The Impact of Team Member Familiarity on Performance: Ad hoc and Pre-formed Emergency Service Teams

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Introduction

Teams have become the primary unit used to conduct emergency service activities. Fire, ambulance, police, search and rescue, and coastguard use teams extensively, ranging from frontline response to command, control and communication (C3) activities. Emergency service teams regularly operate in difficult environments. These teams are required to make decisions and act in dynamic environments that may be uncertain, time-pressured, involve high stakes and pose a threat to either the team or community members.

The challenges confronting emergency service teams may be complex and dynamic so that no single decision maker can develop an adequate understanding of all the issues. This has led to the development of distributed decision making where each team member takes responsibility for a component of the decision making (Brehmer 1991). Teams using distributed decision making are found across a range of organisations and in many other settings besides emergency services, including health, military and industry (Hollenbeck et al. 1995). Central to the composition of such teams is the extent to which members have worked with each other in the past and their knowledge of one another (i.e., member familiarity). This chapter explores the influence of member familiarity on teamwork processes and decision making.

Frequently emergency service organisations may need to deploy teams where the members haven't previously trained or worked together. Several important questions arise from this requirement. First, do teams consisting of personnel who have not worked together before (i.e., an unfamiliar or mixed familiarity team) perform as well as teams where all of the members have worked together previously (i.e., an intact or pre-formed team)? Second, if there are performance differences between unfamiliar and intact (familiar) teams: (a) what are these differences, (b) how large are they, and (c) are they of practical significance to emergency service agencies? Lastly, what types of intervention might an emergency service organisation use to help teams integrate members who haven't worked or trained together?

This chapter considers how the familiarity of members may affect team performance. The research informing this chapter comes from a variety of domains. Where possible, the research referred to has been undertaken with teams in naturalistic settings. Unfortunately, only limited research has been carried out specifically with emergency service teams. However, research from military, aviation, medicine and other organisational settings provides important insights on this issue. The first section of the chapter reviews relevant team and decision making research describing how teams develop, the nature of teamwork and taskwork, and team decision making, and identifies the specific teamwork mechanisms through which familiarity may influence team decision making and performance. This section also discusses research that specifically addresses the influence of team familiarity on team performance. In addition the implications of the research findings for team functioning and decision making are discussed.

The second section outlines the implications suggested by this research for emergency services managers. Two interventions are outlined that may help emergency service agencies support teams when members haven't worked together, namely brief résumés and brief question and answer sessions.

The third section describes some approaches that instructors can use to highlight the importance of familiarity for team performance. Two ideas are suggested, namely highlighting how member familiarity influences communication and coordination within teams, and the importance of a psychological safety (i.e., team members are able to speak up) in supporting information sharing and problem solving.

The chapter concludes with a summary of the key observations and offers suggestions for further reading on this topic.

An Outline of Relevant Team Research and Findings

Description of Teams

Teams involve interdependent members working in specific roles who interact adaptively to complete a common objective (Salas et al. 1992). Teams are dynamic and complex systems that evolve over time and are adaptive to situational demands (Kozlowski and Ilgen 2006). The key point of difference between teams and groups is the interdependency of team members, and it is interdependency that requires team members to work in a collaborative and coordinated manner to be effective.

Team Development and Lifespan

The systematic change in teams over time has been noted by researchers for over 50 years. Tuckman (1965) proposed a stage model suggesting teams progress through the phases of forming, storming, norming and performing. Since Tuckman's initial work a variety of alternative developmental models have been

proposed for teams. The more recent models have moved away from a largely linear view of development indicated by stage models, suggesting that teams follow a variety of pathways. For example, Gersick (1988, 1989) suggested teams follow a pattern of 'punctuated equilibrium' moving through periods of inertia and behavioural changes that appear to be more influenced by members' awareness of time and deadlines than any particular period of time within a developmental stage. Kozlowski and Bell (2003) observed that teams are dynamic entities, and that team-level phenomena emerge from the individual level and develop in a complex way over time. This development is not only linear, but also includes episodic and cyclical aspects.

The Nature of Teamwork, Taskwork and Team Decision Making

Teamwork and Taskwork

For a team to operate effectively, members need not only sound technical knowledge, skills and attitudes, but also the capacity to cooperate and coordinate their actions with their colleagues. In essence there are two important types of behaviours required for a team to perform well, namely taskwork and teamwork (Morgan et al. 1986; McIntyre and Salas 1995). Taskwork involves the competencies – knowledge, skills, attitudes and other characteristics (KSAOs) – directly related to an individual's task performance, whereas teamwork involves the competencies (KSAOs) required for a member to operate effectively within a team (Salas et al. 2009). Teamwork facilitates taskwork and effective team performance requires the successful integration of taskwork and teamwork activities (Salas et al. 2005). See also Brooks (Chapter 9, this volume) for further discussion of emergency management competencies.

Drawing on aviation research focused on temporary (ad hoc) teams, Flin and Maran (2004) developed a teamwork model for acute medical teams. The authors identified four team skills central to performance: cooperation, coordination, leadership and communication (see Figure 6.1).

