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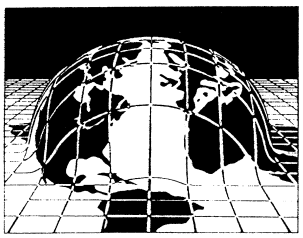

PERSPECTIVE

Coordinating Expertise Among Emergent Groups Responding to Disasters

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In the aftermath of catastrophic events, when plans for organized and timely response break down, impromptu groups often emerge to provide disaster relief. Much remains to be learned about the internal dynamics of these emergent response groups whose representatives may include members from organizations with relief missions; private sector organizations offering resources; and private citizens with the information, relationships, or physical and mental stamina to help. Organizational theories have the potential to contribute to a better understanding of emergent response groups and how they efficiently coordinate knowledge, people, resources, tasks, and technology, thereby substantially improving disaster response for future catastrophes. We apply one organization science theory toward better understanding of these groups—transactive memory systems theory—which is a theory about knowledge coordination in groups. Our application of this theory to emergent response groups requires extending the theory in three ways: the role of expertise in task assignment, how groups function when credibility in member expertise cannot be validated, and how expertise is coordinated. By demonstrating how transactive memory systems theory can be extended to the unique operating conditions of emergent response groups, we hope to inspire organization science researchers to accept the challenge of adapting their theories to study this important problem of our time.

Key words: emergence; tranactive memory systems; coordinating catastrophes

1. Introduction

In the immediate aftermath of recent large-scale disasters such as Hurricanes Katrina and Rita, the Southeastern Pacific tsunami, and the Pakistani earthquake, government emergency response plans failed to meet the urgent needs of those affected (see Exhibit 1). Hurricane Katrina, a disaster nearly 20 times larger than any previous natural emergency in the United States, led to breakdowns in emergency response at all levels of government (GAO 2005, *Time* 2005). In disasters of large scale and scope, formal plans break down in unexpected ways as the disaster unfolds. Authority structures and communities react in unforeseen ways. Planned communication links break down. Information about the disaster arrives at a pace, level of detail, level of credibility and connectedness, and across a variety of sources that rapidly make any planned response too slow, disconnected, and inadequate for the task. In such operating environments, disaster researchers have recognized the importance of *emergent response groups*, i.e., groups with no preexisting structures such as group membership, tasks, roles, or expertise that can be specified ex ante (e.g., Drabek and McEntire 2003, Tierney et al. 2001, Tierney and Trainor 2004). These groups are distinctly different from disaster response groups that operate with preexisting structures and that have experience working together on a variety of tasks, such as police or firefighters (e.g., Bigley and Roberts 2001).

Emergent response groups are characterized by a sense of great urgency and high levels of interdependence, operating in environments that are constantly changing as new information arrives about needs for victims and

Exhibit 1 An Unanswered Cry for Help

"On the morning of August 29th, I received a call that I will never forget, and once I tell you about it, I hope you will never forget it either. My friend and colleague, former appointee to the Social Security Administration, Susan Daniels called me to enlist my help because her sister-in-law, Benilda Caixetta, a New Orleans resident who was quadriplegic, paralyzed from the shoulders down, had been unsuccessfully trying to evacuate to the Superdome for two days. Despite repeated requests to be evacuated, in her power wheelchair, which is a vital tool for mobility and independence, the paratransit system that serves the transportation needs of people with disabilities never showed up. In my naiveté I thought a few phone calls to the 'right' people would help, and I was sure I knew who to call. I was wrong. After many calls to the 'right' people, it was clear that Benny was NOT being evacuated. I stayed on the phone with Benny for most of the day, assuring her that I was doing all I could to make sure help would be coming as soon as possible. I was on the phone with her that afternoon when she told me, with panic in her voice, "the water is rushing in" and then her phone went dead. We learned five days later that she had been found in her apartment, dead, floating next to her wheelchair."

Note. Statement of Marcie Roth, Testimony Before the Subcommittee on Oversight, House Committee on Ways and Means, December 13, 2005.

Exhibit 2 Issuing Money in Emergent Situations

The Red Cross had been using LocalTexasBank to administer debit-card-based relief for Katrina and Rita disaster victims. The process was slow, involving the Red Cross first issuing a check to the victim and then the victim presenting the check to LocalTexasBank to obtain a debit card. As the scope of the Katrina disaster became known and the town was flooded by evacuees, LocalTexasBank became increasingly unable to process and deliver the debit cards in a timely fashion. "The bank was capable of issuing 100 cards a day, when we needed about a 1,000 a day," remarked a Red Cross representative. Sharing his frustration to an officer at another financial institution, the officer was unable to help but referred the Red Cross to a long-term customer, EPAY, a small privately held electronic payment organization. The officer thought EPAY might be able to help because it issued debit cards for the private sector and had an aggressive strategy to expand nationwide. EPAY's CEO had personally lived through a hurricane several years earlier and wanted to help, so he offered EPAY's services at no cost. EPAY and the Red Cross had no prior working experience, nor had EPAY any experience with large-scale disaster relief efforts. Nevertheless, on a handshake, the relationship between the Red Cross and EPAY was formed. The process was streamlined in action. Instead of waiting to get a check from the Red Cross and then presenting the check to LocalTexasBank to receive the debit card, the Red Cross provided information electronically on qualified victims to EPAY and EPAY issued a debit card to the victims. EPAY provided e-mails to the Red Cross with daily issuance totals. Both the Red Cross and EPAY reported results that went beyond their expectations.

Notes. LocalTexasBank and EPAY are pseudonyms. Compiled from interviews of Steven S. Eastland with Red Cross on 12/20/2005 and 1/07/2006; a case study of Disaster Strikes: Aftermath of Hurricane Relief. University of Texas McCombs School of Business.

resources (Drabek and McEntire 2003). This volatility and the need to adapt create unstable task definitions, flexible task assignments, fleeting membership, and pursuit of multiple simultaneous, possibly conflicting purposes. Group members come and go as they have volition and resources to help, making membership in the group fleeting and often unclear, and resembling swarms rather than traditional groups. Members are likely to represent a diverse set of perspectives (e.g., firefighting, homeownership, military command, independent boat ownership, animal rights activism) that is ever changing. Members are unlikely to know one another before the emergency, and may never see one another again afterward. Members may operate remotely from one chasing distributed resources and focusing the resources on the needs of the victims regardless of where the victims are located. Members may represent not only their own altruism and self-interest in helping, but also the interests of their institutions, which may sometimes conflict with the interests of other institutions during these moments of great need.

It is impossible to predict which organizations will and will not engage in disaster response; what tasks, people, and knowledge are needed; and how expertise will be coordinated in an emergent group. However, we can learn much from examples of emergent response groups that efficiently coordinated expertise in the aftermath of Hurricane Katrina. As Exhibit 2 illustrates, social networks were tapped to locate an electronic payment service provider that not only had capabilities (as did the other parties already contacted), but also the volition to perform under the most resource-scarce conditions. Exhibit 3 illustrates that, within hours of Hurricane Katrina's landfall in Louisiana and Mississippi, a KatrinaHelp Wiki emerged. With the independent efforts of hundreds of people across many continents, the Wiki provided lists of shelters, government resources, animal rescue resources, the latest health and safety information, and a people-finder service that helped to coordinate rescue, recovery, and relief efforts. Exhibit 4 illustrates how the U.S. Coast Guard collaborated with civilian boat operators, the National Oceanic and Atmosphere Administration (NOAA), the U.S. Army Corps of Engineers, and the U.S. Maritime administration in unexpected ways to rescue an estimated 22,000 people in the urban areas affected by the hurricane, as well as to reopen waterways to maritime traffic.

