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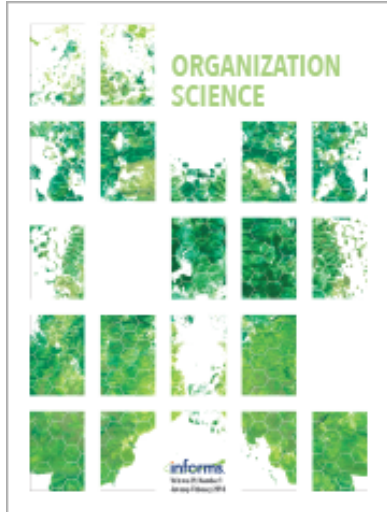
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Managing Boundaries in Multiteam Structures: From Parochialism to Integrated Pluralism

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Abstract. Multiteam structures are increasingly used to coordinate complex tasks between different groups. To realize this potential, however, the members of a multiteam structure must manage a complex set of boundary relations within, between, and beyond the various constituent teams—boundary relations that can be cooperative, competitive, or some combination of both at the same time. This multimethod study provides insight into how multiteam structures can meet this challenge. Specifically, we examined how the different organizations that utilize and support the Dutch railway system learned to manage boundaries as they transitioned from a centralized, arms-length structure to a colocated, multiteam structure for coordinating disruption responses (i.e., the Rail Operations Control Center (ROCC)). In part 1 of our study, qualitative analyses of interview, observational, and archival data suggested that learning to manage boundaries within the ROCC was not simple or linear but evolved through trial and error during various phases. Ultimately, the ROCC developed an approach we call "integrated pluralism," establishing a dynamic balance that combines both collaborative and competitive approaches to boundary management. In this manner, the ROCC teams were able to attain integrated solutions and coordinated task accomplishment while simultaneously defending internal team operations and home organization interests. In part 2, we employed an interrupted time series analysis to demonstrate that the implementation of the ROCC resulted in significant performance improvements. Consistent with the results of part 1, we found that these improvements emerged gradually over time as teams learned to work out their boundary relations and transitioned to integrated pluralism. These findings provide new insights into how individuals and teams can work together to tackle the unique boundary management challenges presented by multiteam structures and illuminate the dynamic trial and error process by which component teams can learn to both cooperate and compete.

The past two decades have seen an increased interest among both scholars and practitioners in the opportunities and challenges presented by multiteam structures (variously referred to as multiteam systems, teams of teams, or team-based alliances) (Luvison and Marks 2013, McChrystal et al. 2015, Mathieu et al. 2018). In a multiteam structure, two or more separate teams—which may represent different organizations or organizational units—coordinate their efforts and manage their interdependencies to achieve a collective goal (Mathieu et al. 2001, Zaccaro et al. 2020). The various teams in a multiteam structure are tightly networked and often colocated so they can interact directly with one another as they work to achieve

goals or solve problems that require the expertise, knowledge, or efforts of all participating teams (DeChurch and Mathieu 2009). Multiteam structures have therefore been recommended for tasks that (1) are highly complex and thus, lend themselves to a team-based structure and (2) require communication and mutual adjustment to coordinate and integrate the interdependent contributions of component teams (Zaccaro et al. 2012, Luciano et al. 2018, Mathieu et al. 2018). Examples of settings where multiteam structures have been employed include interorganizational alliance networks (Faems et al. 2008, Luvison and Marks 2013); emergency response coalitions (DeChurch and Zaccaro 2010, Beck and Plowman 2014);

product launch collaborations (Hoegl et al. 2004, Marks and Luvison 2012); and partnerships of organizations that support transport networks, power grids, or telecommunication systems (Goodwin et al. 2012, Schipper 2017).

Multiteam structures are interdependent working arrangements with collective goals that, at the same time, retain the autonomy and identity of participating teams (DeChurch and Mathieu 2009). As such, these structures are hybrid organizational forms (Luciano et al. 2018) that engender a complex—and potentially contradictory—set of coordination requirements. For example, the teams within a multiteam structure must engage in and support the work of the collective as a whole, without disrupting their own internal work processes (Wolbers et al. 2018; see also Gibson and Dibble 2013). They must work closely with other teams to solve problems of mutual interest, without giving away important information that may help them gain an advantage over those same teams (Goodwin et al. 2012). They must develop a shared sense of identity and trust as members of a multiteam collective, without compromising identity and trust within their team and in interorganizational structures, with their home organizations (Cuijpers et al. 2016, Mell et al. 2020). Put differently, the individuals and teams within a multiteam structure are constantly required to perform an intricate set of "boundary work" activities (Langley et al. 2019) that simultaneously contain both collaborative and competitive elements. Members of multiteam structures perform such boundary work, for example, when they define, reinforce, blur, defend, or dissolve the boundaries that exist between their own team and other teams, between their team and the broader multiteam structure, and between their team and their home organization or unit (Ancona and Caldwell 1988, Faraj and Yan 2009, Langley et al. 2019). Effective boundary work within a multiteam structure "enables collective action, while allowing participants to remain behind their preferred established boundaries, and thus deliberately sustaining both competitive and collaborative boundary relations" (Langley et al. 2019, p. 723).