Team Decision Making

Team decision making has been defined as 'the process of reaching a decision undertaken by interdependent individuals to achieve a common goal' (Orasanu and Salas 1993, p. 328). Team decision making requires managing multiple information sources and varying task perspectives in order to reach a final decision (Ilgen et al. 1995). For example, teams contain members with unique histories, differing levels and types of expertise, and varying status levels (both formal and informal).
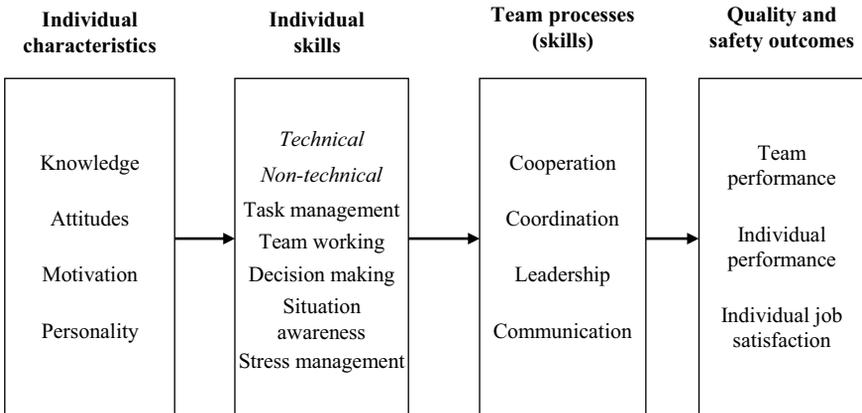
Individual characteristics	Individual skills	Team processes (skills)	Quality and safety outcomes
Knowledge Attitudes Motivation Personality	*Technical* *Non-technical* Task management Team working Decision making Situation awareness Stress management	Cooperation Coordination Leadership Communication	Team performance Individual performance Individual job satisfaction

Figure 6.1   Factors affecting performance in teams (adapted from Flin and Maran 2004, with permission)

Note: Adapted by permission from BMJ Publishing Group Limited (Identifying and training non-technical skills for teams in acute medicine; R. Flin and N. Maran 2004*; Quality and Safety in Health Care*; 13:i80–i84.

Decision Making Research

The focus of classical (i.e., normative) decision research has been largely on the individual decision maker. The early classical decision models assumed the individual as a rational decision maker, seeking to maximise utility, and operating in a reasonably static or constant decision environment. Organisational decision models and naturalistic decision making models differ from such normative models in that these approaches have been developed from observing decision makers situated within teams or organisations. Most importantly, both naturalistic decision making and organisational decision models focus on what decision makers actually do in teams and organisations (Lipshitz, Klein and Carroll 2006), and thus take account of the often dynamic environment within which decision makers are required to operate.

Organisational Decision Models

Herbert Simon recognised that people working in organisations frequently simplified their decision making by limiting their consideration of an issue. By using rules of thumb or heuristics, decision makers are able to consider an issue within a 'bounded rationality', making decisions that satisfy certain criteria (i.e., satisficing decisions) rather than necessarily offering the greatest overall return (Simon 1955, 1979). Organisational decision models have particular relevance for teams who tend to be guided by organisationally determined processes and

decision rules, e.g., standard operating procedures (SOPs). These teams often operate in time-constrained situations, sometimes necessitating the selection of the first satisfactory option rather than risk waiting for the optimal option which may or may not occur.

Naturalistic Decision Making

The naturalistic decision making framework was developed from observing expert decision makers (i.e., fireground commanders) in uncertain, dynamic, time-pressured and often high-stakes circumstances. Unlike classical decision theories, which tend to concentrate on how to choose between different options, naturalistic decision making focuses on the assessment and appropriate categorisation of the situation (Klein 1997). Whilst a novice decision maker tends to rely on his/her reasoning skills to make decisions, experts' decisions are based on their situation assessment abilities (Burke et al. 2008). A further feature of naturalistic decision making is its treatment of decision making cycles, suggesting that these are often interwoven with action. Instead of decision makers gathering and analysing all of the relevant data and then making a decision, people in complex situations often 'think a little, act a little, and then evaluate the outcomes and think and act some more' (Orasanu and Connolly 1993, p. 19). See also Bremner, Bearman and Lawson, Chapter 8, and Brooks, Chapter 9, this volume for further discussion of naturalistic decision making in emergency management.

Distributed Decision Making in Emergency Service Teams

The dynamic environment that emergency service teams may be required to operate within was noted in the introduction. Brehmer (1992) described four features of dynamic decision making environments that make them particularly challenging:

1. a series of decisions is required to reach the goal
2. the decisions required are not independent; earlier decisions tend to constrain later decisions
3. the state of the environment continues to change, both autonomously and as a consequence of the decision maker's actions
4. decisions need to be made in real time.

Teams operating in dynamic decision making environments are typically under considerable time pressure and may need to make decisions under conditions of the uncertainty associated with:

1. when a team may receive information (Clancy et al. 2003)
2. information accuracy (Orasansu and Connelly 1993; Schmitt and Klein 1996)

3. information completeness (Orasansu and Connelly 1993; Schmitt and Klein 1996)
4. information complexity (Schmitt and Klein 1996; Lipshitz and Strauss 1997).

Clancy et al. (2003) suggested that in a dynamic environment, the timeliness of decision making can be as important as the decision content.

The interdependency of team members is an important feature that differentiates a team from a group. Groups tend to make decisions on a consensus basis, with each member using the same information. In contrast, the interdependent nature of teams can lead to distributed decision making, where each team member takes responsibility for a component of the decision making (Brehmer 1991). This requires team members to collaborate in developing and maintaining a shared situation awareness of developing events. Distributed decision making is commonly used in dynamic decision making environments such as firefighting, medical emergencies and military combat operations (Clancy et al. 2003). We can also conceptualise a team as a cognitive unit. Some researchers use the term *team cognition* to capture the various collective processes (e.g., communication, decision making, memory, perception and situation awareness) required by a team. The distributed nature of how information is analysed and decisions are made in teams increases the requirements to coordinate how members share information and develop an appropriate level of team situation awareness.

How Does Team Familiarity Affect Team Performance?