Efficient coordination of expertise has been studied in many organizational contexts such as software development (Faraj and Sproull 2000) and emergency medical response units (Faraj and Xiao 2006) where, in these contexts, the group membership, tasks, roles, and knowledge can be specified ex ante. Although the conventional indicators of efficient coordination—expertise specialization, credibility in expertise, and coordination of expertise—are relevant in disaster response, disasters present a unique operational environment. Disasters are "events, observable in time and space, in which societies or their subunits (e.g., communities, regions) incur physical damages and losses and/or disruption of their routine

Exhibit 3 Katrina Wiki

Within hours of Katrina's landfall, the KatrinaHelp Wiki was created. Internet-based Wiki technology allows anyone to add content in the form of web pages and reorganize existing content on those web pages from their web browser. The notion of a KatrinaHelp Wiki site was simultaneously in many different people's minds, but got its start as Rob Kline's initial e-mail was quickly echoed by others, many of whom were members of the TsunamiHelp Blog and TsunamiHelp Wiki team, started after the December 2004 Indian Ocean tsunami disaster. Rudi Citibrasi, a student in Amsterdam started hosting the KatrinaWiki server space. An emergent group of people started adding any knowledge they had that might help others: names of people they knew were missing, names of people recently found, software that searched and matched missing and found names and notified people, addresses of shelters, directions to the shelters, job opportunities for displaced residents, types of jobs that victims needed or skills they had for jobs they wanted. The site quickly contained lists of shelters, government resources, animal rescue resources, the latest health and safety information, a people finder service, lists of job opportunities for displaced residents, activities for children in the affected areas, ham radio resources, fundraising events, and even a life and death section for immediate assistance—all added by an emergent continuously changing set of participants. Only a few people consistently remained involved in the site over time, with most of the emergent group contributing to the site joining and leaving the group as site and personal needs dictated. Four days after Katrina hit land, the website received a million hits a day, overloading Rudi's server. Site Meter joined the emergent group agreeing to host the site. When it became clear that people without Internet access needed the information offered by the site. Skype joined the emergent group to staff a Skype help line connected to the site.

Note. Compiled from http://katrinahelp.info/wikiarchives.katrina.asiaquake.org and www.skypejournal.com.

Exhibit 4 Waterways

Twenty-two thousand people in a hazardous and constantly changing urban disaster environment needed to be rescued by water in the immediate aftermath of Katrina. The Coast Guard operating outside of its normal scope of work, in conjunction with an emergent and ephemeral flotilla of civilian boat operators converging on the heavily damaged areas, both on their own initiative and in response to a call for assistance by political leaders, did the job. The ability of Coast Guard operational commanders to act relatively autonomously in the field, and the development of a shared vision of what was necessary by both Coast Guard and civilian boat operators facilitated the ability to improvise at a multiorganizational level. Not only did people need to be rescued from the waterways, but the waterways needed to be reopened. With few preplanning documents in place, the Coast Guard, U.S. Army Corps of Engineers, National Oceanic and Atmospheric Administration [NOAA], and U.S. Maritime Administration collaborated in unprecedented ways to get waterways reopened to maritime traffic. NOAA's navigation response teams performed emergency data collection, conducted sonar surveys to update government navigation charts, coordinated navy dive teams to check for hazardous obstructions in the waterways and provided mapping support. Working with the Coast Guard, NOAA repositioned, repaired, and replaced navigation aids such as signal buoys and channel markers. For example, NOAA performed a survey that identified a channel obstruction in Mobile, AL that prevented a shipload of coal to a fuel-starved power plant in Southeast Mississippi. NOAA and the Coast Guard worked together to help Drummond load and navigate its coal vessel in such a way to avoid the obstruction, ensuring electricity for the customers in one of the hardest hit areas of the Gulf.

Note. Compiled from Nagle (2005) and Wachtendorf and Kendra (2005).

functioning" (Kreps 1984, p. 312). Disasters have wide implications for expertise coordination because the preconditions known to facilitate expertise coordination are limited or nonexistent in disaster response. Such preconditions include but are not limited to, a shared goal; a clear reward structure; known group membership, expertise, and skills to accomplish the task; and time to share who knows what. Despite extensive disaster research on emergent response groups, Drabek, a noted disaster researcher pioneering the notion and value of emergent response groups, in fact lamented that "we still lack much insight into the internal dynamics of these emergent organizations" (1986, p. 161). The integration of responders and resources in an adaptive manner is generally not well understood (Trainor 2004).

Organization science theories have contributed much to our understanding of the dynamics of organizations in general, and of groups in particular. However, groups generally studied by organizational scientists rarely face the level of unpredictability, urgency, and reconfigurability required by emergent response groups. Hence, much opportunity exists to apply and extend organizational theories to this unique setting. In addition to contributing to an important problem of our time, theoretical extensions can provide value to organizational theories more broadly by pushing the definitional limits and theoretical boundaries beyond traditional organizations.

In this article, we focus on emergent response groups and how they coordinate expertise. We first briefly review the disaster research literature on emergent response groups to underscore the need for such groups—despite federal preparedness plans—and the need to understand the internal dynamics of emergent response groups, specifically expertise coordination. Transactive memory systems (TMS) theory is one organization science theory focused on understanding how expertise is coordinated in groups. We apply TMS theory to expertise coordination in emergent response groups and find that extensions to the theory are needed. Our extensions on group-level expertise coordination have implications for research topics in organization sciences in general.

2. The Need for Emergent Groups Responding to Disasters

Consistent with other large crises (e.g., Dynes 1983, Dynes and Tierney 1994, Neal and Phillips 1995, Wachtendorf 2004), Hurricane Katrina demonstrated how formal systems fail to respond and how the consequences

of failed plans can be severe. In the United States, the National Preparedness System, consisting of the National Response Plan, the National Incident Management System, and the National Preparedness Goal, establishes structures to bring federal, state, local, and nonprofit organizations together in the event of a disaster. The National Preparedness System specifies that an incident command manager and an emergency management office play central roles in assigning tasks, managing resources, and making decisions that are disseminated through a chain of command (Anderson et al. 2004, DHS 2004). The formal system assumes that responding organizations are known ahead of time, have trained together, and are available when needed (Bigley and Roberts 2001, Trainor 2004). Despite the existence of these formal plans, extensive training, and bureaucratic structures, when the authority structure breaks down, as occurred during Katrina, so do the formal plans (GAO 2005).

In Hurricane Katrina's aftermath, some emergency workers in the affected areas fled to care for their crisis-stricken families. Volunteers without knowledge of the City of New Orleans stepped in to fill the vacuum, but often were without specific experience in emergency response or knowledge about the streets and neighborhoods of New Orleans. People trapped in the Louisiana Superdome, the city's pronounced final safe haven, had extensive knowledge of the city and desire to help their hometown but had no ability to make the knowledge and their volition known to volunteers. As authority structures and plans crumbled, trucks idled at their destinations waiting for official approval to unload ice (Wachtendorf and Kendra 2005). Warehouses full of bedding that had been donated by the private sector sat unused awaiting approved transport, while evacuees nearby slept on the floor (U.S. Congress 2005). Personnel and supplies were turned away by some officials, while other officials called for more of the same resources (Foreman et al. 2005). Communication capabilities in areas affected by Hurricane Katrina were so poor that officials had to use human couriers to transmit messages (*New York Times* 2005).

In large-scale crises, the scope and preponderance of uncertainties give rise to a critical role for emergent response groups (Drabek 1986, Drabek and McEntire 2003, Dynes 1983, Neal and Phillips 1995, Tierney et al. 2001, Wachtendorf 2004). Disaster researchers have defined *emergent response groups* as collectives of individuals who use nonroutine resources and activities to apply to nonroutine domains and tasks, using nonroutine organizational arrangements (Bigley and Roberts 2001, Drabek et al. 1981, Drabek 1986, Drabek and McEntire 2003, Kreps 1984, Tierney et al. 2001). As our examples of emergent response groups in Tables 2–4 illustrate, these groups include representatives from relief organizations; private sector organizations with volition and relevant resources; and private citizens with information, relationships, or physical and mental stamina to help. In many cases, these emergent response groups operate outside the formal authority structures and response plans. For example, emergency shelters were run even before the shelters were approved and managed by the Red Cross (U.S. Congress 2005). Other emergent response groups rescued victims from flooded buildings, organized food drives, delivered drinking water, provided first aid, and transported victims to shelters. Given the vast range of uncertainties and circumstances, none of the emergent response groups could rely on preexisting structures such as group membership, tasks, roles, and expertise that could be specified and relied on ex ante.

Whereas emergent response groups were initially viewed by federal agencies as an aberration that needed to be stopped, recent disaster research concludes that such groups are not aberrations at all, but can be observed in all large-scale disasters; that emergent behavior cannot be stopped; and that emergent activity fills a void that cannot be filled by command and control approaches to disaster response (Tierney et al. 2001). Emergent response groups not only provide physical labor, but they also serve the additional valuable functions of tolerating learning and fostering flexibility and innovation, thereby minimizing ritualistic behavior commonly seen in bureaucratic responses to disasters (Drabek and McEntire 2003).