Understanding how teams and individuals work out the complex coordination requirements of multiteam structures has been an important focus of scholarly interest. Most of this research has examined how the individuals and teams within a multiteam structure manage key boundaries to align members' efforts and enable coordinated task accomplishment or what Langley et al. (2019) referred to as "collaborative boundary work." Collaborative boundary work includes initiatives designed to motivate, enable, and direct cooperative boundary relations, such as the use of contingency plans (Argyres et al. 2007); a central coordinating body (Davison et al. 2012, Kotha and Srikanth 2013); boundary spanners (Waring et al. 2018);

direct mutual adjustment (Marks et al. 2005, de Vries et al. 2016); and emergent norms, goals, and identities (Browning et al. 1995, Mell et al. 2020). However, not all boundary work is collaborative. A smaller set of studies has examined how the teams and individuals within a multiteam structure manage boundaries to protect and defend themselves from external demands, distractions, and interference or what scholars have referred to as "competitive boundary work" (see Langley et al. 2019). Competitive boundary work includes activities such as physical separation (Wolbers et al. 2018); shielding core operations from outside influences (Wu et al. 2020); concealing or protecting information (Mehta and Bharadwaj 2015); and reinforcing a team's unique, distinctive goals, and identity (Porck et al. 2019). Whereas collaborative boundary work enables the spanning of boundaries required for the accomplishment of interdependent, system-level tasks, competitive boundary work enables the protection of boundaries required for team-level task accomplishment.

Prior research often has implicitly assumed that collaborative boundary work and competitive boundary work are opposites, such that investments in spanning boundaries necessarily compromise boundary protection and vice versa (Kislov 2018). Hence, almost no research has grappled with what may be the central challenge in a multiteam structure—the challenge of managing boundaries in ways that *simultaneously* encourage cooperation and competition or what has been referred to as "configural boundary work" (Langley et al. 2019; for an exception, see Kislov 2018).[1] Importantly, scholars have argued that complex interdependencies in multiteam structures require the cultivation of both cooperative and competitive boundary relations and that attending to one at the expense of the other will often diminish system and/or team performance (e.g., Marks et al. 2005, Zaccaro et al. 2012). From this perspective, it is imperative that members of multiteam structures learn to integratively manage contradictory demands for proximity versus distance, sharing versus withholding, and commonality versus distinctiveness. If we are to understand how multiteam structures enable the attainment of collective goals without compromising the functioning of component teams (and vice versa), we must better grasp the complex dynamics of configural boundary work.

Moreover, understanding these complex dynamics requires a more in-depth appreciation for how boundary relations develop over time. Most empirical research has studied the various approaches toward boundary work in multiteam structures from a static perspective, without examining how the actions and activities of individuals and teams may dynamically evolve in response to emergent coordination problems (Davison et al. 2012, Murase et al. 2014,

de Vries et al. 2016; for an exception, see Hoegl et al. 2004). Given the complexities and interdependencies inherent in multiteam structures, effective boundary work is often likely to result from dynamic learning processes—especially when it comes to managing the contradictions and tensions associated with configural boundary work (Mathieu et al. 2018, Zaccaro et al. 2020). Hence, a thorough understanding of how multiteam structures come to operate effectively requires insights not only into their ultimate structural configurations but also, into how and why these configurations evolve over time (Mathieu et al. 2018). Put differently, we need to understand how the participants in a multiteam structure learn to navigate relevant boundaries, working to discover the relational, structural, and cultural solutions that enable the effective integration of collaborative and competitive interactions. We need to describe multiteam structures as they are becoming—and not just after they have come into being (Ahuja et al. 2012).

In short, the present study aims to advance a novel understanding of how individuals and teams within multiteam structures enact configural approaches to boundary work that integrate both collaborative and competitive elements. To address this question, we leveraged a unique research setting. In 2010, the various independent organizations that support, maintain, and utilize the Dutch railway network created a multiteam structure to better coordinate their joint management of rail disruptions. About 300 individuals from 14 teams representing eight organizations came together under one roof, in an effort to facilitate more effective responses to the frequent and multifaceted disruptions that occur throughout the Dutch railway system. We used qualitative data from interviews, archival records, and observations as well as quantitative time series data to examine how individuals and teams within this multiteam structure handled competing demands for cooperation and competition, how their respective boundary work activities evolved over time, and how these activities shaped the effectiveness of joint disruption management efforts.

The results of this study present a nuanced picture of boundary work in multiteam structures that extends and enriches our understanding of these complex organizational forms. We found that collocated teams evolved a set of structural, relational, and cultural mechanisms that integrated the seemingly contradictory demands of promoting system cooperation while protecting team interests. Moreover, our findings suggest that some degree of learning through trial and error is required to achieve such integration. Multiteam structures may find themselves evolving from boundary solutions that unduly emphasize cooperation (and neglect competitive aspects) to solutions that overemphasize competition (and neglect

collaborative elements) before arriving at solutions that adequately combine these approaches. This learning process requires participating teams and individuals to unlearn past expectations and relational assumptions, develop a common language, and create a joint foundation of trust and understanding. Finally, our results illustrate that this learning process has important implications for coordination outcomes, suggesting that learning configural boundary work matters for performance.

Crossboundary Disruption Management in the Dutch Rail System

> On the afternoon of April 6, 2005, all traffic control systems failed near one of the busiest train stations in the Netherlands. As a result, rail traffic controllers, passenger carriers, and cargo transporters had no way of monitoring or guiding train movements in vital parts of the Dutch rail network. To avoid collisions, all trains going into or out of that station were instructed to stop immediately, resulting in snowballing delays throughout the network. Train services did not resume until the next morning, delaying millions of passengers and thousands of tons of cargo.