Familiarity is generally positively related to various aspects of effective team performance in a variety of settings (e.g. Reagans, Argote and Brooks 2005; Espevik et al. 2006; Huckman, Staats and Upton 2009).

Reagans, Argote and Brooks (2005) suggested that the factors which are used to explain the influence of familiarity on team performance can be divided into two complementary groups:

1. mechanisms that support team coordination
2. mechanisms that influence the effective interaction and relationships of team members.

Familiarity positively influences a team's ability to act in a coordinated fashion (Moreland, Argote and Krishnan 1998). Through shared experience Huckman, Staats and Upton (2009) suggested that individual members develop team-oriented customs and norms and that these in turn aid coordinated performance (Mailath and Postlewaite 1990; Chillemi and Gui 1997). Additional support for the role of familiarity in helping coordinate team performance comes from Weick and Roberts (1993) who proposed that familiarity is important in enabling 'heedful interrelating', significant in explaining the almost faultless performance

of an aircraft carrier flight deck. Team members interrelate heedfully when they consider the big picture and their contribution to the collective goals in a careful, critical and purposeful manner. It takes time to develop the shared understanding, openness and disclosure required to heedfully interrelate, and as Weick and Roberts point out, these are indicators of a mature and well-developed team.

Perhaps the most parsimonious explanation of how familiarity may influence team performance is the McLennan et al. (2006) observation that familiar teams tend to use their cognitive resources more effectively. This observation suggests that familiarity may influence team performance through interpersonal relationships and the knowledge of one another that tends to develop with familiarity, and that these relationships and team knowledge enable superior team coordination.

However, there is some evidence that teams that continue to work together for extended periods may show curvilinear patterns of performance with decrements in performance in the longer term (e.g., Katz 1982; Berman, Down and Hill 2002). Katz observed that team performance began to diminish after the project teams had been together for five years. Katz and Allen (1982) described this as the 'not-invented-here' (NIH) syndrome, where long-serving teams believe they have a monopoly of knowledge and thus reject new ideas from outsiders to the likely detriment of team performance.

Research conducted with US Army helicopter crews by Leedom and Simon (1995) found mixed results for the performance of highly familiar (battle rostered) versus mixed familiarity crews. Although the battle rostered crews tended to achieve more tactical simulator missile kills (57/65) than the mixed familiarity crews (46/66), the battle rostered crews tended to have a greater degree of overconfidence than the mixed familiarity crews.

Other researchers have failed to find evidence for the curvilinear relationship between team tenure and team performance. The Keller (1986) study of 32 research and development project teams did not find a curvilinear relationship between team tenure and performance. The best predictors of team performance in the Keller study were team cohesiveness and an innovative orientation as a team. Similar to the Keller study, the Allen et al. (1988) study of 181 research and development teams from nine organisations found no evidence of a curvilinear relationship between team tenure and performance. Although Allen et al. found there was some variability in the performance of the long-tenured teams, there was no general decay in the pattern of performance over time. The authors investigated the relationship between the leadership attributes of the research and development teams' functional and project managers, and team performance. Allen et al. found that the leadership attributes most useful for supporting good performance were somewhat different between the newly formed and long-tenure teams (see also Owen, Chapter 7, this volume).

Perhaps the most plausible interpretation of the curvilinear relationship found between team tenure and team performance is that it is not tenure per se that influences team dysfunction. How well a team functions depends on a combination of team norms, leadership, context and the characteristics of team members.

However, an implication of the Allen et al. (1988) study is that there may be periods during a team's existence when a team is more susceptible to dysfunction. The team tenure research also reminds us that team member familiarity in no way guarantees good performance and that the development of poor team norms and a lack of leadership can be problematic for team performance.

Key Team and Teamwork Processes Influenced by Team Familiarity

Earlier the crucial contribution that teamwork makes to team performance was described. This section describes the three important teamwork processes (i.e., communication, coordination and leadership) and the emergent team process of trust. These processes are influenced by team familiarity and help explain why familiarity is likely to influence effective team performance. These four processes are interrelated. For example, effective leadership is likely to positively influence team coordination, good communication will positively influence coordination, effective leadership may positively influence communication, and trust positively influences team communication.

Team Communication

Communication enables team members to exchange information, coordinate activities, monitor performance, provide feedback, create plans and strategy, and develop a shared understanding of the incident (Rasker, Post and Schraagen 2000). Communication plays a major role in team coordination and importantly, in helping teams develop situation awareness (Palmer 1990). As familiarity increases in teams, communication between team members tends to become more coordinated (Reid and Reed 2000).

The distributed dynamic decision making (D3M) that occurs within emergency service teams heightens the need for effective communication. For example, although simple incidents may be considered relatively routine, as incidents (e.g., hazardous chemical spill, cyclone, or riot) increase in scale and complexity they quickly become non-routine and intra-team communication becomes central to team performance in these conditions (Orasanu and Salas 1993).

MacMillan et al. (2002) made an important observation regarding team coordination and communication, noting that where a team requires communication to coordinate its activities, the need to communicate can have a negative impact on team performance, especially in high workload conditions. MacMillan et al. also noted that 'communication can be good or bad for team performance, depending on when it occurs and what else is going on at the time' (p. 293).

Edmondson (1999) highlighted the importance of psychological safety, a team climate where members will speak up and offer constructive comment to their team mates. Psychological safety develops in teams with shared experience and involves the development of trust and mutual respect within the team (Edmondson 1999). Leadership in the form of leader inclusiveness has also been shown to influence the

development of psychological safety (Nembhard and Edmondson 2006). Leader inclusive behaviours invite and show appreciation for team member contributions. When psychological safety has developed in a team, members will be confident that they will not be undermined, penalised, or embarrassed by their colleagues for speaking up, asking questions, proposing new ideas, or reporting an error (Edmonson 2004; Edmonson and Roloff 2009). Moreover, psychological safety has been shown to support team learning, providing the ongoing opportunity to improve team performance (Edmonson, Bohmer and Pisano 2001).