Much of the sociological disaster research has focused on documenting the existence, value, and characteristics of emergent response groups (e.g., Clarke 1989, Drabek et al. 1981, Drabek 1986, Drabek and McEntire 2003, Dynes 1983, Kreps 1984, Neal and Phillips 1995, Quarantelli 1998, Tierney et al. 2001, Trainor 2004, Wachtendorf 2004). This research has found that emergent response groups have unclear and fluid boundaries; fleeting and unclear membership; unclear, fluid, and dispersed leadership; highly unstable task definitions and assignments as environmental conditions continuously change; and geographic dispersion that makes communication difficult. These characteristics require that emergent response groups adopt specific approaches for knowledge coordination. One such approach commonly documented in studies of such groups is their use of a learn-by-doing (versus decision making) action-based model of coordinated problem solving, in which sense making and improvisation are the norm rather than the exception. For example, Moynihan (2005) studied the efforts of an emergent response group that successfully contained a highly contagious poultry disease among chicken farms in the western United States. The group succeeded only after it dropped initial plans and engaged in learning by doing, facilitated by intensive communication through cell phones and a centralized information system to track farms and actions. Clarke (1989) found that an interorganizational emergent group responding to PCB contamination at a New York City office building

learned by doing rather than spent time deliberating on future consequences of actions or choosing the course of action that offered the best expected outcome. Tierney and Trainor's (2004) analysis of the emergent recovery groups in the aftermath of the World Trade Center disaster in 2001, and Hale et al. (2005) offer other evidence of learning by doing as a common approach to knowledge coordination during disaster response.

As emergent response groups learn by doing, coordination becomes opportunistic, with emergent leaders, emergent norms, emergent coordination principles, and emergent coordination channels. The Katrina disaster found ham radio operators, for example, serving not just in an information transmittal role in the immediate aftermath, but as 911 operators, ambulance dispatchers, and rescue coordinators. The urgency of the situation means that the objective of coordination is to achieve minimally acceptable and timely action, even when more effective responses may be feasible—but would take longer and use more resources. Finally, coordination focused on action suggests that expertise coordination in emergent response groups is done by coordinating action. Knowledge conveyed needs to be tied to possible actions that can be implemented by emergent parties. Despite the extensive sociological research on emergent response groups, there is much that is not understood about the internal dynamics of these groups (Drabek 1986, Drabek and McEntire 2003). Thus, a challenge of theorizing about emergent response groups is to understand how groups coordinate their knowledge and actions when responding to large-scale disasters.

3. Transactive Memory Systems Theory

One organization science theory of knowledge coordination among groups—applied generally to more stable groups than to emergent response groups—is transactive memory systems (TMS) theory. TMS theory, a theory of group-level cognition, explains how people in collectives learn, store, use, and coordinate their knowledge to accomplish individual, group, and organizational goals. It is a theory about how people in relationships, groups, and organizations learn who knows what, and use that knowledge to decide who will do what, resulting in more efficient and effective individual and collective performance.

A TMS is a shared system for encoding, storing, retrieving, and communicating information that develops naturally in relationships and in groups (Hollingshead 1998a, Wegner 1987). TMS theory borrows heavily from what is known about the memory processes of individuals and applies it to groups. A TMS can be thought of as a network of interconnected individual memory systems and the transfer of knowledge among them (Wegner 1995). Individuals who are part of a TMS assume responsibility for different knowledge domains, and rely on one another to access each other's expertise across domains. Expertise is defined in the TMS literature to broadly include the know-what, know-how, and know-why of a knowledge domain (Quinn et al. 1996), what Blackler (1995) refers to as embodied competencies. Expertise specialization, then, reduces the cognitive load of each individual and the amount of redundant knowledge in the group, while collectively providing the dyad or group access to a larger pool of knowledge. What makes transactive memory transactive are the communications (called transactions) among individuals that make possible the codifying, storing, retrieving, and updating of information from individual memory systems. For transactive memory to function effectively, individuals must have a shared conceptualization of who knows what in the group. Evidence of a TMS has been found in a variety of relationships and groups, including married couples, dating couples, families, friends, coworkers, and project teams in both organizational and laboratory settings (e.g., Argote 1999; Argote et al. 2000; Hollingshead 1998a, b, 2000, 2001; Faraj and Sproull 2000; Lewis et al. 2005; Liang et al. 1995; Moreland and Myaskowsky 2000).

Research on TMS has identified three indicators of the level of development of a TMS (Lewis 2003, Moreland and Argote 2003):

1. *Memory (or expertise) specialization:* the tendency for groups to delegate responsibility and to specialize in different aspects of the task;
2. *Credibility:* beliefs about the reliability of members' expertise; and
3. *Task (or expertise) coordination:* the ability of team members to coordinate their work efficiently based on their knowledge of who knows what in the group.

The greater the presence of each indicator, the more developed the TMS and the more valuable the TMS is for efficiently coordinating the actions of group members.

As a theory of knowledge coordination, TMS has been used to describe and explain knowledge sharing in close relationships, work groups, and organizations when three conditions are met: group membership is known, members perceive cognitive interdependence, and members have shared goals (Brandon and Hollingshead 2004). TMS was not developed to predict or explain the emergence and behavior of interorganizational emergent response groups, in which some, if not all, of these conditions are violated.

When applied to emergent response groups, the assumptions about how specific behaviors (e.g., coordination) occur and the resulting effects of TMS on group response might be different from stable groups. Dynamic situations require that groups be flexible and able to respond quickly because delays could result in more damage or more lives lost (cf. Moreland and Argote 2003). Emergent response groups form to accomplish

specific tasks and often then disband when the tasks are accomplished, when the group realizes that members will not be able to accomplish the task, or when a more pressing situation is presented to the group. These groups are likely to be composed of diverse members, many of whom have not worked together before, and may not work together again. Moreland and Argote (2003) suggest that the dynamic conditions under which these groups form and work together are likely to have negative effects on the development of transactive memory. Constant changes in team membership threaten transactive memory. Members do not have significant incentives to learn about what others know since they are unlikely to work together again, and it is risky for people to rely on one another's knowledge without familiarity or accountability. The high levels of stress that emergent response groups encounter are likely to have negative effects on individual and group information processing (cf. Ellis 2006, Moreland and Argote 2003).

Thus, we believe challenges occur in all three indicators of the level of development of a TMS—expertise specialization, credibility, and expertise coordination—requiring a need to consider extending theorizing about each indicator for emergent response groups.

Need for Extension 1: Reconceptualizing the Role of Expertise Specialization as a Basis for Task Assignment. The relative expertise of members in the group serves as the primary basis for deciding who will do what in traditional TMS theory. The processes through which members identify and communicate expertise have been a central theme in previous iterations and more recent expansions of TMS theory (Brandon and Hollingshead 2004, Lewis et al. 2005). Current TMS theory suggests that task performance will be highest in groups when tasks are assigned to members on the basis of their relative expertise, when members share the same mental models regarding members' expertise, and when recognized experts are willing and able to contribute their expertise to the group (Brandon and Hollingshead 2004).

Emergent response groups present a new operating environment in which groups must interact and behave—an environment in which it is difficult to identify experts and assign tasks based on expertise. Unlike many traditional work groups whose members have the requisite knowledge, skills, and tools to accomplish the group task, there may not be any members in an emergent response group with the specific expertise or previous experience to perform the task at hand. In the debit card example (Exhibit 2), neither LocalTexasBank's deep disaster payment expertise nor the Red Cross' expertise in disaster recovery was able to cope with the enormity of the situation; instead, the willingness and ability of EPAY's CEO and the Red Cross team to flexibly adapt their knowledge, resources, and tools to a novel situation proved instrumental. In the Coast Guard example (Exhibit 4), the civilian boat operators did not have expertise in search and rescue, but did have sufficient knowledge to pilot their boats. As emergent response groups form, they need to quickly assess a situation, including what actions are required, who can perform them, and what resources are needed. The ability to contribute to the group's efforts requires more than just knowledge: the provider must also have the motivation and access to the resources (time, equipment, labor, money, etc.) to make that knowledge available to the group. The challenge lies in how to conceptualize expertise, and in determining whether expertise should be the primary basis for assigning tasks to members in emergent response groups.

Need for Extension 2: Assessing Credibility in Emergent Response Groups. Early TMS studies examined dyads and intact small groups where credibility in member knowledge was invariably high because of close social relationships or past interaction history (Hollingshead 1998a, 2000; Liang et al. 1995). The relative credibility in member knowledge was seen to allow different individuals to specialize in different knowledge domains. Credibility in one another's knowledge was an outcome of learning either through direct or indirect means (experience, communication, etc.). In such groups, accountability was also high because parties could assume future interaction in which punishments and rewards could enforce and reinforce expected behaviors.