The Dutch rail network is the busiest in Europe (Ramaekers et al. 2009) and plays a key role in the European trade union. It facilitates the distribution of over 35 million tons of cargo every year Central Bureau for Statistics (2020) and carries approximately 1 million daily passengers who cumulatively travel an estimated 46 million kilometers (Netherlands Railways 2012). This combustible combination of high traffic volume on dense and highly interconnected tracks means that when disruptions occur in some portion of the rail network, interrelated problems can quickly snowball across the system, resulting in a convoluted tangle of rerouted trains, delayed schedules, and backlogged deliveries. Such disruptions can result from train breakdowns, collisions, fallen trees, computer malfunctions, or any number of other unpredictable (but not uncommon) incidents. In fact, the Dutch railway system encounters as many as 3,000 disruptions every year. Restoring rail operations as quickly as possible after a disruption—a high priority for all parties—typically requires information, expertise, and involvement from the seven private firms that utilize, support, or maintain the complex Dutch railway system.[2]

At the time of the incident described, the organizations involved in the Dutch rail system (e.g., passenger and freight carriers, network operators, railway contractors, and train repair companies) used a formalized and centralized structure for disruption management. During this period, rail organizations operated from different locations and had little direct interaction. When faced with a disruption, these organizations would first attempt to coordinate their

respective actions by following predefined scripts and protocols (i.e., "Train Incident Scenarios"). These scripts were designed as best-practice routines that should enable rail organizations to align operations without having to engage in direct contact. In the case of disruptions that existing scripts did not sufficiently cover, members from the "rail traffic control" and "back office" department of ProRail (i.e., the organization responsible for rail network management) took the lead in developing a joint response (e.g., by rerouting trains, coordinating repair activities, etc.). Other organizations would contact ProRail to discuss relevant issues and proposed solutions, and ProRail would then go back and forth between members of the different rail organizations to find a solution that was viable and acceptable by all. These solutions were then communicated through a shared electronic information system, also operated by ProRail. In case a consensual solution could not be found, ProRail's rail traffic control team had the formal authority to decide how to deal with a disruption (although traffic controllers were legally obliged to allocate rail infrastructure in an impartial way that respected each organization's commercial interests).

Research suggests that such centralized and formalized systems can be effective for coordinating boundary relations between teams and organizations (Bigley and Roberts 2001, Moynihan 2009, Wolbers et al. 2018). However, centralization and formalization can become slow and rigid when interactive complexity increases and more flexible and ongoing adjustments are required (Takeda and Helms 2006, Waugh and Streib 2006). Indeed, after the Dutch railway system encountered several high-profile system failures like the one described in the vignette, railway officials concluded that a centralized approach was inadequate and that a multiteam structure that more

directly involved all organizations in problem solving could provide greater flexibility and responsiveness (Menkhorst 2011, van Aggelen 2011). An alliance of rail organizations therefore came together to create the "Rail Operations Control Center" (ROCC), a 24/7 command and control center that would bring teams from different rail organizations into one facility where they could communicate directly and resolve rail disruptions in a less centralized and formalized manner (Menkhorst 2011). In this new multiteam structure, disruption responses would be developed through direct communication and open problem solving involving members of all affected rail organizations, such that ProRail would no longer play a central coordinating role.

On October 8, 2010, the ROCC became fully operational. Built at an estimated cost of 16 million euros, the ROCC provides approximately 2,500 square meters of open floor space in which teams from different rail organizations could colocate. About 300 members from 14 teams representing eight independent organizations worked in shifts at the ROCC (see Table 1). Team sizes generally ranged from 3 to 10 members, and overall shift sizes generally ranged from 47 to 55 members. Team members were permanently transferred to the ROCC, although they remained fully affiliated with their home organizations. Therefore, similar to the pre-ROCC period, ROCC members had to combine their disruption management tasks with other responsibilities for their home organizations. Teams from carrier organizations were also responsible for allocating personnel to trains, for example, whereas teams from maintenance companies were also expected to plan and oversee rail infrastructure renewal projects. Members from diverse organizations had different shift rotation and compensation schemes, and they were required to act as home organization

Table 1. Organizations and Teams Participating in the ROCC

Organization	Team	Role within ROCC
ProRail	Rail traffic control	Reallocating railroad routes when the capacity of the network is reduced
ProRail	Back office	Initiating alarm procedures and registering activities of different teams during disruptions in a central logging system
ProRail	Asset management	Organizing and overseeing repairs, renewal, and maintenance of rail infrastructure
ProRail	Central service desk	Organizing repairs, renewal, and maintenance of rail-related information technology for passenger information and network management
Netherlands Railways	Passenger information	Informing passengers of adjusted train schedules
Netherlands Railways	Allocation center	Planning and rerouting passenger trains, wagons, and staff
Netherlands Railways	Passenger services	Maintaining continuance of passenger services (e.g., arranging alternative transport)
Netherlands Railways	NS Hispeed	Planning and rerouting international high-speed trains
BAM	BAM Rail	Executing repairs for a designated part of the rail network
Strukton	Strukton Rail	Executing repairs in remaining parts of the rail network
Volker	Volker Rail	Executing large-scale renewal and maintenance in the rail network
Nedtrain	Nedtrain	Executing emergency repairs for broken-down trains
DB Schenker	DB Schenker	Planning and rerouting cargo transport
ROCC	National Rail Coordinators	Facilitating and supporting coordination between teams in the ROCC

representatives in both substantive (e.g., preserving the home organization's interests within the ROCC) and symbolic ways (e.g., using home organization— rather than ROCC—logos in official communication). Moreover, teams from different organizations were legally required to remain autonomous and independent to avoid collusion, which was actively monitored by the Dutch government. Each ROCC team had its own designated work area, enclosed by two lines of horseshoe-shaped workstations so that teams could preserve a degree of privacy (e.g., restricted line of sight to computer screens) while remaining visible to each other. Also, large wall-mounted computer screens provided 24/7 information about the status of the rail system. Participating organizations shared in the operating cost of the ROCC, including the cost of five "national rail coordinators" who worked in separate shifts to help facilitate coordination without having formal decision-making authority.

