chapter 5.

In Chapter 1, it was noted that at least one feature of the JDM does not sit well with more conventional analyses of decision-making processes: namely, the separation of the development of a working strategy and the identification of options and contingencies. Although this point might be deemed moot, given the relative lack of occasions when SCGs identified options and contingencies, it still seemed important to conduct a more general assessment of the video footage from Study 1. Unlike Study 2, Study 1 allows decision-making in independent SCGs to be compared and this will be explored further in Chapter 4.

Chapter 4

Variation in exploration and exploitation in group decision-making: Evidence from immersive simulations of major incident emergencies

4.1 Abstract

The objective of this chapter is to better understand multi-agency group decision-making at major incidents in order to inform operational guidance and training. Normative models of individual decision-making, such as the JDM, have been adopted in the guidance and training for multi-agency groups responding to major incidents. However, the way in which these processes are cast within the JDM could be considered idiosyncratic. In order to gain a more general appreciation of how decision-making processes unfold over SCG meetings, the video footage from the 18 meetings from Study 1 was coded using the following categories: situation assessment (SA), plan formulation (PF) and plan execution (PE). These categories have been used in previous studies of decision-making in operational settings (e.g., see Burke et al., 2006; Cohen-Hatton et al., 2015; Cohen-Hatton & Honey, 2015; Lipshitz & Bar-Ilan, 1996; van den Heuvel et al., 2012, 2014). As in Chapter 3, analysis of the transition sequences between these activities revealed marked departures from normative models of decision-making (SA to PF and then PE) that reflected between-group differences in the tendency to explore information (evident in reciprocal transitions between SA and PF) or exploit information (apparent in transitions to-and-from PE). Exploration but not exploitation was associated with the length of sequence prior to critical decisions.

4.2 Exploration and exploitation in group decision-making

As noted in Chapter 3, Bang and Frith (2017) presented a synthesis of the evidence related to the benefits, as well as the pitfalls, of making decisions in groups rather than individually. Their overarching (Bayesian) theoretical analysis, which involves how the past experience of group members is integrated with new information to affect group decisions, is broadly consistent with the Naturalistic Decision Making approach. A central component of this approach to individual decision-making, developed by Klein (1993, 2003, 2008; see also, Klein, Ross, Moon, Klein, Hoffman, & Hollnagel, 2003; Hutchins, 1995ab), was based on just this kind of interaction: how previous experience primes decisions in the face of uncertain information (i.e., recognition-primed or intuitive decision-making; see also Doya, 2008; Gigerenzer, 2007; Gureckis & Goldstone, 2006; Salas, Rosen et al., 2010; Tversky & Kahneman, 1974).

It will be recalled that explorers sample the available information and decision space in order to select the optimal decision, whereas exploiters commit to a course of action without such a thoroughgoing analysis, and based on the prior success of that action (see Frank et al., 2009; see also Badre et al., 2012; Cohen et al., 2007; Daw et al., 2006). For example, in the “observe or bet” task the decision maker has two options that yield rewards or losses according to some predetermined bias (Tversky & Edwards, 1966). They can choose to “observe” the outcome of a trial and gain information but accrue no rewards or losses; or “bet” and accumulate rewards or losses that are only revealed at the end of the task. The observe trials represent an assay of exploration and the bet trials an assay of exploitation.

To the best of my knowledge, the tendency for multi-agency groups to engage in exploration and exploitation during decision-making has not been directly

investigated. Certainly, the selection of individuals that come together to respond to major incidents is not based on any formal assessment of their individual approaches to decision-making. Consequently, if the decision-making style of group members contributes to the tendency of groups to engage in exploration or exploitation, then one might anticipate variation in these processes across different groups: Different groups might behave in a way that resembles individual explorers or individual exploiters.

Here, the sequences of decision-making activities (situation assessment, plan formulation, and plan execution) derived from the recordings allowed assessment of the extent to which the normative model is followed by Strategic Coordinating Groups (cf. Burke, Stagl, Salas, Pierce, & Kendall, 2006). The sequences were also used to assess whether any departure from a normative standard reflected between-group differences in exploration and exploitation (cf. Bang & Frith, 2017). This was achieved through further analysis of the differences in the sequences of decision-making activities across groups. Hypothesis 1: Exploration should be evident as repeatedly moving between situation assessment and plan formulation, whereas exploitation should be evident in transitions between situation assessment and plan execution, and between plan formulation and plan execution. Hypothesis 2: Differences in exploration and exploitation across groups should be reflected, other things being equal, in the number of transitions before a critical decision is made: groups who explore should take more steps to reach a critical decision than those who exploit.

4.3 The scenarios and approach: A reminder

Real multi-agency groups were faced with the two simulated major incidents described in Chapters 2 and 3: a large-scale chemical fire at an industrial site

(Scenario 1 from Wales Gold 1), and a crash between a passenger train and a truck carrying a hazardous substance (Scenario 2 from Wales Gold 2). The scenarios were dynamic, unfolding in time, and the groups were located in Hydra immersive simulation suites that allowed information to and from the groups to be controlled and recorded (Alison et al., 2013; Crego, 1996). In both scenarios, the critical decision was whether or not to evacuate local residents. However, in Scenario 1 the groups were tasked with developing a communications strategy and the decision to evacuate was an implicit component of the task, whereas in Scenario 2 the groups were explicitly tasked with deciding whether to evacuate local residents. The recordings of the meetings were coded as a continuous sequence of three decision-making activities: SA (e.g., “We need more information about how injuries were sustained.”), PF (e.g., How will we transport and shelter affected people?”), and PE (e.g., “Initiate mutual aid plan”). The coding was again conducted independently of the group members who contributed to the decision-making activity. The patterns of transitions between the successive categories were then assessed in a way that mirrored Chapter 3. The first question was whether groups followed the normative model, and consistently moved from situation assessment to plan formulation to plan execution and then further situation assessment in making decisions across the course of the meetings. I then assessed whether deviations from the normative model between group, reflected differences in the tendency to explore or exploit information. As already noted, it was anticipated that while exploration would be evident in transitions between situation assessment and plan formulation (i.e., SA-PF and PF-SA), exploitation would be reflected in transitions to and from plan execution (most obviously between SA-PE and PF-PE). Finally, I examined whether

such differences were related to the number of transitions that each group took to arrive at the critical decision (i.e., whether or not to evacuate local residents).

4.4 Method

Participants. The participants were those from Study 1, but in this case analysis of the two scenarios (Wales Gold 1 and Wales Gold 2) was separated in order to directly assess the generality of the results across them. Briefly, the 18 multi-agency groups attended two-day national training and exercise events in Scenario 1 [9 groups; mean group size = 8 (range: 6-10); female: male = 1:1.84] and Scenario 2 [9 groups; mean group size = 8 (range: 7-10); female: male = 1:2.61]. Scenario 1 involved training events from 2015 (Exercise Wales Gold 1), while those in Scenario 2 involved training events from 2016 (Exercise Wales Gold 2). As noted in Chapter 3, these groups consisted of participants who could be part of multi-agency groups faced with a major incident.

Procedure. Before the start of Scenarios 1 and 2, all participants were given an interactive training session that lasted for approximately one hour and included the use of the JDM. By way of a brief reminder, Scenario 1 began with an update from the Police tactical commander through a video link, which stated that there was a large-scale chemical fire at an industrial site and that the nearby road network and railway line had been closed due to the resulting plume of smoke. The scenario became a serious environmental and economic incident, with media impacts that required decisions on longer-term recovery issues involving health impacts, housing, decontamination and economic recovery. Scenario 2 also began with a video update from the Police tactical commander about a crash between a passenger train and a truck, which was carrying a hazardous substance. The crash caused many fatalities and injuries to passengers on the train; and within the first hour of the

incident a fire ignited, which sent a toxic plume of smoke over a residential area. The analysis for Scenarios 1 and 2 was conducted on the critical second group meeting where there was time pressure and the groups were required to make critical decisions: In Scenario 1, the groups were tasked with providing direction to those involved in tactical operations (including whether it would be necessary to evacuate local residents) and what their media strategy would be; and in Scenario 2, they were explicitly tasked with deciding whether or not to evacuate the nearby caravan site, under conditions where the resources were not available to evacuate everyone and the toxic effects of the plume were unclear. See sections 2.2.1 and 2.3.1 for an overview of the scenarios provided to exercise facilitation staff.