Recent TMS literature on organizational groups assumes credibility in member knowledge as a core element in successful coordination (Lewis 2003, Lewis et al. 2005, Moreland and Myaskovsky 2000). There is, however, little discussion in current TMS literature about how groups develop credibility in member knowledge in high-risk situations of fleeting membership, fluid group boundaries, and nonroutine tasks. The emergent group that formed between EPAY and the Red Cross (Exhibit 2) was neither based on prior interaction history nor on future plans of mutual cooperation. Moreover, the two organizations, one for profit and the other nonprofit, had fundamentally different interests. The challenge is how emergent response groups function effectively when expertise cannot be validated.

Need for Extension 3: Expertise Coordination in Emergent Response Groups. The TMS of a group is shared through a metastructure describing who knows what that is understood and agreed on by group members (Brandon and Hollingshead 2004). These metastructures are rarely made explicit in stable groups because time and membership stability allow individuals to interactively cue, evolve, validate, and refine an understanding of one another's expertise (Hollingshead 1998b). The notion of sharing in the traditional TMS context, then, refers to an implicit cognitive consensus about who knows what.

The notion of shared (or team) mental models has appeared in prior discussions of TMS (Brandon and

Hollingshead 2004, Levine and Moreland 1999). Shared mental models are the extent to which individual team members' mental models overlap—that is, the extent to which team members share the same understanding of the task, the tools, the team, and the situation (Blickensderfer et al. 1997). It is when group members have shared mental models that a TMS is most effective (Brandon and Hollingshead 2004). Benefits of shared mental models include more accurate explanation and prediction of other group members' actions and better coordination (Mohammed and Dumville 2001). TMS theory suggests that the implicit goal of a group is to reduce differences in the individual mental models of group members and to develop a shared mental model regarding the group task and who will do what (Brandon and Hollingshead 2004). In emergent response groups, shared mental models may be much less likely to develop.

Traditional definitions of groups hold that members of a group share a common purpose, a shared sense of identity, and a shared perception of interdependence with others in the group in accomplishing that purpose (Poole and Hollingshead 2005). In an emergent response group, as in the Katrina Wiki example (Exhibit 3), members pursue different individual purposes simultaneously, rather than pursuing a common group purpose, and they may not have a sense of group identity. Rather, they may just have an ideology about volunteering or democratic collaboration (Leuf and Cunningham 2001). Interdependencies among members are likely to change quickly. A news correspondents, for example, may help an emergent response group to locate victims in need, becoming a fleeting member of the group. Just as quickly, though, the news correspondent may move away from the group to broadcast her story. On the surface, the lack of stable membership suggests that a shared mental model may not be viable or even desired in emergent response groups. Time may be too precious to seek consensus on events and actions, and agreements may make the group less flexible to accommodate to changing inputs. In addition, acute stress negatively affects the ability of groups to implement their preexisting transactive memory (Ellis 2006), let alone try to develop one from scratch. How do emergent response groups coordinate their expertise without a shared metastructure?

We believe that emergent response groups offer the opportunity for new theory building because such groups challenge the key assumptions about the operating environment in which TMS develops. As the operating environment is challenged, so are the behaviors to accomplish the key indicators of TMS. Effective response in a large-scale disaster requires broadening the behavioral repertoire to develop TMS. In §3.1, we describe how TMS theory might be extended for each of the three indicators.

3.1. Extending TMS Theory

When membership in a group is fleeting, the notion of the system in a TMS needs expanding beyond the people-expertise links that are traditionally the focus of TMS research (Brandon and Hollingshead 2004). When emergent response groups first come together, members are likely not to ask one another about who knows what; instead, they are likely to ask about what is known about the situation and about the actions taken thus far (Dyer and Shafer 2003, Hale et al. 2005). The cognitive structure that they develop for the group centers not around people, but on action-based scenarios that either have been or might be carried out. These scenarios include decisions, actions, knowledge, events, and feedback (Vera and Crossan 2005). The scenarios are not scripts, because they do not define the roles that people play. Instead, the scenarios are patterns of actions strung together to be matched with events (Dyer and Shafer 2003). Thus, in the emergent response groups exhibited in our three examples (Tables 2–4), we suggest that their TMS were likely composed not of people-expertise links, but rather of links between the tasks that needed to be performed and the skills needed to perform the tasks, interwoven into sets of multiple scenarios of actions, unfolding over time and perhaps in parallel.

Given this expanded notion of system in a TMS, we suggest three extensions that facilitate the ability of members of an emergent response group to coordinate during disasters.

Extension 1: Tailor the Role of Expertise. The role that expertise plays in task assignment needs to be modified when applied to emergent response groups. Some individuals may have considerable expertise relevant to the goal of the group, but may fail to contribute simply because they lack the means or resources to take action on their knowledge (Argote and McGrath 1993). For example, the people who took refuge in the Superdome in New Orleans had considerable knowledge about the local neighborhoods but were unable to contribute that knowledge to the general good. In fact, much expertise that exists in a group may not be actionable for a variety of reasons such as competition, identity threat, power, etc. (Menon et al. 2006). To overcome these barriers to contribution, more stable groups may use their slack resources (e.g., Haas 2006). However, emergent response groups lack these slack resources. Willingness to share expertise, then, may be as important of a factor in determining if a contribution is made as is the expertise itself (Brandon and Hollingshead 2004). Consequently, contributions may not be based on deep task expertise. As demonstrated by the civilian operators in the Coast Guard example (Exhibit 4), the many volunteers in the Wiki example (Exhibit 3), and the small but agile payment operator EPAY (Exhibit 2), task-relevant expertise is not a necessary or even a sufficient condition

for making an important contribution to the emergent response group.

Individuals in emergent response groups may make valuable contributions simply by following directives and providing physical labor without having any requisite expertise. Individuals may bring value to the group from the networks to which they connect (Jarvenpaa and Majchrzak 2005, Majchrzak et al. 2004). In the debit card example (Exhibit 2), the representative at the financial institution to whom the Red Cross turned for advice did not have the scale and scope of resources himself, but he knew where to find them, drawing on his network of relationships. Individuals in emergent response groups may also bring value from having general, rather than narrow specialized, skills. In the debit card example (Exhibit 2), EPAY did not have the deep expertise of LocalTexasBank, which had a long-term working relationship with the Red Cross. EPAY employees had more general skills, however, particularly an agility to adapt. Those with general skills can provide much value to the group by being particularly observant, monitoring changes in the environment, being creative problem solvers, or using interpersonal skills for persuading and motivating people to join the effort. Finally, at the group level, an individual's expertise may be less relevant than the collective expertise of emergent group members, as in the Katrina Wiki example (Exhibit 3).

Thus, we suggest that TMS theory may need to reconsider how task assignments are made beyond a member's deep expertise, to include a group's collective knowledge of relationships, tools, and task performance as well as a willingness of group participants to share and to act on that knowledge. That is, capability and motivation, in addition to the domain knowledge typically examined by TMS theory, are required.

Because of the speed of change in a disaster situation, the TMS notion of expertise as hierarchically organized knowledge in a particular domain may need to be augmented with a notion of knowledge flexibility, defined as expertise plus the ability to update that expertise based on feedback from the environment (Cook and Brown 1999). For example, an individual in an emergent response group may be knowledgeable about debit cards, but if that individual is not a good observer and interpreter of the feedback from the field indicating that debit cards are not working for the victims in the way intended, that person's knowledge about debit cards is of limited value, becoming rapidly obsolete as new knowledge about how to make debit cards work is gained.

Knowledge flexibility may come about by having higher-order domain principles as suggested by Lewis et al. (2005). In addition, though, knowledge flexibility may be derived from individuals' personality traits that enable them to cognitively process divergent information quickly, or through individuals' experiences with enough other disasters that they are able to quickly match incoming patterns to successful past recovery efforts.

In addition to allowing for knowledge flexibility, we need to augment the notion in TMS theory that member selection is based on the expertise requirements of the collective task. The expertise and experiences that individuals bring to the emergent group are likely to be incommensurate, divergent, and potentially irrelevant to the task at hand, and the group may not have all the necessary expertise and resources to achieve its objectives. In addition, individuals will approach the tasks with institutional and other cultural norms dictated by their own experiences, which could make the development of a shared conceptualization of the collective task objective unlikely, if not impossible. Expertise will be constantly changing and challenged, so the focus of the group's efforts in developing its TMS may not be on agreeing who has expertise in a task-related topic, but on constantly scanning the environment to locate knowledge and other resources.