The transition from a formalized and centralized interorganizational structure for rail disruption management (before October 2010) to coordination through the ROCC provided a unique opportunity—a natural experiment of sorts (Shadish et al. 2001)—for an in-depth examination of the coordination dynamics and boundary work approaches within a complex multiteam structure in the field. We therefore undertook a multimethod examination of the ROCC, comprising both qualitative and quantitative analyses. In part 1 of our study, we explored the shift to the ROCC and how teams learned to work out their boundary relations over time using interviews as well as observational and archival data. In part 2, we examined the effects of the ROCC on disruption response effectiveness using quantitative time series data that allowed us to examine time to recovery before and after the ROCC was implemented. This two-part approach is intended to "supplement qualitative work with quantitative data … to check the interpretation of qualitative data, and to strengthen the confidence in qualitatively based conclusions when the two types of data converge" (Edmondson and McManus 2007, p. 1166). In the sections that follow, we describe these two parts of our study and summarize results from each.

Part 1—The Evolution of Boundary Relations in the ROCC
Data and Analysis
Our qualitative analysis draws from archival data (e.g., disruption response procedures, legal information, etc.) as well as interviews and on-site observations. We conducted a first round of semistructured interviews in May 2011 to build a baseline understanding of the experiences and perceptions of ROCC members before and after the launch of the ROCC.

These interviews included 19 individuals representing all of the ROCC teams. We had selected these informants because they had extensive experience in both the pre- and post-ROCC period, thereby increasing the likelihood of accurate and detailed recollection of relevant disruption management processes. Specifically, the respective individuals had, on average, 24.85 years of working experience within the rail system (standard deviation (SD) = 8.55), and all of them had been part of the ROCC since its inception. In interviewing these informants, we used a critical incident method, asking them to describe two disruption response situations they had experienced within the ROCC: one situation in which coordination went well and one situation in which coordination needed improvement. For both situations, we used an interview protocol that asked the participants (a) what and with whom they had coordinated, (b) which communication channels they had used, (c) how the coordination developed during the situation, and (d) what the outcomes were. We further probed interviewees to describe, for example, the reasons for their specific coordination approaches and possible barriers they had encountered, as well as any help they had received (e.g., from their team leader, fellow team members, or members from another team) to deal with relevant coordination barriers.

The initial interviews were followed by a one-week period of immersive, on-site observation in June 2011 to document firsthand how ROCC members were managing boundary relations during rail disruptions. During this period, T.A.d.V. took detailed field notes and observed interactions within the ROCC during more than 100 rail disruptions that ranged from a minor collision to a large malfunction that disrupted all train movement around an international airport. Insights from these initial interviews and observations resulted in a refined interview protocol designed to generate additional insight into how individuals and teams managed their various boundaries during rail disruptions. We used this refined protocol during a second round of semistructured interviews in February 2013, interviewing 13 key informants at the ROCC that represented seven different organizations. These interviewees had, on average, 24.59 years of working experience within the rail system (SD = 7.23). Our questions in this final round of qualitative interviews focused on the evolution of boundary relations after ROCC implementation. We first asked interviewees to describe boundary relations within the ROCC, for example focusing on the sequence of interactions and the type of issues discussed with other ROCC teams, the specific communication channels used when interacting with other teams, and the general development of interteam coordination within the ROCC. We then repeated these questions and asked interviewees to describe the respective

boundary relations and coordination approaches before the ROCC had been implemented. Interviews from both rounds were transcribed to facilitate coding and analysis. The full interview protocols are available from T.A.d.V.

Our analysis of these qualitative data followed an iterative process designed to identify themes that indicated how ROCC teams combined and separated their efforts during the joint management of rail disruptions (Eisenhardt and Graebner 2007). We cross-checked emerging themes against our interview and observation notes, omitting themes that were insufficiently substantiated, combining similar themes, and adding themes to account for newly acquired insights. We then systematically inspected all transcripts from the semistructured interviews and categorized interviewees' verbatim statements according to their corresponding themes. An independent rater blind to the research questions coded 40 randomly selected statements (approximately 25% of all statements) and achieved a 78% agreement score (Isabella 1990). Discrepancies in coding were resolved through discussion and used to improve the coding scheme's calibration.

After themes were identified, we aimed to understand the broader narrative that could explain how teams had learned to manage relevant boundaries within the ROCC. Strauss and Corbin (1998, p. 124) describe this as "the process of reassembling data that were fractured during open coding" (see also van Maanen 1979, Beck and Plowman 2014). As that narrative began to take shape, we returned to the interview data to confirm or disconfirm specific conclusions and to flesh out details. We crosschecked this model with the expert opinions of one of the national rail coordinators and a manager who had been involved in the development of the ROCC. These conversations did not result in any substantive revisions to our emerging narrative. The result of this overall process was a grounded theory on how teams learned to manage boundaries within a multiteam structure that both corroborates and extends past theory and research. This framework is described in the following sections and summarized in Figure 1.