Coding of Activity. The audio-video recordings, from either the Hydra CCTV system or a GoPro camera placed on each group table, were coded using the categories: situation assessment, plan formulation and plan execution. These categories were coded at the level of the group (i.e., independently of the individual contributor), and noted on a spreadsheet for later analysis. Isolated irrelevant comments and those that were not parts of the group discussions (e.g., informal asides, which were infrequent) were excluded from the analysis. The coding was conducted in the way described in Chapter 3. As in Studies 1 and 2, a lag sequential analysis (Sackett et al., 1979; see also, O'Connor, 1999) was used to derive the primary data of interest: the sequences of transitions between the decision-making activities in the group meetings.

4.5 Results

Overall analysis of the transitions. Each pair of bars in the upper panel (from Scenario 1) and lower panel (from Scenario 2) of Figure 7 shows the mean number of transitions from a given initiating category (e.g., situation assessment, SA) to the

succeeding categories (plan formulation, PF, or plan execution, PE). If groups were following the normative sequential model for each decision, then the left bar from each pair should be higher than the right: situation assessment (SA) should be followed by plan formulation (PF), plan formulation (PF) by plan execution (PE), and plan execution (PE) by situation assessment (SA). The impression gained from examining Figure 7 is that the pattern of transitions was similar in Scenarios 1 and 2 and in both cases was not that predicted on the basis of normative models: While situation assessment (SA) was more likely to be followed by plan formulation (PF) than plan execution (PE), plan formulation (PF) was equally likely to be followed by plan execution (PE) and situation assessment (SA); and plan execution (PE) was less likely to be followed by situation assessment (SA) than (PF).

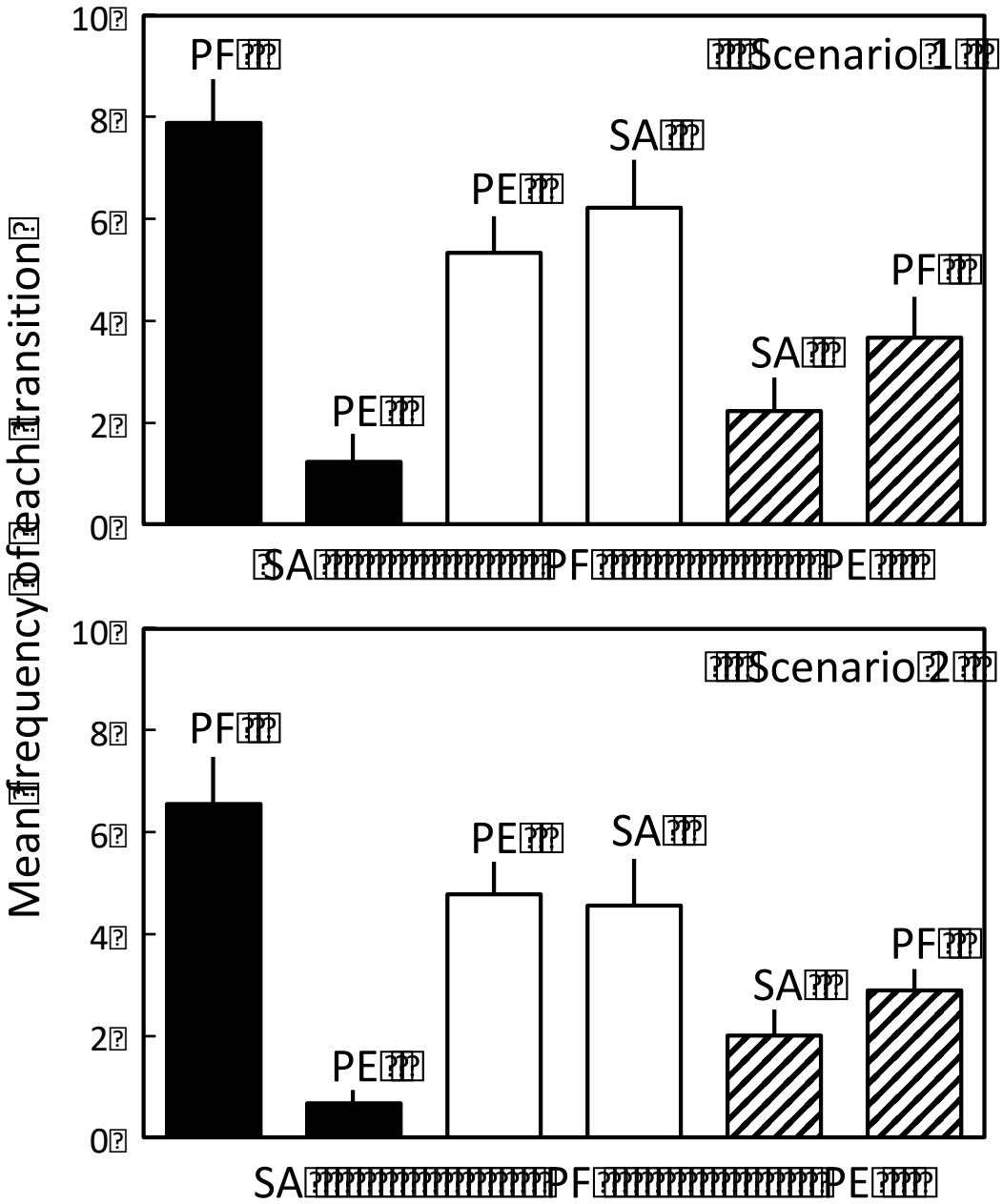


Figure 7. Study 1. The mean frequencies (+SEM) of transitions from each of the categories (situation assessment, SA, plan formulation, PF, and plan execution, PE) to the other two categories. The category labels below the panels (e.g., SA) indicate the first element of the sequences involving the categories denoted by equivalently coloured bars immediately above them (i.e., PF and PE). The results from Scenarios 1 and 2 are depicted in the upper and lower panels, respectively.

ANOVA with scenario (1 or 2) as a between-subjects factor, and initiating category (SA, PF, and PE) and succeeding category (normative or other) as within-subjects factors, confirmed these impressions. There was no effect of scenario, $F(1, 16) = 2.39$, $p > .14$, $\eta_p^2 = .13$, but there were main effects of initiator category, $F(2, 16) = 29.87$, $p < .001$, $\eta_p^2 = .65$, and succeeding category, $F(1, 16) = 22.86$, $p < .001$, $\eta_p^2 = .59$. There was also an interaction between the initiator and succeeding category, $F(2, 32) = 23.80$, $p < .001$, $\eta_p^2 = .60$. There were no other interactions (Fs < 1). Pairwise comparisons confirmed that transitions from SA were more likely to be to PF than PE ($t(17) = 8.19$, $p < .001$, $d = 3.13$), but transitions from PF were no more likely to be to PE than SA ($t(17) = -.38$, $p = .709$, $d = -0.08$); and transitions from PE were more likely to be to PF than SA ($t(17) = -2.12$, $p < .05$, $d = -0.47$).

Group differences in exploration and exploitation: Hypothesis 1. Like in Chapter 3, the overall analysis of the results presented in Figure 7 could give the impression that while the pattern of results did not conform to what might be predicted on the basis of a normative model of decision-making, the groups were adopting a relatively consistent approach to decision-making. However, as in Chapter 3, this impression would not be accurate. A principal components analysis (PCA) was conducted on the frequencies of the 6 possible transitions between these three categories. This analysis converged in 3 iterations and used a varimax rotation and Kaiser Normalization. It revealed two transition classes with eigenvalues of > 1: Class 1 can be labelled ‘exploitation’, with all transitions involving PE: SA-PE, PE-SA, PF-PE, and PE-PF (all loadings > .70). Class 2 can be labelled ‘exploration’ and involved the transitions: SA-PF, PF-SA (both loadings > .93). There were no cross loadings > ±.28. These two classes accounted for 76% of the variance in the frequencies of the 6 transitions between the 3 categories.

These results provide support for Hypothesis 1: Exploration was evident as repeatedly moving between situation assessment and plan formulation, whereas exploitation was evident in transitions between situation assessment and plan execution, and between plan formulation and plan execution.