Research conducted by Kanki and Foushee (1989) found that familiar flight crews demonstrated a more open approach to communication, exchanging more information than crews who had not flown together before. This research suggests that familiar team members are more likely to provide constructive comment to one another and listen more carefully to comments and suggestions from fellow team members.

Coordination

Coordination is seen as a cornerstone of effective team performance (Zalesny, Salas and Prince 1995; Klein et al. 2005). In discussing why teams often fail to perform against expectation, Steiner (1972) developed the term *process loss* to describe performance costs associated with poor team coordination. Team coordination involves 'team members executing their activities in a timely and integrated manner' (Schraagen and van de Ven 2011, p. 178). Familiar teams tend to have developed a greater repertoire of mechanisms (e.g., shared knowledge and customs) to coordinate their activities than unfamiliar teams.

Klein et al. (2005) suggested that there are three primary requirements for team coordination: interpredictability, common ground and directability. For a team to coordinate their actions it is important that members can predict the actions of other members with some degree of accuracy (i.e., interpredictability). Team members also need to ensure that their own actions are sufficiently predictable to support effective coordination. Klein et al. noted that predictability can enable team members to accurately estimate important features of the situation. For example, how much time is required to complete key tasks, the level of skill required, and the degree of complexity and difficulty of tasks. Common operating frameworks such as incident control systems and SOPs support interpredictability by creating expectations of how team members will behave. Douglas (Chapter 5, this volume) highlights the importance of member predictability, particularly when teams are working in emotionally challenging situations.

Clark and Brennan (1991) observed that common ground is a fundamental requirement for coordinated action. Common ground refers to 'the pertinent mutual knowledge, mutual beliefs, and mutual assumptions that support interdependent actions in joint activity' (Klein et al. 2005, p. 146). Common ground can support efficient communications within a team. For example, it can enable team members

to abbreviate intra-team communications yet still be confident that potentially ambiguous messages will be correctly understood.

The third requirement for team coordination is the ability for team members to be able to redirect each other's actions (Christoffersen and Woods 2002). Directability is the ability to modify the actions of other team members as conditions and priorities change. This may occur when a team member noticing that another team member has run into difficulties, alters their own activities to compensate. It may also occur when a team member signals to the wider team that they are either ahead or behind schedule on a key task so that their colleagues can make suitable adjustments. The capacity to redirect enables teams to perform in a more resilient way, able to cope with changing conditions.

The Wittenbaum, Vaughan and Stasser (1998) circumplex model suggested that teams can coordinate their activities along two dimensions: process and temporal. In terms of team processes, activities can be coordinated:

1. explicitly through activity programming (e.g., plans and procedures), and via communication (e.g., oral, written, team meetings)
2. implicitly through shared knowledge of the situation, tasks at hand and each other (MacMillan, Entin and Serfaty 2004).

A particular advantage of implicit coordination is its lower overhead, involving less member time and cognitive capacity, and thus assisting team performance (MacMillan, Entin and Serfaty et al. 2004).

A second way that team coordination can be considered is on a temporal basis (Fiore et al. 2003; Wittenbaum, Vaughan and Stasser 1998). Given the complex and dynamic environments that teams operate within, information overload can be a particular problem for team coordination (Fiore et al. 2003). Technology adds to this challenge by often providing large amounts of information (Klein 2009; Edmunds and Morris 2000). Teams can coordinate and manage information during three different periods of time:

1. prior to the team activity occurring (pre-process)
2. during the team activities (in-process)
3. after the team activities have occurred (post-process).

The Wittenbaum, Vaughan and Stasser (1998) and Klein et al. (2005) frameworks provided somewhat complementary accounts of the factors influencing team coordination. The Klein et al. account suggested that team members who have worked together tend to develop an informal understanding of one another's skills, habits and way of working. In essence, common ground is a form of intra-team situation awareness that overlaps with the Wittenbaum, Vaughan and Stasser concepts of pre-process and implicit coordination. To enable crews or incident management teams to function immediately, organisations provide comprehensive training, protocols, checklists and a variety of SOPs. These organisational

preparations are examples of pre-process coordination that explicitly help support greater team member interpredictability and common ground. The concept of directability (Klein et al. 2005) is an example of an in-process coordination mechanism (Wittenbaum, Vaughan and Stasser 1998) that may also be thought of as a form of leadership. In the following section, the role of leadership in team performance is discussed. The importance of shared leadership, which may also support the coordinating mechanism of directability, is described.

Although coordinated performance in emergency response teams tends to be chaotic early on, it tends to become self-organised over time (Guastello 2010). Recent simulation-based research conducted by Gorman and Cooke (2011) with three-person crews flying unmanned aerial vehicles indicated that team cognition evolves in an exponential way as crew members become increasingly familiar. Gorman and Cooke (2011) observed that as members become familiar there is a shift in the basis of team cognition from interaction to shared knowledge.

Leadership

Two types of leadership appear to be most relevant to teams: vertical leadership and shared leadership (Pearce 2004). Vertical leadership is a traditional model of leadership which suggests the senior officer or the manager is in charge whilst the other team members are simply followers. Shared (or distributed) leadership occurs when team members assist in providing leadership, and this assistance varies over time depending on the particular issues challenging the team and the specific competencies of team members. Shared leadership takes time to develop in teams and generally requires some degree of familiarity. Pearce and Conger (2003) defined shared leadership as 'a dynamic, interactive influence process among individuals in groups for which the objective is to lead one another to the achievement of group or organizational goals or both' (p. 1).