The Pre-ROCC Period: Isolation
As noted earlier, before the implementation of the ROCC, disruptions within the Dutch railway network were managed using a combination of formal protocols and centralized coordination by departments of one company (i.e., traffic control and back office departments from ProRail). This created an environment in which teams from various rail organizations emphasized competitive boundary work (Langley et al. 2019), isolating themselves from other organizations and focusing primarily on their own local problems with little concern for how their actions might affect other parts of the system. Members simply "threw

problems over the fence," leaving the resolution of broader problems to ProRail staff. Moreover, because communication was prescribed and centrally mediated, resolving rail disruptions often required multiple back and forth exchanges; it could take up to 28 separate phone calls to resolve a single issue (Goodwin et al. 2012). Organizations operated with a limited understanding of what others were doing, resulting in significant misalignments when a single team chose to deviate from a plan or protocol. The following quotes illustrate this narrow approach to resolving rail disruptions that prevailed under the pre-ROCC system.

> We did not seek to communicate with neighboring regions to see if a countermeasure was ineffective for them. We tried to contain the snowball effect of a disruption within our region, but we didn't look at other regions. I could develop a good solution for my region that created a mess in another region; we did not take this into account. —Interviewee 7, rail traffic control

> If a disruption surpassed your jurisdiction, then your countermeasure could cause problems for your neighboring region. We did inform others about how we dealt with disruptions, but we did not consider that what I would do in my region could have serious consequences for other regions further along the way. Problems were just thrown over the fence so that they were relocated rather than resolved. —Interviewee 27, rail traffic control
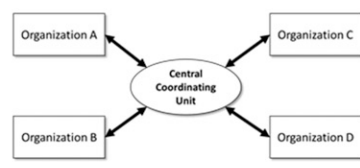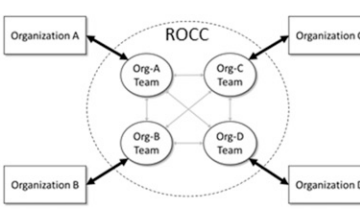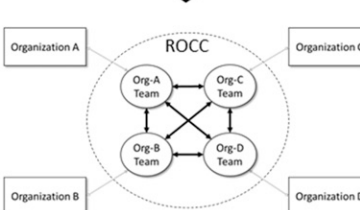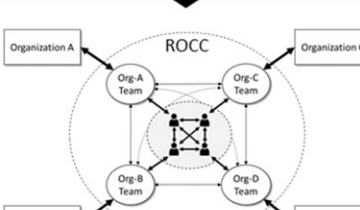
This insular approach to resolving rail disruptions contributed to a number of high-profile system failures, which as suggested, set the stage for the creation of the ROCC. The core objective in creating the ROCC was to facilitate open communication and rapid information exchange between colocated teams and therefore, to allow for quicker and more integrated problem solving as well as greater buy-in and support from participating teams. As noted earlier, past theory and research suggest that these aspirations were not unreasonable because such multiteam structures may be an effective mechanism of task accomplishment in situations of high complexity (which favors team designs to manage diverse subtasks) and high interdependence (which necessitates close coordination between teams) (Mathieu et al. 2001, Zaccaro et al. 2012). Past research has also suggested, however, that multiteam structures come with their own set of internal coordination challenges that arise from their complex boundary relations (Davison et al. 2012, Luciano et al. 2018). In the following, we will describe how the ROCC learned to work out those coordination and boundary challenges.

The Initial ROCC Period: Transitioning from Parochialism to System Integration
Given their history of isolation, it is perhaps unsurprising that early interactions between teams in the

Figure 1. The Evolution of Coordination Within the ROCC

newly formed ROCC were often clumsy and tentative. These interaction challenges resulted, in large part, from the fact that teams came to the ROCC (a) with different ways of understanding and talking about the rail system (parochial viewpoints) and (b) with a narrow focus on their home organizations' specific interests (parochial interests). We therefore refer to this initial period as a period of parochialism, a narrow focus on home team activities and interests and a lack of awareness of and concern for the interests and activities of other teams. Prior research on multiteam structures has indicated that such between-team differences in understanding and focus can give rise to "boundary-enhancing forces" (Luciano et al. 2018, p. 1067) and "representational gaps" between teams (Firth et al. 2015, p. 816) that prevent information sharing and effective coordination, thereby undermining collective performance (Mathieu et al. 2018, Mell et al. 2020). Consistent with this research, we found that a lack of trust and understanding between teams in the ROCC

caused them to initially maintain the competitive approach toward boundary work that characterized the pre-ROCC period. Interestingly, these problems prevailed both between teams from different home organizations and between teams originating from the same organization, who similarly aimed to isolate and differentiate their operations by focusing on resolving their own immediate problems without concern for the implications of their actions for other teams.

Parochial Viewpoints. Teams within the ROCC initially differed markedly in the aspects of a rail disruption they saw as most relevant as well as in the language they used to talk about disruptions. Rail traffic controllers, for example, were mainly concerned with national rail corridors, whereas passenger and cargo carriers were concerned with passenger timetables and cargo delivery deadlines and engineering teams were concerned with specific system error codes and material defects. At the same time,

each team discussed disruptions in language they assumed was understood by all, without realizing that other teams in the ROCC either did not understand that specific terminology or perhaps assigned different meaning to the same words. This led to frustration and delayed disruption responses, illustrated in the following quotations.