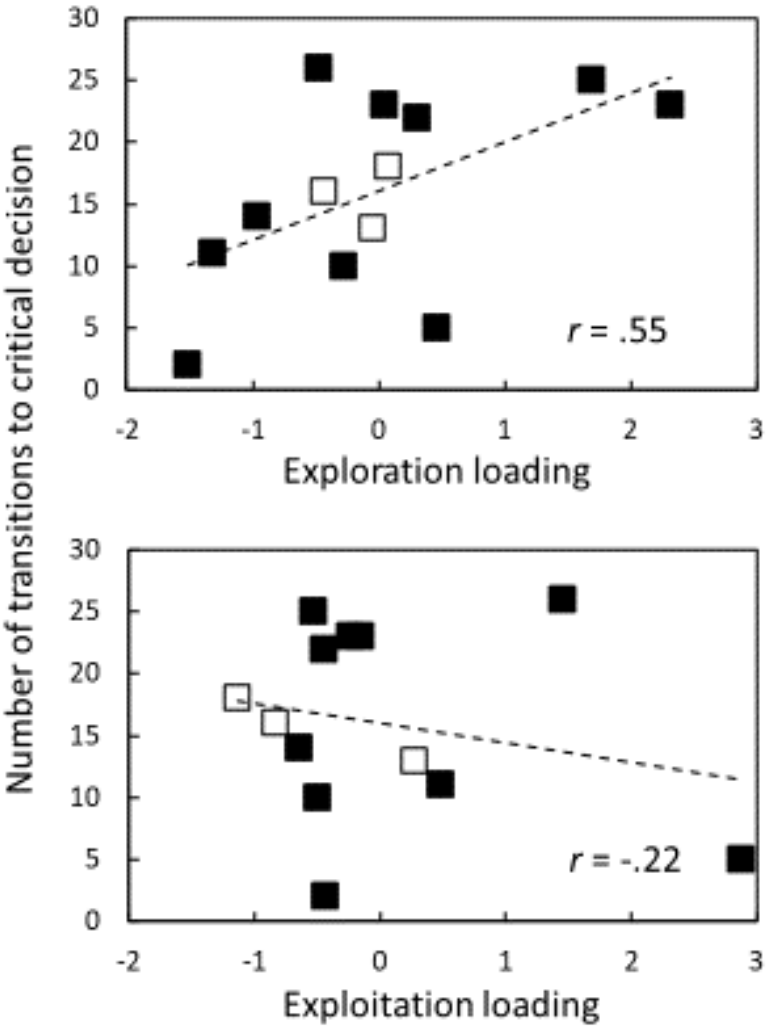


Figure 8. Study 1. The relationship between exploration and the number of transitions to arrive at the critical decision (upper panel) and between exploitation and the number of transitions to the critical decision (lower panel). The total number of groups who came to a decision was 13, with 10

deciding to evacuate (filled symbols) and 3 deciding not to evacuate (open symbols).

Relationship between exploration, exploitation and critical decisions: Hypothesis 2. Figure 8 shows the relationships between the PCA loadings for exploration (upper panel) and exploitation (lower panel), and the numbers of transitions to the critical decision to evacuate (open symbols) or not (closed symbols). The number of groups that reached this decision within the session was 13. Inspection of the upper panel shows that there was a correlation between exploration and the number of transitions to the critical decision, $r_p(13) = .55$, $p < .05$, with higher loadings associated with more transitions to the decision. Pearson's correlation coefficient was used following inspection of the scatterplot. However, there was no relationship between exploitation and the number of transitions to the critical decision, $r_p(13) = -.22$, $p > .46$. These results provide support for Hypothesis 2: Differences in exploration and exploitation across groups were reflected in the number of transitions before a critical decision is made: groups who explore took more steps to reach a critical decision than groups who exploit.

Figure 9 depicts the results from a complementary analysis, where the 13 groups were divided based on their decision-making bias (exploration loading minus exploitation loading) to form group Explore ($n = 6$; mean bias =1.22; $SEM = 0.38$) and group Exploit ($n = 7$; mean bias = -0.92; $SEM = 0.37$). There was a significant difference between their bias scores, $t(11) = 4.31$, $p < .005$, $d = 2.40$, and group Explore took more transitions to reach the critical decision than group Exploit, $t(11) = 2.82$, $p < .05$, $d = 1.61$.

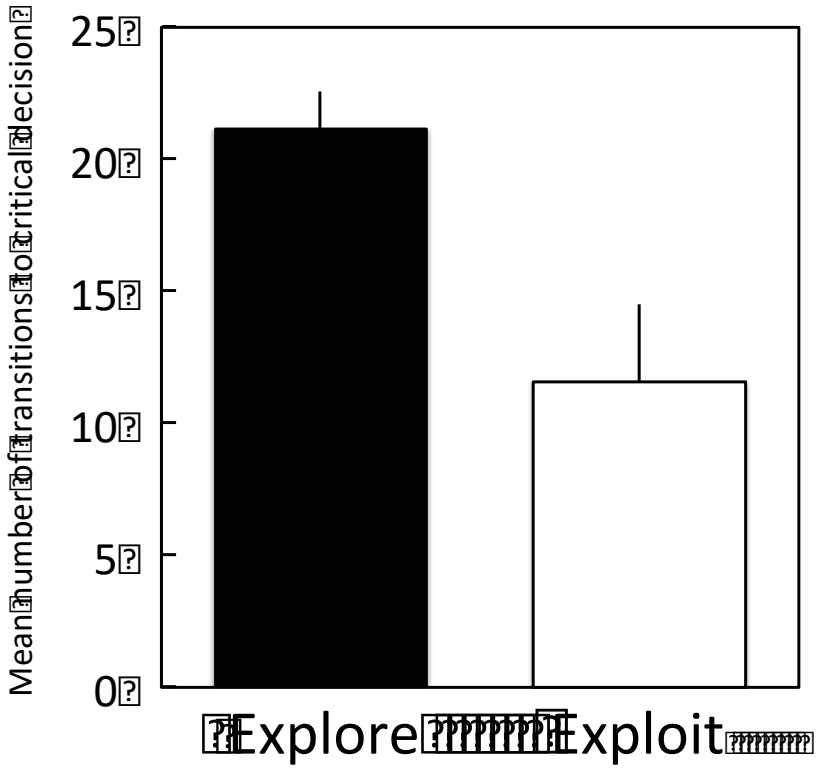


Figure 9. Study 1. The mean number of transitions (+SEM) to reach the critical decision in groups Explore and Exploit classified on their decision-making bias scores.

Supplementary analyses. The final set of analyses examined the relationships between exploration and exploitation loadings, and sequence length and group size. Inspection of the table confirms that there was a similar pattern of correlations in the full set of 18 groups (values above the line of 1s) and the subset of 13 that came to the critical decision about evacuating local residents (values below the line of 1s). While exploration and exploitation loadings did not correlate with one another (as would be anticipated from the PCA), both correlated with sequence length, but neither correlated with group size. Moreover, sequence length did not correlate with group size. The results presented in

Table 3 also illustrate the similarity between the relationships involving the full set of 18 groups and the subset of 13 that reached the critical decision; and show that the exploration and exploitation loadings are similarly related to other aspects of decision-making (i.e., sequence length and group size).

Table 3: Relationships between exploration, exploitation, sequence length and group size

	Exploration	Exploitation	Sequence length	Group size
Exploration	1	0	.70**	-.34
Exploitation	.02	1	.70**	-.27
Sequence length	.71**	.71**	1	-.41
Group size	-.23	-.25	-.35	1

Note: Pearson's correlations above the 1s are from the 18 groups, while those below the 1s are from the 13 groups who reached the critical decision (to evacuate or not; * = $p < .05$, ** = $p < .01$).

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4.6 General Discussion

Chapter 4 investigated decision-making in multi-agency groups during immersive simulations presented in Hydra suites (Alison et al., 2013; Crego, 1996). This approach - based on the replication of the same incidents across different groups - enabled a systematic analysis of the process of group decision-making in this important context. The recordings of the meetings were coded as sequences of decision-making activities that have been employed to characterize individual decision-making in the emergency services (i.e., situation assessment, SA, plan formulation, PF, and plan execution, PE; see Burke et al., 2006; Cohen-Hatton et al., 2015; Cohen-Hatton & Honey, 2015; Lipshitz & Bar-Ilan, 1996; van den Heuvel et al., 2012, 2014). This analysis allowed us to assess, for the first time, whether or not the groups followed a normative cyclical model of decision-making, which assumes that situation assessment (SA) is followed by plan formulation (PF) and

then plan execution (PE), and back to situation assessment in a cyclical fashion. This could not have been achieved without the use of simulated environments, which enable replication, together with analysis of group decision processes in real time.