Extension 2: Replacing Credibility in Expertise with Trust Through Action. In emergent response groups, the notion of credibility in member knowledge as a basis for a TMS found in traditional TMS literature (e.g., Lewis 2003, Moreland and Myaskovsky 2000) may need to be replaced with the notion that TMS develops from a trust that others will behave in ways that will be helpful to the community—trust that is continuously created and recreated through action (Child and Mollering 2003). Trust is defined as a willingness to hold positive expectations of another party's behaviors, regardless of the inability to monitor or control that other party (Mayer et al. 1995). In contrast, traditional TMS literature assumes that efficient coordination of knowledge is dependent on the group's ability to validate that members have credible knowledge and are doing the tasks that they are assigned (Brandon and Hollingshead 2004). Such validation occurs through shared experiences or explicit information about members' skills and knowledge (Moreland and Myaskowsky 2000). The resource-scarce and time-pressured operating environment of the emergent response group precludes such validation. In such groups, there is an implicit threat of common fate such that, unless one trusts others and takes immediate action, significantly more harm (even to their own security) may result (Meyerson et al. 1996). The threat encourages risk taking, while the generation of action increases the willingness to trust others' knowledge without social proof. In the debit card example (Exhibit 2), only a handshake put the partnership of Red Cross and EPAY into full gear; subsequent daily e-mails suspended doubt and built trust.

Trust in emergent response groups takes a form of swift trust that is developed through task-based action in the presence of a shared fate or higher-order goal. Swift trust implies different conceptualizations of trust than are

typically examined in the TMS literature. Often associated with ad hoc project teams (Harrison et al. 1997, Jarvenpaa and Leidner 1999, Meyerson et al. 1996), swift trust does not assume any shared experience among the whole group; it simply includes the positive expectation that others will be trustworthy ex ante of any observed carryover from past interactions or expectation of future interactions. The concept of swift trust was originally developed to describe the emergence of trust in role-based temporary groups, such as film crews and cockpit crews that come together for a short time and then disband (Meyerson et al. 1996). Swift trust, however, is not limited to teams that coordinate face to face; it can emerge in dispersed teams that have no opportunity for face-to-face encounters (Jarvenpaa et al. 1998, Jarvenpaa and Leidner 1999), as well as in virtual learning communities (Coppola 2004).

In emergent response groups, action may initiate swift trust. The maintenance of trust is likely to be multifaceted, however, relying on many sources, particularly as groups face adversity and an inability to observe or even an awareness of others' actions. These trust sources can also reinforce initial swift trust. If the response group has a member who can be singled out as a core member (e.g., the Red Cross) or a go between who assembled the other members, and the other members have had prior interaction with this core member (e.g., EPAY and the Red Cross both did business at the financial institution), trustworthiness of this core member is assumed to generalize to trust in the whole group (trust by transference) (Harrison et al. 1997, Meyerson et al. 1996). Trust may also be strengthened on the basis of institutional factors, including social and organizational membership, rules, and roles, unless a member (e.g., a person in a police uniform) is observed engaging in activities that violate expectations (e.g., stealing food) (Kramer 1999, McKnight et al. 1998). Trust may also be based on dispositional tendencies (Kramer 1999, McKnight et al. 1998). When uncertainty is high, the dispositions of members have a strong impact on determining the level of trust for action, particularly when others cannot be directly observed acting in a trusting manner (Meyerson et al. 1996). The CEO of EPAY took the high road by assuming that rescued victims seeking financial relief were legitimate unless proven otherwise. Finally, where members can visibly see what is happening and perhaps digitally record it, trust can be based on deterrence (punishment or reputational sanctions) (Lewicki and Bunker 1995).

In uncertain conditions, swift trust promotes efficient response as long as it is neither too low nor too high (Meyerson et al. 1996). Swift trust that is too high is detrimental, although disappointments can rapidly bring a downward spiral. Also, in emergent response groups composed of strangers, swift trust that is too high may promote opportunistic actions and negative outcomes, particularly when accountability is low (Langfred 2004). Group members may take advantage of trust placed in them. Moderate trust is is less amenable to these problems because it promotes alternative paths (e.g., hedges, fail-safe mechanisms) to cover the worst-case scenarios that might occur because of the great uncertainties present (Meyerson et al. 1996).

Sometimes operating conditions (time urgency, high emotions, severity of harm) of the emergent response group may be so inhospitable that the group must contend with low trust and still engage in transactions and develop TMS. In such cases, the group may build redundancy in task-expertise scenarios by maintaining parallel actions that help accomplish similar goals. The group may also engage in additional activities where specific goals are set and members' behaviors are monitored toward those goals. The team may set up an information system to track and transmit status information about each team member and to make the information available to the whole team. The team may also resort to external authorities or plans that instruct the members for particular actions even if doing so results in a less-than-optimal response.

All in all, the level of trust present in an emergent response group is likely to affect TMS development, as suggested by existing TMS literature, but the nature of that influence is likely to be substantially different than assumed in the TMS literature. High levels of trust may not be helpful. Instead, moderate levels may provide sufficient predictability with protection from harm. In addition, trust is unlikely to be determined by situational factors; instead, trust is likely to be highly dynamic, needing to be constantly created and recreated through action (Child and Mollering 2003). The group dynamics, not the situation, are likely to affect how trust is continuously won (Adler 2001).

Extension 3: Coordinating Knowledge Processes Without a Shared Metastructure. Instead of the TMS conceptualization that knowledge coordination occurs through a shared metastructure consisting of a directory of who knows what and a set of cues for encoding and retrieving information from each group member, knowledge coordination in an emergent response group will need to occur without shared mental models. Based on past experiences either as observers of or participants in emergencies, members may have individual mental models about how people should behave in emergency situations and may bring expectations about their own and others' roles (Bechky 2006, Faraj and Xiao 2006, Moreland and Argote 2003), as well as ostensive routines (Feldman and Pentland 2003) for performing in an emergency situation. Emergent response groups, however, are likely to pose challenges to meeting these expectations. Roles may be in conflict, roles may be left unattended,

or roles identified as needed may not be matched precisely to the knowledge and motivation that exists at the time. In the debit card example (Exhibit 2), the role that required a high volume of cash distribution was mismatched to the capabilities of the initial debit card company. In the Coast Guard example (Exhibit 4), the Coast Guard's formal role expectation did not include urban waterways, or coordinating with civilian boat operators in rescue operations.

Coordinating an emergent response group in the absence of a metastructure is likely to create "epistemic differences, reputation stakes, and possible blame apportionment" (Faraj and Xiao 2006, p. 1155), potentially making the process quite difficult. There may be attribution errors, miscues, communication rework, and significant inefficiency in how knowledge is shared and used (e.g., DeSanctis and Monge 1999). While the group is likely to attempt to create a metastructure (Lewis et al. 2005), the instability in roles, task, and membership is likely to rapidly make such a metastructure obsolete. The group, then, may need to evolve not a metastructure, but a set of mechanisms for managing its activities.

A group may evolve a variety of mechanisms. Faraj and Xiao's (2006) study of medical trauma center practitioners as well as studies reviewed by Tierney et al. (2001) of emergent teams responding to large-scale disasters demonstrate that such groups evolve the use of dialogic coordination practices such as joint on-the-spot sense making when metastructures fail. Brown and Eisenhardt (1998) suggest that such groups may use simple process structures to coordinate. In the debit card example (Exhibit 2), the simple structure of e-mailing an approved list of victim names and daily disbursement amounts quickly evolved as the mechanism for coordination.

Emergent response groups may also use a mechanism of creating a community narrative (Boland and Tenkasi 1995), which is a running narrative of the actions taken and not taken, the decisions made, and the theories in use. Narratives do not represent a single shared understanding of a domain; rather they represent the multiplicity of events and actions a community is taking, as members are taking them. Narratives may be articulated explicitly or understood implicitly. In the Katrina Wiki example (Exhibit 3), the emergent response group of Wiki contributors created a community narrative of their activities by the very act of contributing to the Wiki site. Since the site was an organized aggregation of the emergent response group's activities, with a history page documenting any changes to the page and a discussion page describing discussions that ensued prior to significant changes, the Wiki site was simultaneously the product of an emergent response group's work and the narrative of their actions, decisions, and implied causal principles. Narratives, when made explicit, may serve as a coordination mechanism by providing an observable record of others' actions that may help members recognize a routine, role, or sequence of actions into which they might contribute (Bechky 2006, Feldman and Pentland 2003). Explicitly articulated narratives may also make clearer that multiple sequences of actions may be occurring simultaneously, thus resolving role conflicts by allowing multiple ways to accomplish a task. For example, by encouraging civilian boat operators to articulate their plans of action for rescuing victims from the waterways (e.g., a community narrative), Coast Guard personnel were able to recognize the need for different types of support for different plans of action—some boat operators needed armed guards, others needed experienced emergency personnel on board, and others needed the communication linkage that the Coast Guard could provide to local medical personnel.