> Passenger carriers lived on a different planet. While we focused on the future, passenger carriers thought about the current situation and the near past. That gave some friction from time to time. —Interviewee 28, rail traffic control

> In order to work in the ROCC, we all had to attach the same meaning to the same term. If I said "stranded train," then I would have meant a train from which the driver has called to my department. That was very different for the passenger carriers, as well as for Pro-Rail. What ProRail meant with a stranded train was not a stranded train in my book, but still we were all talking about stranded trains. We could not manage to all use the same definition. —Interviewee 29, Nedtrain

> What amazed me was that it was extremely difficult to get something in the open, to discuss something. If you would ask certain questions to other teams, they just would not understand you. . . . It was unclear what we could do to improve things and whether everyone was being transparent. —Interviewee 20, asset management

Parochial Interests. Parochial viewpoints made it difficult for ROCC teams to understand one another. However, effective coordination was diminished even further—and perhaps more fundamentally—by parochial interests or the continued tendency for teams to pursue their own or their home organization's narrow interests while disregarding the interests of other teams. Before the ROCC, many of the respective teams were quasicompetitors, working independently to reduce the consequences of disruptions for their own operations without regard for how this might affect other rail organizations. They consequently had internalized a win-lose mindset (Johnson et al. 2006, Beersma et al. 2009), which carried over into their interactions within the ROCC. This led some teams to deliberately emphasize competitive boundary work practices, such as withholding information, pulling back from the collective decision-making process, or demanding priority voice in joint decisions. Examples are illustrated in the following quotations.

> Only after a long while did [team X] start to join in—they had been reluctant in providing us with information because they feared that this would have negative financial consequences for their company. —Interviewee 22, back office

> Certain passenger carriers thought they had the first right to use repaired rail infra as soon as it came available

after a disruption. We had to make clear that (1) others depend on us as well, and (2) look at all the other trains waiting to deliver cargo, so why should you get the first right to use released infrastructure? —Interviewee 27, rail traffic control

> There was a discrepancy between the logistical and passenger communication side. In the past, logistics was superior to passenger communication. Alterations were made in the logistical train schedules, and we simply had to communicate that to passengers. But . . . we slowly but steadily got a bigger voice. —Interviewee 26, passenger information

Overcoming Parochialism Through Colocation and Familiarity. In short, because of parochial viewpoints and parochial interests, the ROCC did not initially achieve the free and open communication and collaboration that its architects had envisioned. By bringing teams together under one roof with the collective goal of improving disruption response times, however, the ROCC created an environment where stubborn parochialism would be difficult to sustain and where planned attempts to overcome parochialism would have a greater chance of success. To be more precise, colocation within the ROCC as part of a collective enterprise heightened awareness of other teams, encouraged discussion and questioning between teams, and enabled planned socialization and sharing activities, all of which gradually chipped away at parochialism by fostering understanding, familiarity, and trust.

This process was both planned and emergent. In terms of planned activities, meetings were held during which teams could educate one another about their various activities. Also, ROCC members could complete "internships" that enabled them to participate in the work of another team for a period of time. Finally, field trips to the different parent organizations were organized so that the activities and personnel of that organization would become more familiar to other ROCC members. Although these planned activities certainly helped to foster understanding and awareness, the unplanned and emergent interactions between colocated individuals may have been even more important. These informal face-to-face interactions not only fostered understanding but also, began to build a critical foundation of trust. They allowed members to observe one another's activities and become intimately acquainted with one another's work processes while also developing interpersonal familiarity. Here are a few sample quotes from our interviews.

> Understanding of other teams in the ROCC increased because we work right beside each other. You get to know people on a personal level, much more than would have been possible if we only telephoned each other; that is the human aspect of it. Second, there is a physical aspect, in that the ROCC facilitates

members, if they are interested, to visit a partner team at a quiet moment and observe how things work in their organization. —Interviewee 27, rail traffic control

The benefit of the ROCC is that it removes preconceptions; you can see what the others do and how these persons tackle problems. You get a lot of insights from other teams during ad hoc meetings. —Interviewee 28, rail traffic control

Our understanding of other teams increased, among other things, through joint activities, providing insights into each other's teams, and through a lot of courses. —Interviewee 23, central service desk

Over time, these activities helped to alleviate the parochialism described earlier, and they created an environment in which ROCC members were comfortable interacting with one another more freely. The ROCC therefore transitioned from a collection of guarded fiefdoms to system integration—a situation in which members of different teams in the multiteam structure were strongly connected with each other and worked closely together to combine efforts for joint goal attainment. In other words, the ROCC's members moved from a primarily competitive boundary management approach toward more collaborative boundary activities (see Langley et al. 2019) that helped them to overcome differences and combine their efforts. As a result, collective disruption response started to improve as teams began to more effectively share relevant information and jointly solve problems.

We can easily approach each other and swiftly share relevant information in case something happens. . . . This was difficult before because our messages had to go through "coffee filters" before they reached other teams. —Interviewee 31, passenger services

The advantage of the ROCC is that we can intensively interact with each other—you see more of each other. We can easily discuss issues and we can work as a collective. —Interviewee 29, Nedtrain

Disruptions were obviously also managed in the past, but the sharing of information and the collaboration has quadrupled since the ROCC was implemented. —Interviewee 23, central service desk

So far, the dynamics we observed at the ROCC are consistent with past research suggesting that, to be effective, multiteam structures must encourage their participating teams to reduce parochialism and enhance shared understanding to span boundaries and engage in open and unmediated interactions (Larsen et al. 2014, Firth et al. 2015, Shuffler et al. 2015). As encouraging as this picture is, however, further analysis of coordination within the ROCC suggests that blurring team boundaries and open collaboration created additional unforeseen problems that required new boundary management solutions.