The overall analysis of the sequences of transitions revealed marked departures from the normative model. Over the course of the simulated incidents, situation assessment was more often followed by plan formulation than plan execution; but plan formulation was just as likely to be followed by situation assessment as it was to be followed by plan execution. Finally, plan execution was more likely to be followed by plan formulation than situation assessment. Further analysis of the sequences revealed that these departures from the normative standard reflected systematic between-group differences in exploration and exploitation. A principal-components analysis was conducted on the six pair-wise transitions between the three decision-making activities (i.e., SA-PF, SA-PE, PF-PE, PF-SA, PE-SA, PE-PF). This analysis revealed that there were marked between-groups differences in the tendency to move between situation assessment and plan execution (i.e., SA-PF and PF-SA). At a descriptive level, these group differences could be aligned to differences in a process of decision inertia (Alison et al., 2015) or they could be characterized as reflecting differences in the tendency to engage in exploration (cf. Bang & Frith, 2017). The additional analysis showed that groups also differed in their tendencies to move between plan execution to both situation assessment and plan formulation (i.e., PF-PE, PE-PF, PE-SA, and SA-PE). Taken together, these between-group differences in the sequences of decision-making activities are clearly analogous to individual differences in information exploration and exploitation. I have already noted that there is evidence for individual

differences in these processes (e.g., Badre et al., 2012), and my results provide the first evidence that these differences can be seen at the level of group decision-making. If this is an appropriate analysis for the results, then it begs the following question. Why do some groups explore and others exploit information?

The results are consistent with the general claim that the composition of groups might be an important determiner of effective group decision-making (Bang & Frith, 2017). The groups were opportunity samples of individuals from the various agencies. This sampling approach mirrors how the composition of groups who assemble to respond to major incidents in the UK might vary. If some individuals in the groups are explorers and others exploiters, then it is plausible to suppose that the relative numbers of these different individuals within the sample affects the behaviour of the group. This analysis could be assessed by examining how such differences affect group decision-making. Alternatively, the decision-making style of specific individuals (e.g. the chair) might have a disproportionate influence on group decision-making processes; when the chair is an explorer (or exploiter) the group is more likely to exhibit the same bias. This could be assessed using a version of the "observe or bet" task (Tversky & Edwards, 1966). In either case, the results take our appreciation of group decision-making from appeals to 'groupthink' (see also Janis, 1972, 1982; Janis & Mann, 1977) to a form of analysis that is analytically tractable and testable (cf. Bang & Frith, 2017; see also, Alison et al., 2015).

To conclude: The results from the simulations provide one basis upon which to develop future policy, guidance and training for groups who have to make life-determining decisions under conditions of uncertainty and time pressure. The analysis developed in the previous paragraphs highlights important issues around the selection of individuals to be charged with responding to major incidents. The

suggestion that individuals could be selected based on their individual decision-making styles (explorer or exploiters) is, at least in principle, a relatively simple one to implement (e.g., by using version of the “explore or bet” task). However, in situ monitoring of the utility of repeated requests for further information and additional situational assessment is another area that could be targeted in a variety of ways: by the presence of a critical friend or by training the chair to monitor the balance between exploration and exploitation (cf. Janis, 1972, 1982; Lovallo & Kahneman, 2003; Ministry of Defence, 2013; see also, Newell, Lagnado, & Shanks, 2015). As noted in Chapter 3, future research will need to provide an experimental analysis of the origin of group differences in exploration and exploitation; for example, by manipulating the proportion of explorers and exploiters in different groups and examining the consequences for decision-making of this manipulation. This research too will need to be based on real groups responding to simulated major incidents.

Chapter 5

General discussion and implications for policy, practice and research

5.1 Overview

The aim of this thesis was to understand the process of decision-making in Strategic Coordinating Groups (SCGs) that make life-determining decisions in time-pressured, high-stakes, emergency environments. The context in which these groups operate is worth revisiting. Chapter 1 presented a description of that context that was aligned to the large-scale simulation called Exercise Unified Response. The description on page 12 of this thesis, which is reproduced below, has become more poignant since the research described in this thesis was initiated. There have been numerous occasions where SCGs have convened and faced a myriad of terrible events including the Grenfell Tower fire, the Manchester Arena bombing and London Bridge attack.

At a Police Special Operations Room in central London a group of people wait anxiously to be ushered into their first meeting. In the large and windowless office space, the atmosphere is solemn and tense. A wall of TV screens shows grainy live CCTV footage of an underground station at London Waterloo. Ceiling mounted cameras display overturned trains buried in a sea of rubble. Through a fog of dust, a tunnel camera shows emergency responders treating wounded people. Much is unclear: why did the trains derail and buildings collapse? How many injured people are trapped in the trains? How many people might have died?

Amid this uncertainty, one thing however is clear: the group of people waiting to meet need to make urgent decisions to save lives and protect the city. To do so, they will become members of a Strategic Coordinating Group (SCG).

The central plank of the response of the UK to emergencies is the Joint Decision Model (JDM). However, when this thesis was initiated, there has been no research on how SCGs use this model in the context of responding to major incident emergencies. Nor had there been much systematic analysis of decision-making processes in SCGs (Power, 2018). The research described in Chapters 3 and 4 took advantage of simulated major incident emergencies, to investigate decision-making in SCGs. This enabled the response of different SCGs to the same reproducible incident to be assessed. Rather than rely on self-report assessments or post-event interviews, the research reported in this thesis was based on an analysis of video footage from simulated emergency exercises. This approach combines the reproducibility of traditional decision-making studies with the realism advocated by the paradigm of Naturalistic Decision Making. The findings of the research are intended to provide an impetus to develop future policy, guidance and training for groups who must make life-determining decisions.

5.2 Summary of results

Investigation of strategic decision-making by SCGs at a range of national and international exercises revealed systematic departures from the UK doctrine of the Joint Decision Model. The key findings were:

1. Group decision-making did not follow the sequence of activities assumed by normative models of decision-making such as the JDM.

2. There were marked between-group differences in the process of decision-making: some groups can be characterised as information seeking, others as action

orientated. This leads to pronounced differences in the tendency of groups to explore or exploit information when making decisions.

3. All groups consistently gave little consideration to alternative courses of action or options when making decisions.

5.3 Preliminary impact of the research

The study of SCGs is interesting in the general context of how groups make decisions. However, the specific context in which SCGs operate means that the research undertaken in this thesis, has the potential to have direct impact on policy, guidance and training. In addition to publishing the first peer-reviewed article including data from Exercise Wales Gold and Unified Response (Wilkinson, Cohen-Hatton, & Honey, 2019), the research has begun to have impact beyond academia. For example, at the request of the Cabinet Office, a summary of findings and training recommendations were produced to inform a national assessment of future SCG training needs by the emergency services, and local and central government in the UK. (See Appendix 3). I have also given invited presentations on the research to the National Fire Chiefs Council conference, and at Strategic Coordinating Group (SCG) Chair training, which was a pilot event and included potential chairs of SCGs from across emergency response agencies in Wales. Moreover, attendees at the National Fire Chiefs Council conference included the Cabinet Office, which led to the request for a summary of findings and training recommendations (Appendix 3). The summary findings and training recommendations (Appendix 3) have been included in the pre-course learning materials for all attendees at SCG training at Exercise Wales Gold 3 in 2018 and 2019. Work is underway to include the research in a specific course for SCG Chairs in Wales (see Appendix 5).

5.4 Implications for policy, practice and research

The evidence presented in this thesis suggests changes and improvements to the current way in which SCGs are trained and operate. In this section, I will present a series of suggestions for what kind of changes might be useful in the context of the evidence described in Chapters 3 and 4 and summarized in Section 5.2.

5.4.1 A national programme of SCG Chair training

> *It will normally, but not always, be the role of the police to co-ordinate other organisations and therefore to chair the SCG. The police are particularly likely to field a SCG chair where there is an immediate threat to human life, a possibility that the emergency was a result of criminal activity, or significant public order implications. Under these circumstances the same person may be the Police Strategic Commander and the SCG Chair. These two roles should however be clearly distinguished.*
>
> Emergency Response and Recovery (Cabinet Office, 2013a)

Chairing an SCG meeting whilst also considering and representing your own agency's views in decision making (e.g. being the SCG Chair and simultaneously the Police Strategic Commander) will increase the cognitive demands on the Chair. This increase in cognitive load may well impair performance (Miller, 1956) and as reflective processes require more cognitive effort (Lipshitz, Omodei, McClellan, & Wearing, 2007), is likely to encourage decisions to be made reflexively without explicit plan formulation or consideration of options. There is a clear case to be made, highlighted in the independent review of the Manchester arena attack in 2017 (Kerslake, 2018), that the role of the SCG Chair should be a stand-alone role and

not be performed simultaneously as a Strategic Commander for an agency represented at the SCG. The UK National Resilience Standards for emergency planning and response advocate use of the JDM, but there is no specific training prescribed for the role of SCG Chair. Whilst the College of Policing offer Multi-Agency Gold Incident Command (MAGIC) training for SCG attendees, there is not a specific focus on the role of SCG Chair. The Government-commissioned provider of training for emergencies in the UK, the Emergency Planning College, does not offer training on the specific role of SCG Chair.