Pearce (2004) and colleagues (Conger and Pearce 2003; Cox, Pearce and Perry 2003) argued that both vertical and shared leadership are important for effective team performance. Cox, Pearce and Perry (2003) suggested that shared leadership supplements vertical leadership and that vertical leadership is an antecedent to shared leadership in teams. In a study of 71 change management teams, Pearce and Sims (2002) noted that although both vertical and shared leadership were important predictors of team performance, shared leadership was found to be the more useful predictor.

The type of leadership required changes as teams mature and with the level of expertise within a team (Kozlowski et al. 2009). This observation suggests that the leadership style in unfamiliar (ad hoc) teams may differ to that found in familiar (intact or pre-formed) teams and may also vary depending on the level of expertise found within the team. The development of shared leadership appears to be related to several aspects of team familiarity. Shared leadership develops over time as team members interact, influence one another, and negotiate their roles within the team (Carson, Tesluk and Marrarone 2007). It takes time for team members

to develop an understanding of their respective competencies and thus familiar teams are more likely to develop the capacity and willingness required to engage shared leadership than unfamiliar teams (Perry, Pearce and Sims 1999; Avolio et al. 1996).

Trust

A further way that familiarity may influence team relationships and performance is through trust. DeJong and Elfring (2010) defined trust as 'a psychological state involving confident, positive expectations about the actions of another' (p. 536). Shared experience can lead to trust, an important factor influencing the sharing of information within a team (McEvily, Perrone and Zaheer 2003). Liang, Moreland and Argote (1995) found that teams who have trained together were more likely to trust one another's expertise. Trust has been found to be critical in a range of emergency situations, especially where time is critical and the response requires good coordination (Omodei, Wearing and McLennan 2000; Omodei and McLennan 2000).

Trust has been shown to favourably influence a number of important team processes (Adams and Webb 2000). Trust within a team can reduce the need for monitoring of other members' performance (McAllister 1995; Currall and Judge 1995) and lead to improved cooperation (Meyerson, Weick and Kramer 1996; Rousseau et al. 1998). Nahapiet and Ghoshal (1998) emphasised the relationship between trust and cooperation, noting that 'trust lubricates cooperation and cooperation itself breeds trust' (p. 255). Higher levels of trust facilitate within-team communication (O'Reilly 1978; Currall and Judge 1995), reduce conflict between members (McEvily, Perrone and Zaheer 1998) and improve team processes and performance (Dirks 1999; Kirkman et al. 2006). However, low levels of trust can be problematic in teams because this can add costs that reduce team effectiveness (Wilson, Straus and McEvily 2006).

Adams and Webb's (2003) research suggested that there are two types of trust at play during the formation and operation of a team. The first type of trust is person-based trust, which develops over time and is based on prolonged interactions, enabling building the knowledge and experience of others necessary for trust (Rempel, Holmes and Zanna 1985; Lewicki and Bunker 1996). The second form of trust is category-based trust, which develops on the basis of a person's membership of a group (or category) that is positively linked with trust (Kramer 1999). Category-based trust can occur even when circumstances do not allow for the development of person-based trust.

Swift trust is a particular form of category-based trust that enables a range of temporary teams to operate successfully. Meyerson, Weick and Kramer (1996) observed that diagnostic teams, film crews, aircraft cockpit crews, paramedics and firefighting teams all operate effectively even though their members may have not worked together previously. For example, a new team member's previous

experience working in a known high-performing team would help provide confidence for colleagues that this new member is competent and can be trusted.

In considering the role of trust in team functioning it is important to take account of the appropriate level of trust for a given situation: more trust isn't necessarily better (McEvily, Perrone and Zaheer 2003). An important judgement that team members need to make is when do they trust the recommendations of colleagues and personnel outside the team and when do they ask for more information from them? Trust is also context specific, so a colleague's judgement may be readily accepted for a particular situation, but might be questioned in different circumstances.

McEvily et al. (2003) offered an alternative view of trust, proposing that it is an organising framework or heuristic that helps select and guide behaviours. A heuristic trust offers certain efficiencies, for example allowing team members to economise on information processing and monitoring, thereby conserving cognitive resources in information-rich but time-poor environments such as emergency incidents. However, where team members rely too heavily on trust, this may limit their scanning of wider networks and alternative information sources that might lead to improved decision making (McEvily et al. 2003).

The Influence of Familiarity on Team Performance

In this section four studies that consider how familiarity influences team performance are discussed. The studies come from the aviation, medicine, military and emergency management sectors. A common feature of the teams in these studies was the requirement to work in a highly coordinated manner in order to be successful.

The National Transportation Safety Board (NTSB) (1994) used archival data to investigate whether team familiarity was a factor in flight crew-involved major crashes of US commercial flights between 1978 and 1990. The NTSB found 44 per cent of accidents occurred on the first leg of newly paired flight crews (i.e., where the pilot and co-pilot have not flown together before). The incidence of crews involved in accidents during their first flight together was considerably greater than the estimated proportion of new flight crew pairings (ranging from 2.8 per cent to 10.5 per cent). The NTSB found that 73 per cent of accidents occurred during the first day of a flight crew pairing. Similarly, the incidence of crews involved in accidents during their first day together was considerably greater than the estimated proportion of new flight crew pairings (ranging from 6.8 per cent to 30.3 per cent). The NTSB study suggested that low team familiarity may lead to poorer decision making and pose greater operational risks.