The Maturing ROCC Period: From System Integration to Integrated Pluralism

Although the transition from parochialism to system integration, as described, enabled coordination improvements within the ROCC, it also introduced a new set of boundary challenges. As ROCC teams began to work together in a more integrated way, problems of (1) excessive collaboration demands and (2) misalignment with parent organizations began to emerge. These new problems were grounded in the reality that ROCC teams had different tasks, incentives, and expectations—and they threatened to derail the ROCC's capacity to find coordinated disruption solutions. To address these issues, novel boundary management solutions evolved. Ultimately, these new solutions leveraged the benefits of colocation and familiarity to enable richer and more frequent communication while simultaneously respecting and defending each team's distinct operational environment and home organization—an approach we label integrated pluralism. We explore these problems and emergent solutions in the following sections.

Problem 1: Collaborative Overload and Boundary Shielding. As familiarity increased, ROCC members felt increasingly comfortable approaching other teams with questions or information requests. This was, after all, the purpose for which the ROCC was created—to remove barriers to open communication and information exchange. However, although such questions and requests may aid coordination, responding to them takes time and can be a significant distraction. Many ROCC members therefore reported a sense of collaborative overload or an inability to effectively perform their core work because of frequent demands from other teams. Collaborative overload was particularly problematic during the early stages of managing a disruption, when uncertainty was high and teams were scrambling to make sense of an evolving situation. Those teams with direct communication lines to train drivers and repair engineers (e.g., back office and Nedtrain), in particular, would often find themselves swamped with requests for updates, even as they were working frantically to understand the situation and explore possible responses. As a result, these members would become frustrated because they were unable to complete their tasks without interruption, and members from other teams would become frustrated because they were not getting satisfactory answers and updates.

[A] helpdesk employee really crawls into the cab of the train driver when he receives a call from a train driver. He really tries to visualize what the train driver must be seeing. "Do you see a little light over there on the dashboard? Is it lit up? What color? Green? Ok, green. And the big handle right behind you on the left, you

have to pull that one." This employee does not have time to inform the rest of the world, not at all, because that would mean that he has to step out of his role, to leave the position of train driver. —Interviewee 13, Nedtrain

For us, the ROCC made things worse because it sucked us right into the moment. Earlier, there was a phone line that separated us, between the back office and us. Then they started phoning us if they had questions. But now they show up at our desk. That is when you get sucked into the situation. That is beneficial for the ROCC, because ProRail now has speedier information on broken-down trains and there is more oversight of the situation. But my supervisor also wants me to do my normal duties and that creates conflicts in my priorities. —Interviewee 16, back office

In no time the different teams notice that something is the matter that has not yet been registered in the information system. Then they all show up here at my desk, which then prevents me from starting the alarm procedure and informing everybody. . . . They just stand there, asking questions . . . and that, to me, is a big annoyance. —Interviewee 13, Nedtrain

In response, ROCC teams—especially those dealing most directly with field operations—began taking aggressive measures to shield their core operations from outside interference. Busy members might simply ignore or deflect incoming questions, for example, and team leaders would act as gatekeepers to intercept approaching members from other teams before they could request information or assistance. Some team leaders further tried to shield their teams by mounting large computer screens between their own and the other teams' workspaces to retain their own members' task focus. Yet, others would fail to show up for meetings with other teams' representatives. In short, in an attempt to protect oneself from other teams' interference, a variety of competitive boundary work practices (re-)emerged within the ROCC, including "boundary buffering" and "boundary reinforcement" (Faraj and Yan 2009, pp. 606–607; see also Ancona and Caldwell 1988, 1992), that significantly reduced the amount of interaction between members.

At first glance, these shielding efforts align with research suggesting that multiteam structures may be most effective when coordination is orchestrated by a central unit of liaisons or leaders (Davison et al. 2012, Lanaj et al. 2013). Because coordinating with many individuals can become inefficient and impractical, some degree of centralization and boundary shielding can be useful (Carter et al. 2014, Luciano et al. 2018). Importantly, however, analysis of our qualitative data suggests that teams' boundary shielding efforts also resulted in problems unanticipated in this past research. Although these emergent activities succeeded at reducing the frequency of interruptions and distractions, they also meant that team members were often denied access to vital information that would have helped them to develop more appropriate and coordinated disruption responses. The following examples are illustrative.

The collaboration was really ineffective . . . because we did not receive any information. Several people went to other people's desk to get information, but we just could not get a grip on the situation at hand. Eventually, they tried to find a towing locomotive in Roosendaal and in Eindhoven. That did not work out. . . . [T]hey could have communicated with me because I could have cancelled a train for them. . . . I can do that . . . but only if they communicate with me. —Interviewee 6, passenger services

We got the call at 19:36 hours, a train broken down . . . The train driver was on the phone with the technical specialist and is trying all sorts of things. We don't hear anything for a while, which makes it hard to do our work. We can't assess where our approach with this train is going. But you have to make adjustments to prevent tracks from becoming congested—we had to reverse trains, initiate countermeasures, without knowing how long it would take. . . . The result was that the train sat there for two hours with passengers aboard, which is much too long. —Interviewee 6, passenger services