The urgency of time may make it too onerous for the extra effort of articulating actions as they are being performed, yet most emergency response requires some communication. Community narratives may then evolve through a human intermediary. In Hurricane Katrina's aftermath, ham radio operators, in relaying messages to people in the field, shared the evolving narrative of what was happening and who was doing what about it. In Moynihan's (2005) study of an emergent group responding to a U.S. poultry disease outbreak, a central dispatcher became the aggregator of the community narrative as members shared the status of avian health on the farms they visited, the possible reasons they considered that a farm contracted the disease while another farm was spared, and the steps each member planned to take to prevent the next farm from falling victim; the central dispatcher continuously shared this information with other members as they called in. After a hurricane in Florida, trucks with satellite dishes were driven around the impacted area so that Florida hurricane disaster response teams could periodically synchronize the latest information they had collected on building conditions, using Groove peer-to-peer software; in so doing, they were contributing to an evolving narrative of the group's perspective on the hurricane's impact and victim needs.

In sum, in the absence of a shared metastructure, emergent response groups need to evolve mechanisms for coordination. These mechanisms may include simple structures or more comprehensive narratives. They may coordinate face to face with dialogue or through intermediaries, be they human or a website. They may quickly evolve a routine, may constantly negotiate actions, or may adopt a set of parallel actions. Given the urgency of the situation, the mechanism they choose may be less relevant than whether they adopt any at all.

Exhibit 5 Expanding TMS Theory to Emergent Response Group

Characteristics of emergent response groups*	Implications for knowledge coordination	Current TMS theory	Suggested extensions to TMS theory for emergent response groups	Implications for research topics in organization science
		TMS Indicator 1: Expertise specialization		
• Unstable task definitions and assignments • Pursuit of multiple, conflicting, and changing purposes and perspectives • Fleeting and sometimes unclear membership • Geographically distributed, diverse, unfamiliar group members • Volitional member participation, based on urgent personal needs	• Action-based coordination • Learning-by-doing model • Minimally acceptable timely action suffices • Opportunistic coordination with emergent leaders, emergent coordination principles, emergent coordination channels	Task-relevant expertise serves as basis for task assignment and specialization	• Task-relevant expertise often not present, so any knowledge of relationships, tools, or tasks and ability and willingness to act on that knowledge may serve as basis of task assignment and specialization • Knowledge flexibility, sufficiency, and motivation as additional bases for task assignment and specialization	• Evolving nature of expertise in a group • Converting focus on domain knowledge to actionable knowledge • Keeping volunteers engaged when their initial needs are met
		TMS Indicator 2: Credibility in member expertise		
		Validation of expertise needed for effective group functioning	• Replace credibility with trust in action • Moderate levels of trust more conducive to building a TMS than high levels • Trust encouraged without observing member behavior • Development of swift trust	• Examining nature of trust as it evolves • How group dynamics affect trust • When trust and expertise credibility differ • Conflicts of swift vs. generalized trust
		TMS Indicator 3: Knowledge coordination		
		Shared mental model of who knows what necessary for efficient coordination	• Knowledge coordination occurs by observing and recognizing action scenarios, identifying ways to contribute to scenarios, and quickly devising simple coordination mechanisms • Community-developed narratives describing events & scenarios may help coordination	• Finding ways to overcome communication difficulties • Using IT to facilitate narrative evolution and communication • Coordinating with multiple conflicting action scenarios

*Drabek and McEntire (2003).

3.2. Summary: Emergent Response Group Dynamics Revisited

Our examination of TMS theory is summarized in Exhibit 5. Our examination suggests that by expanding the context in which TMS theory is applied to include emergent response groups, insights can be gained into their internal dynamics. The three indicators of the level of development of a TMS provide a useful framework for organizing these insights in the exhibit.

Traditional TMS research would not be able to account for emergent response groups being able to function with relatively little expertise and a specialization that is based on volition and tasks, not expertise. Our extensions to TMS theory allow a more inclusive conceptualization of how tasks are assigned that focuses on actionable knowledge sufficiency of people, tools, tasks, and member volition.

Traditional TMS theory would not be able to explain how members assess the credibility of one another's expertise without observing their behaviors. Our extensions to TMS theory suggest that credibility in emergent response groups is less important for coordination than members' ability to constantly create and recreate trust with task-specific action or without observable action based on associations.

Traditional TMS theory would not be able to account for emergent response groups coordinating their knowledge from afar, without knowing each other's expertise and without agreed-on cues about how to encode, store, and retrieve each individual's knowledge. Our extensions of TMS theory suggest that, because in an emergent response group there will be no metastructures that everyone agrees to and understands, participants will bring to the situation their theories in use and experienced and expected roles for others to play; when those roles conflict or are insufficient, the group will evolve coordination mechanisms that range from simple structures to more comprehensive community narratives.

Practical Implications of Extending TMS Theory. Our extensions to TMS theory suggest several insights about the internal dynamics of emergent response teams that have practical implications for disaster preparedness. The current practice of joint training for emergency response is focused on learning what others know to facilitate coordination with one another when the crisis occurs. However, in the event of the crisis, these trained people and their expertise are not necessarily present. Our exploration into the internal dynamics of emergent response groups suggests that such groups will include

people who have not been trained together, such as people who volunteer with relatively little specialized expertise in the emergency domain.

Therefore, training should focus on learning how to quickly recognize volunteers' volition in participating in an emergent group, the tasks they might engage in, and the support they might need to carry out those tasks. Such training could also help people to recognize the benefits and dangers of generalized trust. It could also help people to quickly evolve a coordination mechanism that does not rely on what people know, but on compiling and communicating a narrative of the actions that volunteers take, so that others are able to assess for themselves what actions they could take to help. Such training might help emergency personnel recognize the important role they might play as intermediaries in the coordination process, rather than as coordinators themselves. Finally, such training should not be limited to emergency personnel. Citizens, too, can be empowered with such training. These practical suggestions, then, build on the current crisis management literature recommending training for emergence (e.g., Tierney et al. 2001) by providing specificity about the content of that training.

4. Implications for Organization Science Theorizing

Our examination of the internal dynamics of emergent response groups through a TMS lens has implications for theorizing about a broader set of groups and organizations. Our three extensions collectively suggest that the cognitive models of knowledge sharing and coordination developed for intact work groups need modification to apply to rapidly and continually changing environments. Even theories of improvisation, with their focus on action as preceding thought and retrospective sense making (e.g., Weick 1998), are limited to groups with a well developed understanding of internal resources and materials at hand, proficiency, presence of associates similarly committed to and competent at impromptu decision making, and confidence in dealing with nonroutine events (Weick 1998). Thus, jazz quartets, firefighters, and other groups that many scholars who are interested in processes of improvisation have studied are quite different from the emergent response groups we examine here. Our theorizing extends thinking about the relations between cognition and action in groups of highly skilled members to those groups whose members may not have individual mental models, let alone shared mental models of the task.

Our extensions also have implications for theories of dynamic organizations. As the marketplace is becoming increasingly dynamic, many groups, organizations, and communities face ever-higher levels of unpredictability, urgency, and reconfigurability. Process networks in China form emergent value chain relationships in response to customer needs for manufacturing a product (Hagel and Brown 2005). Cross-organizational new product–development teams form and disband rapidly, leaving membership unstable and uncertain (Majchrzak et al. 2004). Virtual organizations and communities emerge in response to social needs and competitive pressures (DeSanctis and Monge 1999). Terrorist and security threats create the need for emergent response groups comprising security personnel from ports, private corporations, the FBI, and public utilities (Jarvenpaa and Majchrzak 2005). Theories of dynamic organizations need to push their definitional limits and theoretical boundaries to explain human behavior, where humans are struggling to collaborate under extreme time pressure and risk, with inadequate information, with emotionally laden volition, and with others who have conflicting purposes, fleeting involvement, and changing perspectives. As suggested by Peterson and Mannix (2003), such theories need to focus on human behavior and interaction and go beyond structural patterns, typologies, and features of dynamic organizations.