Reagans, Argote and Brooks (2005) investigated surgical teams undertaking joint replacements over a five-year period. These teams were rostered to work together so that they may be working with either familiar or unfamiliar peers. The researchers assessed the performance of the orthopaedic teams for 1,151

hip and knee replacements. Familiar teams carried out the joint replacement operations more quickly than the unfamiliar teams. For example, a surgical team that had undertaken 10 knee replacements together would take 5 per cent less time (approximately 10 minutes) to perform this operation than a surgical team that had not worked together before.

Espevik et al. (2006) compared the performance of six-person submarine attack teams in a tactical submarine simulator. In one simulation, the participants worked in intact teams (i.e., having worked together as crew on a submarine for the three months prior to the experiment), and in the second simulation, the second-in-charge for each team was swapped with a person unfamiliar with the rest of the team. The intact teams scored 33 per cent more hits ($M = 4$) than the mixed familiarity teams ($M = 3$). The authors also noted that there was a trend for the familiar teams to discover, identify, attack and hit targets at greater distance than the mixed familiarity teams.

Hayes and Omodei (2012) used simulation-based research to compare the performance of small (four-person) unfamiliar (ad hoc) and pre-formed (familiar) wildfire incident management teams. The authors found that, compared to ad hoc (unfamiliar and mixed familiarity) teams, the pre-formed teams showed superior performance across a range of measures including:

1. the number of fireground events attended to
2. the quality of responses to fireground events
3. the quality of handover briefings and documents
4. timeliness of decision making
5. the level of team situation awareness
6. team and teamwork processes (e.g., intra-team communication, coordination, leadership and trust).

The pattern of results indicated a positive exponential relationship between member familiarity and team performance. The authors noted that the familiar (pre-formed) teams performed better than the ad hoc (unfamiliar and mixed familiarity) teams both in terms of the number of simulated fireground events that they attended to (efficiency) and the quality of these responses (thoroughness). Importantly, the familiar teams managed to perform better on both counts than the unfamiliar teams, suggesting that their greater level of coordination enabled them to deal more effectively with the fireground events. This observation is consistent with the McLennan et al. (2006) observation of greater cognitive efficiency meaning that the familiar teams' limited resources went further than the unfamiliar teams'.

The Hayes and Omodei (2012) study used two intra-team communication measures: listening to other team members and providing constructive comment to other team members. The higher levels of constructive comment and listening to team members in the familiar teams suggest that psychological safety was an important aspect of team climate that positively influenced team performance. Recent research by Lewis, Hall and Black (2011) highlights the importance of

psychological safety in teams, observing that even experienced firefighters may face social pressures that mean they remain silent in some situations (see also Owen, Chapter 7, this volume).

An interesting question prompted by the curvilinear results from the Hayes and Omodei (2012) study is whether there is more at play than simply member familiarity shaping team performance? In other words, does pre-training teams (i.e., pre-formed) provide an incremental benefit over and above familiar team members working together? The pre-training of teams is designed to enable teams to rapidly commence management of an incident in a seamless manner. The term *familiar* suggests that team members have developed some degree of rapport. Depending on the nature and duration of their previous shared experiences, familiar team members may also have developed some understanding of each other's backgrounds and relevant work experience. However, familiarity by itself does not necessarily ensure team members have sufficient understanding and knowledge of one another in specific roles that will support high levels of team coordination. The pre-training of pre-formed teams can help ensure clarity of member roles and responsibilities, develop the capacity to use implicit coordination and ensure they are able to allocate suitable work to members. In sum, pre-training supports greater member interpredictability than simple familiarity and thus may further aid team coordination and performance.

It was noted earlier that team performance is influenced by mechanisms that support:

1. team member relationships and interaction
2. team coordination.

Team member familiarity appears most likely to support (1) and some aspects of (2). Effective pre-training should not only support member familiarity, but also assist in some team coordination issues not necessarily addressed by familiarity (e.g., member roles and responsibilities). Particularly in time-critical settings, the greater clarity of team member roles and responsibilities of pre-formed teams may provide a valuable performance advantage over teams comprising members who are simply familiar with one another.

A second interesting familiarity-related issue for the performance of teams is whether there is enhanced learning from members rotating or working in other teams. An important finding from Hayes and Omodei (2011) was the requirement for adaptive and flexible incident management personnel who can improvise. Pre-training and pre-forming teams tends to create greater predictability for team members, which generally should support superior team coordination and performance. However, this predictable environment does not necessarily create the opportunities to regularly work with new colleagues and the variation important in the development of adaptive and flexible personnel.

The Gorman and Cooke (2011) simulation-based research with teams operating unmanned aerial vehicles has interesting implications for how familiarity may

influence team cognition. The authors found that mixing members from different teams resulted in significant knowledge and process gain. In other words, there were team learning benefits from mixing teams. The authors also observed that as team members became more familiar, cognition in teams shifted from an interactive basis (i.e., team interaction is team cognition) to a greater emphasis on shared knowledge (i.e., team mind). Moreover, this transition in team cognition from interaction-based to shared knowledge occurred in a non-linear manner that may be best described by nonlinear dynamics (Cooke and Gorman 2009; Gorman, Amazeen and Cooke 2010). Nonlinear dynamical systems is a general systems theory used to describe and predict change processes (Guastello 2010). Nonlinear dynamical systems may appear unpredictable or random, but are essentially deterministic. A team's start point will influence subsequent shifts in team cognition and coordination. For example, in wildfire incident management teams, this may be the combination of the level of member familiarity and the state of the incident (e.g., uncontained small fire vs. contained large fire).