To address this training gap, implement the key findings of this thesis and highlight areas for further research, a national programme of training potential Chairs of SCGs is recommended. The following headings identify key themes on the content of what the training should include, and many suggestions can also be incorporated into how groups make strategic decisions in real-life emergencies.

5.4.2 Decision controls

Goal-oriented training for operational firefighters has been shown to improve the development of explicit plans and anticipatory situational awareness in virtual and simulated fire and rescue environments (Cohen-Hatton & Honey, 2015). If the rationale for prospective courses of action are routinely and explicitly assessed against goals, anticipated consequences, and a risk/benefit analysis, Cohen-Hatton and Honey showed that training firefighters using such explicit assessments (which they called ‘decision controls’), before committing to a course of action, increased the use of reflective decision-making relative to recognition-primed or intuitive decision-making. The implementation of decision controls in a group context might also yield greater reflective decision-making and increase consideration of alternative options. The use of decision controls in SCGs or other decision-making

groups has yet to be formally assessed, but this presents a fruitful area for future research.

Whilst the process of decision-making in groups might be affected by decision controls and could be examined by experimental analysis, the question remains as to whether a change in process – to a more reflective and linear/cyclical use of the JDM or increased consideration of options – produces a better quality of decisions and actions. The use of external views and decision support tools can help answer this question.

5.4.3 External challenge and assessment

> *London would benefit from improved training for officers who undertake strategic roles. Those undertaking these roles should be afforded the help of a mentor, someone who could act as a 'sounding board' and as a 'critical friend' to support the strategic decision-making process.*
>
> Exercise Unified Response report, Craig Mackey, Deputy Commissioner, Metropolitan Police Service

The results presented in Chapters 3 and 4 were taken to suggest that some SCG groups can be characterised as information-seeking and exploratory in their decision-making processes. These groups could also be said to exhibit a type of decision inertia identified in post-incident interviews with emergency responders (Power & Alison, 2017) and highlighted in the review of large-scale emergencies (Pollock, 2017). Conversely, Chapters 3 and 4 also indicated that some groups can be classed as action orientated, in that they exploit the information available and move straight to the conclusion to implement decisions. (This characterisation has echoes of the 'satisficing' outlined in Chapter 1 on individual decision-making). A

method to address redundant deliberation or information seeking, encourage reflection and consideration of options, and also improve assessment of decision-making in training environments, could be to use in situ monitoring and challenge of SCG group decisions by ‘Red Teams’ (Ministry of Defence, 2013)

The UK Ministry of Defence advocate the use of Red Teaming as a major aid to decision-making, not just in a military context, but also in government and commercial settings. Red Teaming is ‘the independent application of a range of structured, creative and critical thinking techniques to assist the end user make a better informed decision’ (Ministry of Defence, 2013). Membership of Red Teams is determined by the task they are to undertake – the optimum number suggested is between five to nine people. Membership is intended to include a Team Leader and a combination of subject matter experts, analysts, and critical and creative thinkers. As well as being a method of avoiding group think (Janis & Mann, 1977) key activities undertaken by Red Teams that apply to groups making strategic decisions are to: Challenge assumptions; identify faulty logic or flawed analysis; assess the strength of the evidence base; identify alternative options or outcomes and explore the consequences of a specific course of action; and, assess the potential for surprise and strategic shock.

A suggested improvement to preparing SCG Chairs and members for their decision-making role in emergencies is to use the principles of Red Teaming as a ‘critical friend’ during Hydra exercises. The Red Team could observe, via the Hydra CCTV and decision logs, the decision-making process of SCGs during exercises and provide feedback and critical challenge, during ‘Plenary’ sessions (Alison et al., 2013). A Plenary session is a period of time during the exercise where the scenario is paused and teams/SCGs meet together in one room to discuss the decisions they

took. Giving feedback during simulation based training, in a manner that fits with the suggested use of Red Teams, has been found to improve the understanding by participants on the impact of multiple organisational and psychological factors (Barry Issenberg, Mcgaghie, Petrusa, Lee Gordon, & Scalese, 2005) and help absorb and transfer learning for use in the real world (Crego, 1996).

Indeed, if the membership of a Red Team could be kept consistent during a series of repeated national exercises (such as Exercise Wales Gold) this would enhance the quality of feedback provided to participants, and recognise that use of subject matter experts to produce 'gold standards' of decision-making can improve the evaluation of decision-making effectiveness (van den Heuvel et al., 2012). The use of Red Teams, who typically produce a verbal brief and presentation on their tasks, a written report, or interact as a team with the end users, could also be incorporated by SCGs during real-life emergencies. This use of external views and assessment could help address the following observation by Thomas Shelling, Nobel Prize winner 2005:

> *One thing a person cannot do, no matter how rigorous his analysis or heroic his imagination, is to draw up a list of things that would never occur to him.*

5.4.4 Decision tools and forecasting

MacFarlane (2015) has summarised a range of decision tools that could be useful when making decisions in different contexts. When faced with novel situations, mind maps (Buzan & Buzan, 2006), Brainstorming (Adair, 2019) and frame analysis (Wright, 2001) can be utilised. In complex cause and effect problems, impact tress and root cause analysis can help guide decisions. Where there is inherent uncertainty or a need to check assumptions, thinking and decisions,

there are a range of tools to support groups (and those involved in external challenge) such as a premortem (Klein, 2007), Devil's advocacy and Red Teaming.

Whilst decision support tools such as checklist-based frameworks have been shown to improve decision-making and safety in medical settings (Haynes et al., 2009) and complex environments (Gawande, 2010), it is pertinent to examine the use of decision tools in the complex and unpredictable environment of strategic decision-making by groups in emergencies. Further research is needed on whether decision support tools help summarise information and problems (Orasanu, 2017), engender a more systematic approach to forecasting the range of potential impacts arising from a scenario (Lindgren & Bandhold, 2003; Wright & Cairns, 2011), and help find a balance between structuring discussion in time pressured situations whilst not hindering new ideas or solutions (van der Haar et al., 2017).

5.4.5 SCG membership

In Chapter 2 it was suggested that the decision-making style of specific individuals (such as the Chair) might have a disproportionate influence on group decision-making processes; when the Chair is an explorer (or exploiter) the group is more likely to exhibit the same bias. Bang and Frith (2017) argued that group decision-making might also benefit from the combination of different types of individual decision maker: specifically from the combination of *explorers* and *exploiters*. There are clearly pitfalls associated with being either an explorer (who might not reach a decision in a timely fashion) or an exploiter (who might quickly reach the wrong decision). Bang and Frith (2017) reasoned that "a mixture of such diverse individuals can create advantages for the group." It is interesting to note that, at present, the selection of individuals that come together as an SCG (simulated or real) in the UK is not based on any formal assessment of their

individual approaches to decision-making; or whether their individual decision-making styles might be more or less consistent with the use of the JDM. This could be assessed using a version of the "observe or bet" task (Tversky & Edwards, 1966). The suggestion that individuals could be selected based on their individual decision-making styles (explorer or exploiters) is, at least in principle, a relatively simple one to implement (e.g., by using version of the "explore or bet" task).

Future research can provide an experimental analysis of the origin of group differences in exploration and exploitation, for example, by manipulating the proportion of explorers and exploiters in different groups and examining the consequences for decision-making of this manipulation.