A fundamental issue in dynamic organizations is how to manage the continuous tension between stability and instability (Brown and Eisenhardt 1998, Peterson and Mannix 2003). Previous research on dynamic organizations has argued for stability at the organizational level and flexibility at the individual and group levels (Dyer and Shafer 2003, Moreland and Argote 2003). Our examination of emergent response groups reiterates the need for theorizing to consider multiple levels of analysis; in addition, though, we suggest the possibility that such theorizing may need to reverse the focal point of stability: individuals, and not the organization, may be the source for stability. In fact, research studying individual response to disasters repeatedly finds that people maintain behavioral continuity and remarkable composure when responding (Drabek 1986). Therefore, since the organization contributing to and managing a dynamic group may need to be as fluid as the group itself, stability may need to be found in the individual: the individual's ability to quickly work with others to develop coordination mechanisms, the individual's willingness to contribute where applicable and the individual's ability to know what she knows herself, how to use her network and how to rapidly signal her knowledge to others. The role of the organization, then, may become one of serving as an intermediary and directory of coordination mechanisms, resources, action scenarios, and emergent response groups that the individual may contribute to, and use, in responding to the changing environmental conditions.

Our extensions also have implications for theories on trust. The trust literature—even those studies focused on dynamic organizations—frequently theorize about trust

as a relatively stable social characteristic generalized from patterns of past and current interaction, dispositions, and institutional structures. The literature portrays trust as situationally dependent. As the situational conditions (such as characteristics of the relationships) change, so does trust (e.g., Lewicki and Bunker 1995, McKnight et al. 1998). Even the current literature on swift trust assumes predictability and deterrence from the situational conditions of clear roles, intense social interaction, social proofs, firm deadlines, and so on (Meyerson et al. 1996, Jarvenpaa and Leidner 1999). Our theorizing, in contrast, suggests that emergent response groups face conditions that undermine all these situationally based sources and bases of trust and require trust that is constantly created through action (Child and Mollering 2003). In such situations, swift trust is only a fleeting, situationally specific assessment of "what you just did." In such high-risk settings, trust comes from purposive action that conveys investment and vulnerability. Trust is highly dynamic and is continuously won rather than called on (Adler 2001). Our extensions imply a shift in attention from the conditions influencing trust to the examination of how action in the team creates and recreates trust, how group dynamics affect swift trust, and how swift trust affects group dynamics. What happens when swift trust conflicts with contextually based sources and bases of trust? How does a group resolve these conflicts?

There is a plethora of other research questions worthy of study. Communication difficulties abound in dynamic organizations, difficulties made even more complex by the time urgency, rapidly changing conditions that make information quickly obsolete, emotionality of the situation, and an inability to observe the actions of other members. Research is needed on how members communicate their actions and intents in difficult situations, especially when roles imported from previous contexts do not work. Research is also needed on the role of deep expertise and how it evolves, if at all, in dynamic organizations when each situation is so different, or whether the cognitive rigidity of deep expertise outweighs its benefits. Emergent collaboration is emotionally, intellectually, and potentially physically draining. What are the coping strategies that lead to the most effective response?

In our theorizing, we have repeatedly referred to time pressures and the emotional intensity typical in a disaster; the effect these have on knowledge coordination deserves further research. Disaster scale and scope are likely to have significant impacts, as well. Social networks and institutional norms of the organizations and communities from which emergent response group members are drawn may affect not only trust, but the speed of forming groups, role negotiation, and interaction patterns. Further research examining these impacts is needed.

5. Conclusion

The bureaucratic model continues to be the most commonly used approach for coordinating crossorganizational response to major disasters. The National Preparedness System perpetuates and continues to institutionalize this approach. This approach is used in spite of the disaster research evidence indicating that such an approach is not likely to accommodate the multidimensional crisis situation found in large-scale disasters. Organization science is concerned with dynamic organizations, virtual teams, networks of individuals within and between organizations, interorganizational relationships, and coordination within and across organizations. Therefore, it is within the domain of organization science to contribute to this debate about new alternative models for emergency response. However, this potential contribution can only be realized if theoretical models elaborate on the dynamics of the phenomenon, opening up the internal dynamics of the emergent response group leading to a deeper understanding of how the emergent response group functions within the larger institutional network of organizations, communities, and individuals. With our improved understanding and readiness, when the next disaster hits (as it most assuredly will) the cries for help (as in Exhibit 1) may not go unanswered.

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References

Adler, P. S. 2001. Market, hierarchy, and trust: The knowledge economy and the future of capitalism. *Organ. Sci.* **12** 215–234.

Anderson, A. I., D. Compton, T. Mason. 2004. Managing in a dangerous world: The National Incident Management System. *Engrg. Management J.* **16**(4) 3–9.

Argote, L. 1999. *Organizational Learning: Creating, Retaining and Transferring Knowledge*. Kluwer, Norwell, MA.

Argote, L., J. McGrath. 1993. Group processes in organizations: Continuity and change. *Internat. Rev. Indust. Organ. Psych.* **8** 333–389.

Argote, L., P. Ingram, J. M. Levine, R. L. Moreland. 2000. Knowledge transfer in organizations: Learning from the experience of others. *Organ. Behav. Human Decision Processes* **82** 1–8.

Bechky, B. A. 2006. Gaffers, gofers, and grips: Role-based coordination in temporary organizations. *Organ. Sci.* **17**(1) 3–21.

Bigley, G. A., K. Roberts. 2001. The incident command system: High reliability organizing for complex and volatile task environments. *Acad. Management J.* **44** 1281–1300.

Blackler, F. 1995. Knowledge, knowledge work and organizations: An overview and interpretation. *Organ. Stud.* **16** 1021–1046.

Blickensderfer, E., J. A. Cannon-Bowers, E. Salas. 1997. Theoretical bases for team self-correction: Fostering shared mental models. M. M. Beyerlein, D. A. Johnson, S. T. Beyerlein, eds. *Advances in Interdisciplinary Studies of Work Teams: Team Implementation Issues*, Vol. 4. JAI Press, London, UK.

Boland, R. J., R. V. Tenkasi. 1995. Perspective making and perspective taking in communities of knowing. *Organ. Sci.* **6** 350–372.

Brandon, D. P., A. B. Hollingshead. 2004. Transactive memory systems in organizations: Matching tasks, expertise, and people. *Organ. Sci.* **15** 633–644.

Brown, S., K. Eisenhardt. 1998. *Competing on the Edge: Strategy as Structured Chaos*. Harvard School Publishing, Boston, MA.

Child, J., G. Mollering. 2003. Contextual confidence and active trust development in the Chinese business development. *Organ. Sci.* **14**(1) 69–80.

Clarke, L. B. 1989. *Acceptable Risk? Making Decisions in a Toxic Environment*. University of California Press, Berkeley, CA.

Cook, S. D., J. S. Brown. 1999. Bridging epistemologies: The generative dance between organizational knowledge and organizational knowing. *Organ. Sci.* **10** 381–400.

Coppola, N. 2004. Building trust in virtual teams. *IEEE Trans. Professional Comm.* **47**(2) 95–104.

Department of Homeland Security (DHS). 2004. National Incident Management System. Government Printing Office, Washington, D.C. http://www.dhs.gov/interweb/assetlibrary/NIMS-90-web.pdf.

DeSanctis, G., P. Monge. 1999. Communication processes for virtual organizations. *Organ. Sci.* **10** 693–703.

Drabek, T. E. 1986. *Human System Responses to Disasters: An Inventory of Social Findings*. Springer-Verlag, New York.

Drabek, T. E., D. A. McEntire. 2003. Emergent phenomena and the sociology of disaster: Lessons, trends and opportunities from the research literature. *Disaster Prevention and Management* **12**(2) 97–112.

Drabek, T. E., J. L. Taminga, T. S. Kilijanek, C. R. Adams. 1981. *Managing Multiorganizational Emergency Responses: Emergent Search and Rescue Networks in Natural Disasters and Remote Area Settings*. Bounder Institute of Behavioral Sciences, University of Colorado, Boulder, CO.

Dyer, L., R. Shafer. 2003. Dynamic organizations. R. S. Peterson, E. A. Mannix, eds. *Managing People in Dynamic Organizations*. Lawrence Erlbaum, Mahwah, NJ, 7–40.

Dynes, R. 1983. Problems in emergency planning. *Energy* **8** 633–660.

Dynes, R., K. Tierney. 1994. *Disasters, Collective Behavior, and Social Organization*. University of Delaware Press, Newark, DE.

Ellis, A. P. J. 2006. System breakdown: The role of mental models and transactive memory in the relationship between acute stress and team performance. *Acad. Management J.* **49** 576–589.

Faraj, S., L. Sproull. 2000. Coordinating expertise in software development teams. *Management Sci.* **46** 1554–1568.

Faraj, S., Y. Xiao. 2006. Coordination in fast-response organizations. *Management Sci.* **52** 1155–1189.