In terms of the Hayes and Omodei (2012) study, the high workload requirements may have disadvantaged the less familiar (ad hoc) teams reliant on interactive cognitive processes and favoured the familiar (pre-formed) teams using more shared cognitive processes. Moreover, the Gorman and Cook (2011) research suggests that changing team membership may help team learning for future settings – despite the consequential lower member familiarity – but undermine team performance in the current setting, especially in high workload D3M settings.

Figure 6.2 integrates the findings from Hayes (2012) with the Gorman, Amazeen and Cooke (2010), Gorman and Cooke (2011) and the Reagans, Argote and Brooks (2005) perspectives of how team familiarity influences team performance. In a manner consistent with the Hayes (2012) findings, Gorman, Amazeen and Cooke suggested that team cognition evolves in a positive exponential way as members become increasingly familiar. This evolving team cognition, which is based on increasing shared knowledge, may help support greater team efficiency. The nonlinear dynamical systems characterisation of team cognition suggests that the shift from a dominance of interaction to shared knowledge may occur at various points in time as well as being dependent on the system starting point. The upward concave curve in Figure 6.2 approximates the Hayes (2012) results and is suggestive of the general relationship proposed by Gorman, Amazeen and Cooke. A pre-trained team is likely to commence operating at a higher level of efficiency than a merely familiar team. Figure 6.2 suggests that the Reagans, Argote and Brooks mechanisms of member interaction and relationships, and team coordination also tend to evolve in a team. In the early stages of a team whose members are new to one another, member interaction and relationship development will tend to be prevalent. As the team trains or works together, there will be an increasing focus on coordinating team and member activities. This evolving pattern of activities can be viewed as behavioural indicators of the changes in team cognition.
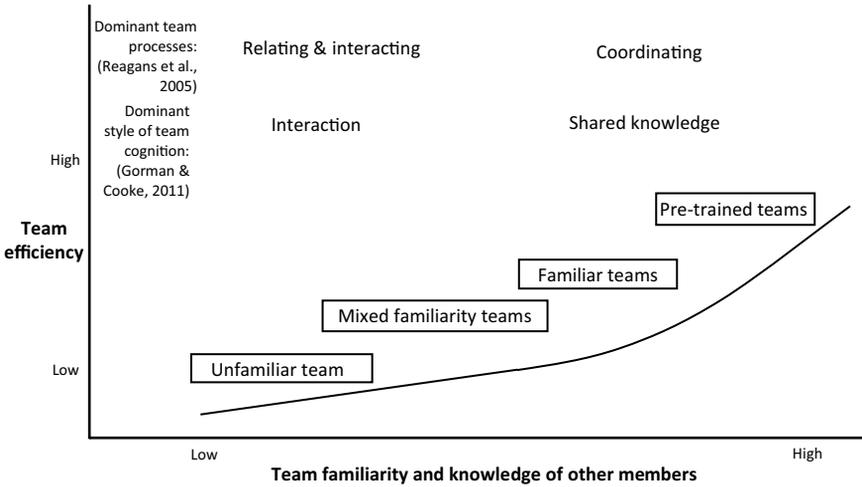
The figure shows a two-axis conceptual diagram. The vertical axis is labeled "Team efficiency" with markers "High" and "Low". The horizontal axis is labeled "Team familiarity and knowledge of other members" with markers "Low" and "High". At the top, two rows of text read:

Dominant team processes: (Reagans et al., 2005) — "Relating & interacting" and "Coordinating"

Dominant style of team cognition: (Gorman & Cooke, 2011) — "Interaction" and "Shared knowledge"

Along an upward-curving line are boxed labels: "Unfamiliar team", "Mixed familiarity teams", "Familiar teams", "Pre-trained teams".

Figure 6.2   Conceptual view of the Hayes (2012) findings integrated with the mechanisms influencing team performance

An implication of Figure 6.2 is that to achieve maximum levels of efficiency requires teams to be pre-trained. In the case of incident management teams, although these teams develop high levels of familiarity by working together, the infrequent deployment of these teams and membership changes suggests that pre-training in regular exercises may be the best way for emergency service agencies to ensure very high levels of team efficiency on an ongoing basis.

Implications for Practitioners and Instructors

The evidence provided in this chapter suggests that teams which regularly work together tend to be more effective than ad hoc teams. The apparent greater cognitive efficiency of familiar teams suggests that these teams will be particularly valuable for managing difficult tasks or incidents.

Value of Mixing Personnel from Different Teams to Enhance Training

The Gorman and Cooke (2011) research suggested that there may be learning benefits from conducting team-based training and exercises with personnel from different teams. Requiring members to work in an unfamiliar team can create an environment which may require personnel to interact more and to adapt to the likely variation in the way that their new colleagues conduct themselves.

Regular Exercising of Personnel who may be Required to Work with Each Other

In a recent study identifying incident management team competencies, it was noted that it usually takes some time for personnel to get back into the swing of incident management (Hayes and Omodei 2011). For teams that work together infrequently this observation suggests that agencies should consider periodic training to maintain teamwork and taskwork competencies, and importantly, team familiarity.

Increasing familiarity in ad-hoc teams
There are probably always going to be situations where emergency service agencies need to deploy ad hoc teams. Therefore, an important question to answer is how does an agency assist ad hoc teams to more quickly become familiar so they may perform more like the pre-formed teams? The swift trust and social cognition literatures provides some insights for considering this issue. When personnel haven't worked together, there is no experience to base judgements of another team member's competency, reliability and integrity (i.e., trustworthiness). In time-pressured situations, team members may rely on surface-level information in the form of category-based assessments of a team member who they have not worked with before. Meyerson, Weick and Kramer (1996) described this as importing expectations from other settings. Team members are particularly likely to develop category-based impressions of unknown personnel in time-constrained situations when little other information is available (Fiske and Neuberg 1990). Clearly this may be the case during the initial phases of a team's deployment where personnel haven't worked together previously.