5.4.6 Considering options

A consistent feature of the decisions made by SCGs was that they involved relatively little by way of explicit consideration of alternative options and contingencies. The failure to assess alternative interpretations of evidence (and test alternative hypotheses) has been widely documented in both laboratory studies (e.g., Wason, 1966) and in police investigations (e.g., Dando & Omerod, 2017). Indeed, Dando and Omerod (2017) have highlighted the fact that current practice in the police (in particular the use of decision logs) might constrain the explicit generation of alternative interpretations of evidence by (less experienced) police detectives investigating serious crime. As discussed in Chapter 3, a need to maintain group harmony could serve as a constraint on the evaluation of alternative courses of action and contingencies (Janis, 1972, 1982), and the extent to which the chair is perceived as inclusive and the environment psychologically safe, might moderate the tendency of individuals to contribute alternative views or speak up (e.g., Bienefeld & Grote, 2014). There is a clear need for training to encourage SCG

members to explicitly consider the merits of different courses of action. While some decisions might well be time-pressured and therefore actively discourage considerations of options, others will not: SCGs make decisions that operate across multiple temporal scales. Indeed, a key role of the SCG it make predictive and anticipatory decisions in the medium to long term (Cabinet Office, 2013a). These type of longer-term decisions, which are suited to the consideration of options, could benefit from the use of decision controls and tools, external views and assessment of group membership, to effectively evaluate options before committing to a decision.

5.4.7 Turning experience into expertise: Training and exercise recommendations

The suggestions above carry implications for how SCGs are trained, learn and exercise. If external challenge and assessment is used at training events by a consistent team of subject matter experts, their role in providing this feedback could be supported and improved by reusing a consistent scenario. Experience and assessment of repeated decisions by an external team, using the same scenario, should increase the team's knowledge and experience of the range of decisions taken by different SCGs and, ideally, increase the expertise of the external team in providing timely feedback and assessment. Therefore, external challenge and assessment should be undertaken at training events for SCGs using a consistent team and repeated scenarios.

A practical suggestion on the types of scenario used in training and exercises is to use the highest impact and most likely hazards and threats in the UK National Risk Register of Civil Emergencies (Cabinet Office, 2017). As an indication of the utility this approach, the most likely and highest impact hazard in the UK

National Risk Register is pandemic infectious disease, which at the time of writing this thesis, is a manifest global emergency in the form of the COVID-19 disease.

It is worth noting the similarity found in this research in the type of group decision-making processes evident in a small-scale simulated exercises using Hydra (Exercise Wales Gold 1 and 2) and a 4 day long live-play event (Exercise Unified response). This correspondence in group decision-making process suggests that small-scale exercises have a similar level of credibility to large scale exercises in creating the conditions for decision-making that is ecologically valid for participants. With this in mind, the suggestion made in a Cabinet Office commissioned report on interoperability in the UK, to shift from infrequent large scale and complex exercises to more frequent and shorter exercises (Pollock, 2017) is supported by the findings of this thesis.

Finally, it is interesting to consider the extent to which SCG and emergency environments present suitable conditions for turning experience into expertise. Emergencies are often novel, messy, complex and unpredictable – to what extent does this environment lend itself to expertise that adheres to policies and procedures?

Training and exercise events to improve strategic group decision-making that seek to impart factual knowledge on policies and procedures and ensure adherence to the Joint Decision Model, may overlook the necessity or benefits of deviating from standard operating procedures and principles. For instance, the independent review on the response to the Manchester Arena attack (Kerslake, 2018) noted that, based on professional discretion and a dynamic risk assessment, the requirement to avoid deploying responders to help casualties in the ‘hot zone’, as required by Joint

Operating Principles, was not adhered to. The review stated that in terms of protecting saveable lives, this was one of the most crucial decisions taken and should be commended.

Therefore in addition to the focus on specific scenarios used in training and exercises and imparting factual knowledge on policies, it should be recognised that a key benefit of training and exercises is to provide repeated experiences that allow opportunities for creating expertise. To reiterate the above, smaller scale exercises (which nonetheless contain challenging scenarios) are easier to deliver more frequently and because of this help address the assertion that expertise is a product of repeated and deliberate practice, outside the 'comfort zone', informed by expert teaching and assessment (Ericsson & Pool, 2016).

5.4.8 How should the Joint Decision Model (JDM) be used?

If facts conflict with a theory, either the theory must be changed or the facts.

Baruch Spinoza

It is notable that an evidence base to support the introduction of the JDM in the UK, based on its beneficial use and outcomes in emergency environments, was not provided despite repeated requests to key UK agencies involved its development and introduction. Whilst this research provides an evidence base of its use in simulated scenarios, it does not demonstrate that the JDM is typically or generally used as intended as a 5-step cycle. For instance, in the 163 decisions made by the SCGs in this research, no decision taken ever followed the standard sequence of: (1) gather information and intelligence; (2) assess risks and develop a working strategy; (3) consider powers, policies and procedures; (4) identify options and contingencies; and (5) take action and review what happened. For this reason, and

solely in relation to group decision making, the question can be raised as to how effective the JDM is in guiding and supporting group decision making.

The rationale for separating ‘develop a working strategy’ from ‘identify options and contingencies’ can also be questioned. Relatedly, why does ‘considering options and contingencies’ come after ‘developing a working strategy’ in the JDM? One might argue that judging what to do (developing a working strategy) should include considering alternatives (options) and what might happen (contingencies). Concerning both of these points, it is important to note that the UK doctrine recognises that ‘strict adherence to the stepped process outlined in the JDM should always be secondary to achieving desired outcomes, particularly in time sensitive situations’ (Joint Emergency Services Interoperability Principles, 2016). However, this qualification does not detract from the general point that components of the sequence seem to be out of step with respect to conventional analyses of how decisions should be made. The observation that the complete sequence of steps within the JDM is rarely adhered to suggests that members of SCGs do not find it a natural way to approach a complex, dynamic and often shifting emergency environment. In fact, the behaviour of SCGs observed in Exercise Wales Gold 1 and 2 seems to reflect the operation of quite different approaches to decision making than those envisaged by the JDM.

Power and Alison (2016) have suggested improvements to the Joint Decision Model based on evidence from interviews with experienced emergency incident commanders and a Hydra delivered firearms terrorism exercise. These suggestions included using a distributed decision model that enhances understanding of individual agency priorities and avoids conflict on how to achieve goals. They also proposed making a clearer separation between the competing goals of achieving the

positive outcomes of ‘saving lives’ whilst avoiding the negative outcomes of ‘reducing harm’, to reduce redundant deliberation and decision inertia. In the context of the preceding sections, which had a focus on training to improve decision making rather than suggesting changes to JDM, it is important to note that Power and Alison also suggested training as method to improve the use the JDM. They advocated training for commanders to help anticipate and manage deciding between ‘least worst’ options.

Given the fact that changes to the JDM have not yet been explicitly detailed or empirically assessed, and recognising that my research has described rather than prescribed how group make decisions, this thesis does not suggest making changes to the steps, wording, or order of the JDM. Instead, the practical implications of this thesis for SCGs include the training of Chairs, more prominent and explicit use and research on Decision Controls, use of external challenge and assessment, use of decision tools, and examination of manipulating SCG membership.

5.4.9 Summary of implications for policy, practice and research

To summarise the preceding section, the recommendations on how strategic groups are trained and exercised, make decisions in real-life emergencies, and for future research are to:

1. Instigate a national programme of training for SCG Chairs
2. Implement and examine the use of decision controls
3. Implement and examine the use of external challenge and assessment in exercises and during real-life emergencies
4. Implement and examine the use of decision tools

5. Examine how manipulating the membership of SCGs influences decision-making process and outcomes

Specifically on training and exercising groups to make strategic decisions, the following recommendation is made:

6. Provide short, more frequent training and exercise events for SCG members to give repeated opportunities to turn experience into expertise. Events should include: i) SCG Chair training, ii) Decision controls iii) external challenge and assessment by a consistent team with experience of repeated scenarios, iv) decision tools

5.5 Limitations of the approach and results

Whilst it is clear this thesis has focused on the process of decision-making, data was analysed from simulated emergency exercises, rather than real-life incidents. Therefore, it is important to question if the simulated exercises used can be claimed to have i) realistic teams and tasks ii) realistic settings.

5.5.1 Realistic groups and tasks?

The claim that the groups participating in the exercise were realistic is straightforward: Participants in the SCGs studies were from the actual agencies and tiers of command that would participate in an SCG in a real-life emergency. Moreover, they represented their agency in decision-making at the SCG – again, as would be expected in a real-life emergency. If it is acknowledged that the membership of decision-making groups being studied was realistic, the next issue to consider is whether groups were engaged in realistic tasks.