Feldman, M. S., B. T. Pentland. 2003. Reconceptualizing organizational routines as a source of flexibility and change. *Admin. Sci. Quart.* **48** 94–118.

Foreman, T., M. M. Ahlers, A. Cooper. 2005. People making decisions hesitated. http://www.cnn.com.

GAO (U.S. Government Accountability Office). 2005. Hurricane Katrina: Providing oversight of the nation's preparedness, response, and recovery activities. GAO-05-1053T (Sept. 28).

Haas, M. R. 2006. Knowledge gathering, team capabilities, and project performance in challenging work environments. *Management Sci.* **52** 1170–1184.

Hagel, J., J. S. Brown. 2005. *The Only Sustainable Edge*. Harvard Business School Publishing, Boston, MA.

Hale, J. E., R. E. Dulek, D. P. Hale. 2005. Crisis response communication challenges. *J. Bus. Comm.* **42** 112–134.

Harrison, R. T., M. R. Dibben, C. M. Mason. 1997. The role of trust in the informal investor's investment decision: An exploratory analysis. *Entrepreneurship Theory and Practice* (Summer) 63–81.

Hollingshead, A. B. 1998a. Communication, learning, and retrieval in transactive memory systems. *J. Experiment. Soc. Psych.* **34** 423–442.

Hollingshead, A. B. 1998b. Retrieval processes in transactive memory systems. *J. Personality Soc. Psych.* **74** 659–671.

Hollingshead, A. B. 2000. Perceptions of expertise in and transactive memory in work relationships. *Group Processes and Intergroup Relations* **3** 257–267.

Hollingshead, A. B. 2001. Cognitive interdependence and convergent expectations in transactive memory. *J. Personality Soc. Psych.* **81** 1080–1089.

Jarvenpaa, S. L., D. E. Leidner. 1999. Communication and trust in global virtual teams. *Organ. Sci.* **10**(6) 791–815.

Jarvenpaa, S. L., A. Majchrzak. 2005. Developing individuals' transactive memories of their ego-centric networks to mitigate risks of knowledge sharing: The case of professionals protecting cybersecurity. *26th Internat. Conf. Inform. Systems Proc.*

Jarvenpaa, S. L., K. Knoll, D. Leidner. 1998. Is anybody out there? The antecedents of trust in global virtual teams. *J. Management Inform. Systems* **14**(4) 29–64.

Kramer, R. M. 1999. Trust and distrust in organizations: Emerging perspectives, enduring questions. *Annual Rev. Psych.* **50** 569–598.

Kreps, G. 1984. Sociological inquiry and disaster research. *Annual Rev. Sociol.* **10** 309–330.

Langfred, C. W. 2004. Too much of a good thing? Negative effects of high trust and individual autonomy in self-managing teams. *Acad. Management J.* **47**(3) 385–399.

Leuf, B., W. Cunningham. 2001. *The Wiki Way: Quick Collaboration on the Web*. Addison-Wesley, Boston, MA.

Levine, J. M., R. L. Moreland. 1999. Knowledge transmission in work groups: Helping newcomers to succeed. L. L. Thompson, J. M. Levine, D. M. Messnick, eds. *Shared Cognition in Organizations: The Management of Knowledge*. Lawrence Erlbaum, London, UK.

Lewicki, R. J., B. B. Bunker. 1995. Trust in relationships: A model of trust development and decline. B. B. Bunker, J. Z. Rubin, eds. *Conflict, Cooperation, and Justice*. Jossey-Bass, San Francisco, CA.

Lewis, K. 2003. Measuring transactive memory systems in the field: Scale development and validation. *J. Appl. Psych.* **88** 587–604.

Lewis, K., D. Lange, L. Gillis. 2005. Transactive memory systems, learning, and learning transfer. *Organ. Sci.* **16** 581–598.

Liang, D., R. Moreland, L. Argote. 1995. Group versus individual training and group performance: The mediating role of transactive memory. *Personality Soc. Psych. Bull.* **21** 384–393.

Majchrzak, A., L. Cooper, O. Neece. 2004. Knowledge reuse for innovation. *Management Sci.* **50** 174–188.

Majchrzak, A., A. Malhotra, J. Lipnack, J. J. Stamps. 2004. Can absence make a team grow stronger? *Harvard Bus. Rev.* **82** 131–137.

Mayer, R. C., J. H. Davis, F. D. Schoorman. 1995. An integrative model of organizational trust. *Acad. Management Rev.* **20** 709–734.

McKnight, D. H., L. L. Cummings, N. L. Chervany. 1998. Initial trust formation in new organizational relationships. *Acad. Management Rev.* **23** 473–490.

Menon, T., L. Thompson, H.-S. Cho. 2006. Tainted knowledge vs. tempting knowledge: People avoid knowledge from internal rivals and seek knowledge from external rivals. *Management Sci.* **52** 1129–1144.

Meyerson, D., K. E. Weick, R. M. Kramer. 1996. Swift trust and temporary groups. *Trust in Organizations: Frontiers of Study and Research*. Sage Publication, Thousand Oaks, CA.

Mohammed, S., B. C. Dumville. 2001. Team mental models in a team knowledge framework: Expanding theory and measurement across disciplinary boundaries. *J. Organ. Behav.* **22** 89–106.

Moreland, R. L., L. Argote. 2003. Transactive memory in dynamic organizations. R. S. Peterson, E. A. Mannix, eds. *Leading and Managing People in the Dynamic Organization*. Lawrence Erlbaum, Mahwah, NJ.

Moreland, R. L., L. Myaskowsky. 2000. Exploring the performance benefits of group training: Transactive memory or improved communication? *Organ. Behav. Human Decision Processes* **82** 117–133.

Moynihan, D. P. 2005. Leveraging collaborative networks in infrequent emergency situations. Collaboration series: Research report. IBM Center for the Business of Government (June).

Nagle, K. J. 2005. Katrina's federal heroes. *Traffic World* (Sept. 19).

Neal, D., B. Phillips. 1995. Effective emergency management: Reconsidering the bureaucratic approach. *Disasters* **19** 327–337.

New York Times. 2005. Government prepares for next big disaster. (Dec. 31).

New York Times. 2006. Red Cross sifting internal charges over Katrina aid. (March 24).

Peterson, R. S., E. A. Mannix. 2003. *Leading and Managing People in the Dynamic Organization*. Erlbaum, NJ.

Poole, M. S., A. B. Hollingshead. 2005. *Theories of Small Groups: Interdisciplinary Perspectives*. Sage, Thousand Oaks, CA.

Quarantelli, E. L. 1998. *What Is a Disaster?* Routledge, New York.

Quinn, J. B., P. Anderson, S. Finkelstein. 1996. Making the most of the best. *Harvard Bus. Rev.* **74**(2) 71–80.

Tierney, K. J., J. E. Trainor. 2004. *Networks and Resilience in the World Trade Center Disaster*. Center for Earthquake Engineering Research, University of Buffalo, Buffalo, NY.

Tierney, K. J., M. K. Lindell, R. W. Perry. 2001. *Facing the Unexpected: Disaster Preparedness and Response in the United States*. Joseph Henry Press.

Time. 2005. Four places where the system broke down. **166**(Sept. 19) 34–41.

Trainor, J. E. 2004. Searching for a System: Multi-Organizational Coordination in the September 11th World Trade Center Search and Rescue Response. Doctoral dissertation, Department of Sociology and Criminal Justice and Disaster Research Center, University of Delaware, Newark, DE.

U.S. Congress. 2005. House Ways and Means Committee, Subcommittee on Oversight. *Hearing to Review the Response by Charities to Hurricane Katrina*. (Dec. 13).

Vera, D., M. Crossan. 2005. Improvisation and innovative performance in teams. *Organ. Sci.* **16** 203–224.

Wachtendorf, T. 2004. Improvising 9/11: Organizational Improvisation Following the World Trade Center Disaster. Doctoral dissertation, Department of Sociology and Criminal Justice and Disaster Research Center, University of Delaware, Newark, DE.

Wachtendorf, T., J. M. Kendra. 2005. Improvising disaster in the city of jazz: Organizational response to Hurricane Katrina, http://understandingkatrina.ssrc.org/Wachtendorf_Kendra/.

Wegner, D. M. 1987. Transactive memory: A contemporary analysis of the group mind. B. Mullen, G. Goethals, eds. *Theories of Group Behavior*. Springer-Verlag, New York.

Wegner, D. M. 1995. A computer network model of human transactive memory. *Soc. Cognition* **13** 319–339.

Weick, K. E. 1998. Introductory essay: Improvisation as a mindset for organizational analysis. *Organ. Sci.* **9** 543–555.