There are two types of intervention that may assist members of ad hoc teams to work more effectively together – brief résumés and short question and answer sessions. The aim of these interventions is improve the ability of team members to coordinate their actions and this is achieved through developing team member knowledge of each other and fostering effective working relationships. These interventions may work in part by providing additional and categorical information that supports the development of swift trust.

Brief résumés provide the opportunity for managers and team members to rapidly appraise the likely capability of personnel who they may not have worked with before. Developing good teams is not only about placing good performers in the key roles, but also ensuring that personnel don't end up in the wrong role and thus undermine team performance. In a study of team member turnover, Levine and colleagues (2005) found that providing team members with information about newcomers task-relevant skills helped support higher levels of transactive memory (i.e., knowing who knows what in a team) and team performance, whether or not subsequent team turnover occurred. The Levine et al. study suggests that brief résumés may help teams more quickly and successfully integrate newcomers. A brief résumé may provide information about common connections or experiences and thus support the development of swift trust (Wildman et al. 2012).

A simple method that some experienced team leaders use to help assess personnel that they haven't worked with before is to ask a few simple questions about the person's experiences of working in teams. This may be done in a reasonably informal way, as a brief chat, and enable sectional leaders to gather information about the capability of personnel by asking about the last two or three incidents that they have worked on. Questions typically probe the person's role and responsibilities, the nature of the incident, the size of the team, their team or section leader, and how comfortable they felt in undertaking their duties. The more experienced team leaders use their knowledge of who the person has worked with to help assess the unfamiliar team member. For example, if an unfamiliar team member has successfully worked under a section leader who they know is a highly effective albeit demanding manager, then the likelihood is that the new person is a sound team member. Some simple probing can provide a reasonable sketch of the likely capabilities of a new team member and any local knowledge they may have.

The brief question and answer (Q&A) session fulfils two main functions. First, it provides further information about the likely capability of the unfamiliar team member and thus should help ensure the person is allocated to a suitable role. The Q&A may provide a more nuanced view of the likely competence of the person and thus assists in development of an appropriate level of trust. Similar to the brief résumé, the Q&A may provide information about common connections or experiences and enable the development of swift trust (Wildman et al. 2012). If there are doubts about the capability of the unfamiliar team member, then appropriate oversight of their work can be implemented. This approach may work by using trust as a heuristic, thus reducing the cognitive workload for team members by identifying where monitoring may or may not be required.

A second function a Q&A session may play is developing rapport between the unfamiliar team member and their new colleagues. Researchers highlight the central role that high-quality social relationships play within teams in supporting knowledge integration. A simple conversation is likely to help newcomers feel a little more at ease (i.e., psychologically safer) in the new team environment and thus more willing to make helpful suggestions that may assist the team to function effectively.

Strategies for Instructors

Highlighting the Relationship between Team Familiarity, Team Communication and Team Coordination

An important feature of team performance identified in this chapter is the close relationship between team communication and coordination. The influence of team familiarity is likely to be particularly valuable for team coordination and communication in time-constrained, high-workload settings. To highlight this communication-coordination relationship, instructors can use a novel short

role-play exercise where participants are required to manage an incident with a mixture of familiar and unfamiliar team members. The idea here is to highlight the increased coordination and time costs associated with working with personnel who participants are unfamiliar with and identify some strategies to help better manage this. A short after-action review (AAR) following the exercise should help highlight some of the issues encountered by the teams and the opportunity to discuss strategies that can be used in these types of situations. For example, what can be done prior to deployment (pre-process coordination – e.g., exercising with new team members, brief résumés), during the incident (in-process coordination – e.g., sharing workload, brief question and answer), and consolidating the learning from the event (post-process coordination – e.g., AARs).

Supporting Psychological Safety in Teams

In order to encourage team members to speak up it is important that personnel understand the importance of psychological safety and some of the ways that they can help create and maintain this in team settings. By demonstrating behaviours that support psychological safety, an instructor can help create a safe training environment where participants can discuss and practise these same supportive behaviours. For example, the instructor may break the ice by highlighting the importance of recognising the fallibility of human decision making and the possible error traps that can be experienced. The instructor may then reveal to the group at a time when they have made an error or mistake on (e.g., a time that they became lost). By demonstrating openness, candour and perhaps some light humour, the instructor is modelling the types of behaviour that help develop rapport and trust in teams, and a climate that is psychologically safe.

The next step in this exercise would be to organise participants into groups where they take turns at talking about a time when they have made an error or mistake and discussing what they learned from that experience. The instructor could ask the groups to suggest ideas as to how they would develop rapport in a team where they didn't know anyone, and how they might help a new team member feel psychologically safe in a team. The last part of the group discussion could explore what prevents team members from speaking up and the importance for team leadership of adopting inclusive behaviours.

Conclusion

Emergency service teams are regularly required to work in difficult, complex, uncertain and dynamic environments. To perform well these teams need to coordinate their activities through teamwork so that effective and timely decisions can be made. The evidence presented in this chapter indicates that team communication, coordination, leadership and trust are central in enabling emergency service teams to effectively respond to key events, develop and

implement appropriate plans, and make good quality decisions to resolve the incident. There will always be circumstances where team members haven't trained or worked together. By understanding how familiarity is likely to influence team performance, we can prepare teams and team members to better manage any unfamiliarity in these situations.

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