The following will outline a case that the tasks of the exercises were realistic. The core scenario of Exercise Wales Gold 1 was based on an elaboration of a real-

life large-scale industrial fire and was developed by teams of multi-agency personnel with operational, tactical and strategic expertise, including the author of the multi-agency debrief of the emergency on which the scenario is based (Wilkinson, 2011). It's worth noting that the undertaking the multi-agency debrief of this fire meant that I held detailed and structured conversations with members of the SCG (and TCG and Bronze groups) to discuss and examine the decisions they faced. This detailed knowledge of a real-life response directly informed the tasks that SCG members would face and make decisions on in Exercise Wales Gold 1.

Exercise Wales Gold 2 was also developed by a range of emergency planning experts, was based on the UK National Risk Register (Cabinet Office, 2015) and the multi-agency planning group was Chaired by the author of this thesis. Utilising the expertise of multi-agency emergency planners and the impacts of the National Risk Register is a sound basis on which to claim the decision-making tasks required of the SCG had validity.

Exercise Unified Response (EUR) took two years to plan and deliver and was co-funded by the European Union. It was conducted simultaneously over four days in locations across London with its centerpiece being a building collapse at Waterloo train station. For the purpose of exercise play, Waterloo train station was re-created in a disused power station. EUR involved 4,000 responders and 2,500 casualty volunteers. It delivered an end-to-end test of London's resilience at all levels of response, from front line responders, up to central government and European coordination. It also included a test of UK National Resilience and the arrangements which deliver assistance through the EU Civil Protection Mechanism. Given the scale of multi-agency planning for this exercise and the breadth of actual responders performing the roles of their 'normal job' at either the real locations of where they

would operate (e.g. SCG facilities) or physically recreated versions such as a building collapse on train carriages, a fair claim can be made that the groups and tasks in EUR were realistic.

It is also with noting that my close involvement in planning the exercises, as advocated when studying teams in emergencies (Waring, 2019), also helped ensure that a data gathering method selected (i.e. unobtrusive video recording) had no bearing on the tasks and decisions faced by the SCG.

However, even if the groups and tasks of this research can be claimed as realistic, the question remains about the extent to which simulated emergency environments provide realistic responses.

5.5.2 Is the exercise environment a realistic setting?

Two of the exercise scenarios in this study were delivered using the immersive simulated environment of Hydra (Crego, 1996). It has been claimed that Hydra can provide a research tool to study teams with both fidelity to real-world situations (Alison et al., 2013), and immersion to the extent that participants treat the exercise as it were real (Crego, 1996). In Exercise Wales Gold, the tactical and operational levels of command were simulated by the written, audio and video updates provided during the scenario and in real-time by Exercise Control (i.e. the exercise staff controlling the Hydra system). The fact that two-way communication between the SCG and other tiers of command was simulated by Exercise Control is a limitation on realism. This limitation applies less in Exercise Unified Response as all tiers of response were played ‘live’ and not simulated. It is acknowledged that this imitation of real-world practices provides a degree of realism in terms of setting, but the extent to which this environment can replicate real decision-making

environments cannot be fully determined. However, recent studies have revealed a high degree of consistency between decision-making processes in Incident Commanders attending real-life emergencies (Cohen-Hatton et al., 2015) and simulated emergencies in virtual reality and practical scenarios with actual fires, vehicles, equipment and teams (Cohen-Hatton & Honey, 2015)

5.5.3 Does coding capture complexity?

A further potential weakness of the approach taken is whether the assessment of group decision-making processes is sufficiently nuanced to capture their complexity (Alison et al., 2013), and whether the categories of the JDM represent a suitable basis for analysis. Certainly, the analysis of group dynamics is not captured by coding the group interactions as sequences of states or categories, and the categories themselves are open to idiosyncratic interpretation. However, the approach has the virtue of being based on direct observation of the groups as they are making decisions (van den Heuvel et al., 2012), with this footage being linked to the written decision and time-stamped communication logs of the groups in Exercise Wales Gold, and the minutes of the SCG meetings produced in Exercise Unified Response. This method has the virtue of enabling the objectivity, reproducibility, and generalizability needed in applied research (Lipshitz, 2010). As noted in Chapter 2, a recent study by Waring et al. (2020) adopted the same coding approach and analysis of frequency and distribution of decisions as in this thesis, and observed similar results in their study of two large-scale exercises that are comparable in scale to Exercise Unified Response. Indeed, Waring et al. reported that SCGs (and also Tactical Coordinating Groups) rarely considered options and could be characterised as either information seeking or action orientated. Moreover, the conclusions based on the use of the JDM categories in Chapter 3 hold even

when the categories of activity in the JDM were collapsed, in Chapter 4, into the more conventional and broad categories of situation assessment, plan formulation and plan execution.

5.6 Concluding comments

The research presented in this thesis was guided by a clear need to understand group decision-making in a particular context: major incident emergencies. It is abundantly clear that decision-making at this strategic level can have profound impacts not only on the immediate repercussions of a major incident, but also on its medium and long-term consequences. The approach taken in this thesis is to reconcile the need to conduct research that is context appropriate with the dual needs for reproducibility and for the primary data to be based on observation as opposed to recollection. The approach also involved the adoption and analysis – for the first time – of the principal doctrine enshrined within the UK response to emergencies: The Joint Decision Model

By focusing on the Joint Decision Model, it was hoped that the research would have a practical impact on informing and improving how SCGs are trained, exercise and respond to emergencies. As already noted, the article that reports the results from Chapter 3 of this thesis (i.e., Wilkinson et al., 2019) now informs the ongoing Exercise Wales Gold training programme for SCG members. In Appendix 3, this research was summarised and training recommendations produced at the request of the Cabinet Office to inform a national assessment of future SCG training needs by the emergency services, and local and central government in the UK. Also, work is also underway to include the findings of the research in training for SCG Chairs in Wales (see Appendix 4).

5.6.1 Decision consequences

Science is the knowledge of consequences, and dependence of one fact upon another

Thomas Hobbes

This thesis focussed on the process of decision-making in groups – how decisions were made. The more complex and pertinent question about consequences - whether decisions taken would result in positive consequences and protect lives, remains unanswered. As decisions were made in exercise scenarios, outcomes could not be measured or assessed. Whilst the suggestions above on implications for policy, practice and research provide a route for examining the quality of group decision-making, the approach of this thesis in quantifying, analysing and characterising the decision-making process, means that the qualitative assessment of whether certain processes of group decision-making result in better or worse consequences, is a key unanswered question.

5.6.2 Real-life emergencies

The people heard it, and approved the doctrine, and immediately practiced the contrary

Benjamin Franklin

It is recognised that studies of decision-making in SCGs at real-life major incident emergencies, which use the same form of analysis, may yield different or contradictory results to those reported in this thesis. This is also a fundamental unanswered question: To what extent will the findings of this thesis be replicated in real-life contexts where groups make strategic decisions in emergencies? It is interesting to speculate if in real-life emergencies where pressure, anxiety and

cognitive demands on SCG members are much larger than in exercises, the findings of this thesis, rather being contradicted, are in fact more pronounced or exaggerated. In other words, if in real-life emergencies SCGs deviate even further from the normative and cyclical use of the JDM, are even more pronounced in their tendency to be information or action orientated, and, consider even fewer options when making decisions.

The next natural step in continuing the research of how groups make strategic decisions in emergencies is to study SCGs responding to actual incidents. Moreover, an examination of the decision-making processes used by SCGs and the consequences of the decisions taken in real-life emergencies may give an insight into how the process of decision-making links with consequences. If access to video footage of SCGs responding to real-life emergencies can be provided for analysis, applying the methodology of this thesis in future research to examine how groups make strategic decisions, will be informative and fascinating.

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Appendices

Appendix 1: Participant information and consent form

CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD

Emergency decisions research

Participant information

Purpose of this document

To invite you to be part of a research study to improve understanding of multi-agency decision making in the emergency response environment.

Research objectives

1. To gather data on why and how multi-agency decisions are made

2. To analyse the process of how multi-agency decisions are made

3. To examine how current academic and emergency service decision models explain and predict the observed data

Research outcomes

To contribute to understanding the process of how decisions are made at various types of emergency - e.g. single agency, multi-agency, at the scene and remote from the scene.

This research project is part of wider work looking at Fire Service incident commanders, 999 call judgements and existing national decision models.

A key expectation is that a better understanding of multi-agency decision making will contribute to improving training and exercising, such as the course you are currently attending.

It is also the intention that this research will have practical application in improving how emergencies are responded to nationally.

What if I participate?

It is important to be clear that your performance is not being judged. Instead, the collective process of decision making is being studied.

How is data gathered?

By archiving decision logs and video footage which are part of the exercise.

Is the research confidential and anonymous?

Yes. All information will be kept confidential, that is, private from other people who are not on the research team.

This form is the only document that will have your name on it. It will be kept in a locked filing cabinet in the Cardiff University Psychology Department.

All of the data that results from analysis will be held anonymously. That is, it will not be possible to attribute any stored data to a given individual who is taking part in the exercise.

Who has approved this study?

The research study has been reviewed and approved by the School of Psychology Research Ethics Committee at Cardiff University. If you have any concerns or complaints about the research you can contact the Ethics Committee Secretary at:

School of Psychology, Tower Building, 70 Park Place, Cardiff, CF10 3AT

Further information

If you want to discuss any aspect of this research please contact Byron Wilkinson at wilkinsonb@cardiff.ac.uk, or 07980 726223

Signature of consent

Name:.....

Signature:.....

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Appendix 2: Coding dictionary

JDM category	Description	Example	Decision phase
Gather information and intelligence	What is happening? Do we need to know anything else at this stage?	"*We need more info about how injuries were sustained.*"	Situational Assessment
Assess risks	What is the likelihood of harm? Is that level of risk acceptable?	"*What is the risk of evacuating people*."	Situational Assessment
Develop working strategy	What are the aims and objectives to be achieved? Who by? When? Where?	"*We need to develop a media strategy.*"	Plan Formulation
Consider powers policies and procedures	What powers might be required? Is there any appropriate national guidance?	"*Can we control the airspace to legally prevent helicopters from taking footage?*"	Plan Formulation
Identify options and contingencies	What are the other options and what if things do not happen as we anticipate?	"*If we move people out and the fire burns for two weeks where will they go?*"	Plan Formulation
Take action	Commit a decision to the Hydra log. Record an action.	"*Initiate mutual aid plan.*"	Plan Execution
Review what happened	What happened as a result of the decision?	"*Let's review our strategic objectives.*"	Not applicable

Appendix 3: SCG research training recommendations

A summary of research was presented at the National Fire Chiefs Council Command and Control Conference in 2017**.** Following this presentation, at the request of the Cabinet Office, a summary of findings and training recommendations were produced to inform a national assessment of future SCG training needs by the emergency services, and local and central government in the UK.

SCG research: Training recommendations

Aim of this document

- To outline **key findings** in the research of how Strategic Coordinating Groups (SCG) **make decisions**.
- To make recommendations to **improve** strategic decision making **training**

Research

From 2015 to 2016 video footage evidence from **19 national and international exercises** was analysed to investigate the process of how **teams of responders**, at SCG level, make decisions. Events included accredited nationwide training for SCG members and the **UK largest ever civil protection event** — Exercise Unified Response.

24 SCGs, comprised of **289** people were analysed.

Exercise scenarios

- A large scale **fire** and **toxic plume** of smoke in a **populated** area
- A **passenger train** and a hazardous goods vehicle **crash**
- A **building collapse** onto passenger trains at **London Waterloo**

Research framework

Data was analysed using the JESIP **Joint Decision Model** (JDM).

All responding agencies are trained to use the JDM at major incident emergencies — it is the **cornerstone of interoperability and joint response.**

Above: Joint Decision Model (JDM)

Key result 1: Most frequently used areas of the JDM

- Strategic decisions are **focussed** on gathering **information,** assessing **risks** and **developing working strategy** and then taking action.
- There is **very little consideration** of **powers, polices and procedures** and **identification of options** and **contingencies.**

Above: The standard model of JDM use

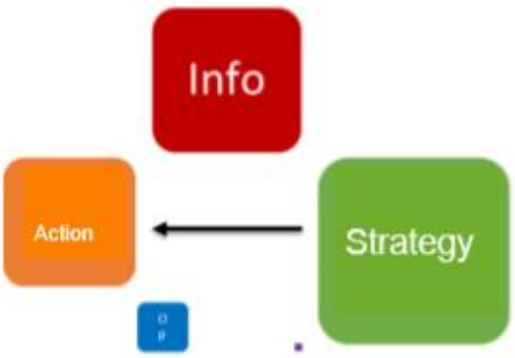
Above: Actual use of the JDM observed during exercises

Training recommendations: Chairing and participating in the SCG

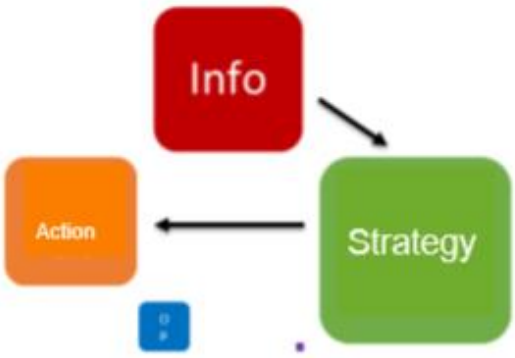
1. <u>Teaching use of the JDM:</u> Use the JESIP website to host a multi-agency training package, including tutorial videos, specifically about the **use of the JDM by SCGs.**
2. <u>Chairing the SCG:</u> Provide guidance in the **JESIP doctrine** on the role of the SCG Chair. The SCG Chair should be **recognised as a stand alone role** that has a **pivotal impact** on how group decisions are made.
3. <u>Decision controls</u>: Encourage consideration of **options and contingencies** and **enhance situational awareness** by training on use of **Decision Controls.**

Key result 2: How the majority of decisions were made

Below is the process by which **45% of all decisions** (i.e. transitions to action) were made by the 24 SCGs at all 19 exercises.



26% of all decisions



19% of all decisions

Training recommendation: External views

4. **External views:** SCG training should incorporate in the decision making process **external peer assessment** and **critical review** to:

- Challenge **assumptions**
- Identify **alternative options** or outcomes
- Explore the **consequences** of actions
- **Horizon scan**

> London would benefit from **improved training** for officers who undertake strategic roles ...Those undertaking such roles should be afforded the help of a **mentor**... **a critical friend to** support the strategic decision making process'
>
> **Craig Mackey, Deputy Commissioner, MET Police**
>
> **Exercise Unified Response report**

EXERCISE UNIFIED RESPONSE

Summary of recommendations

1. **Teaching use of the JDM:** Use the JESIP website to host a multi-agency training package, including tutorial videos, specifically about the **use of the JDM by SCGs.**
2. **Chairing the SCG:** Provide guidance in the **JESIP doctrine** on the role of the SCG Chair. The SCG Chair should be **recognised as a stand alone role** that has a **pivotal impact** on how group decisions are made.
3. **Decision controls:** Encourage consideration of **options and contingencies** and **enhance situational awareness** by training on use of **Decision Controls.**
4. **External views:** Train SCGs to incorporate a process of **external peer assessment** and **critical review** in decision making.

Authors of this document

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Dr Sabrina Cohen-Hatton, Assistant Deputy Commissioner, London Fire Brigade.

Professor Rob Honey, School of Psychology, Cardiff University.

Key references

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Appendix 4: Use of Research letter – Joint Emergency Services Group

Ymddiriedolaeth GIG
Gwasanaethau Ambiwlans Cymru
Welsh Ambulance Services
NHS Trust

Pencadlys Rhanbarthol Ambiwlans / Regional Ambulance Headquarters
Matrix One, Rhodfa'r Gogledd / Northern Boulevard
Parc Menter Abertawe / Swansea Enterprise Park
Abertawe / Swansea SA6 8RE
Ffôn/Tel 01792 562900
www.ambulance.wales.nhs.uk

Your Ref:
Our Ref:

Date: 29th May 2019

To whom it may concern

Re: Use of Academic Research

I am the Joint Emergency Services Group (JESG) Civil Contingencies Co-ordinator for Wales and, as part of this role, I chair the Wales Learning and Development Group (WLDG).

The WLDG provides a number of pan Wales training products designed to support all responder agencies in emergency preparedness. Examples include the award winning Exercise Wales Gold III and Wales Silver, to name but two.

Wales Gold III delegates have been provided with summary reports on the academic research undertaken by Byron Wilkinson, as well as a short video clip providing an overview of the research and raising awareness of the implications for delegates.

The WLDG are developing a specific course for Strategic Co-ordinating Group (SCG) Chairs and intend to use the research on this course, to ensure that delegates benefit from the findings.

Yours sincerely

Patrick Rees
JESG Civil Contingencies Co-ordinator, Wales