Solution 1: Provisional Hierarchy. Prior research has not examined how individuals and teams can resolve the key problem of collaboration in multiteam structures identified above—namely, to establish the right balance between open and timely information sharing on the one hand and the prevention of unnecessary distractions on the other (i.e., the combination of cooperative and competitive boundary work practices that scholars have labeled configural boundary work) (Langley et al. 2019). We found that ROCC teams developed a novel structural solution to this challenge. This solution involved a fluid and informal hierarchy, such that interteam interactions were indirect and mediated during periods of high task uncertainty (when needs for both interteam information sharing and intrateam sheltering were high), whereas direct, unmediated interactions between different teams' members were permitted during periods of greater task certainty. This "provisional hierarchy" built on designated liaison members from each ROCC team who gathered during complex and uncertain disruptions to communicate information from their respective teams, solicit additional information from other teams, and jointly develop strategic responses that they communicated back to their own teams.[3] By serving as the key point of contact for interteam information sharing, these liaisons protected other members within their teams from unwanted distractions.

Also, by working at the center of information flows, liaisons could construct a broad picture of an emerging disruption in order to craft a coordinated ROCC response. Liaisons thus emerged as informal boundary spanners that participated in central planning and coordination with liaisons from other teams and then played an important part in structuring and orchestrating the implementation of those plans within their own team—although they did not have formal authority to make binding decisions for their teams. One ROCC member described this approach as follows.

We initiate an ad hoc liaison meeting when someone shouts that he or she wants to discuss a specific disruption that has just emerged. Ad hoc meetings also happen during the disruption, if something changes. We then do a quick round of sharing perspectives on the disruption. We discuss if repair crews are on site and how the train services are affected. Liaisons ask each other to clarify their actions and the actions of their home organizations: What are they doing? Why are they doing that? Could we do this or that instead? First, we try to get insight into the situation, to understand what is happening. Then we can deal with the situation by discussing options. After an ad hoc meeting, liaisons return to their groups. Often they get an assignment to explore some options in their group and then return in 15 minutes to discuss their findings. —Interviewee 25, national rail coordinator

In other words, to solve problems of collaborative overload, the ROCC teams concentrated coordination activities within a small group of individuals and in doing so, reduced the amount of direct interaction between different teams. It might seem that this solution contradicted the very purpose of the ROCC, which was to facilitate direct interteam interaction and collaboration. Importantly, however, the concentration of coordination within the ROCC operated very differently than the centralized coordination that was used in the pre-ROCC period for three reasons. First, prior to the ROCC, coordination activities had been centralized within teams from a single organization (i.e., traffic control and back office from ProRail). After ROCC implementation, ProRail lost its central positioning to a large extent, and coordination occurred more dynamically between liaisons who represented all participating teams and organizations. Hence, whereas centralization in the pre-ROCC period involved a single organization with formal authority to impose decisions, the concentration of coordination activities in the ROCC involved informal representatives from multiple autonomous teams. Second, the foundation of shared understanding and trust that developed through colocation and familiarity meant that ROCC teams now had a greater appreciation for system interdependencies and the need to find collaborative

solutions. Hence, coordination was more efficient in the ROCC because it leveraged a shared understanding of each team's operations. Third, the ROCC's concentrated approach to coordination was task contingent and emerged only in situations that were perceived as nonroutine and uncertain (i.e., it was provisional). When tasks were more routine or certain, coordination was mainly achieved through standard protocols and procedures, a shared information system, and when necessary, direct and unmediated interactions between members of different teams. The following quotes describe this contingent dynamic.

When a disruption is "business as usual," it typically goes very smoothly and almost automatically. Then there is little contact between, for example, carriers, traffic controllers, and asset management. But when something deviates from the typical disruption, [liaisons] come into the picture. —Interviewee 25, national rail coordinator

During a routine disruption with a routine countermeasure you don't have much interaction because you do it according to prescribed plans. That goes via the shared information system and [liaisons] don't have to have conversations. This changes if it is a nonstandard countermeasure, if there are multiple things happening, or if it is at a place for which we don't have routine countermeasures because it is too tricky. —Interviewee 31, passenger services

[Under less severe disruptions], the contact is now direct and not necessarily from liaison to liaison only. It can also emerge between a member from a passenger carrier and a traffic controller. —Interviewee 28, rail traffic control

Moreover, even when disruptions were uncertain or complex, our data show that liaisons only engaged in coordination activities during certain phases of the disruption response. Liaisons were especially important during the initial phase of a complex or nonroutine disruption when it was necessary to integrate and make sense of information from separate teams, consider countermeasures, and decide on a collective response. After this overall response strategy was developed, individual teams worked out implementation details on their own. If major unforeseen complications arose during implementation, liaisons reconvened to devise an appropriate response, which was then communicated back to the individual teams. For routine execution details, ROCC members reached out directly to other teams for necessary information and updates. This approach enabled technical specialists within the individual ROCC teams to focus on their own tasks without distraction when this was most critical and to benefit from direct interteam contact during other disruption phases if necessary. Put differently, we found that provisional hierarchy was more heavily used during transition

than during action phases (see Zaccaro et al. 2020).[4] Although some scholars have alluded to this possibility of using more or less concentrated approaches toward joint decision making during different coordination phases in multiteam structures (Mathieu et al. 2018), empirical research has not yet demonstrated whether and how such provisional hierarchy solutions are realized in practice.

Problem 2: Misalignment with Home Organizations. Beyond problems of collaborative overload, greater integration within the ROCC resulted in boundary misalignment between ROCC teams and their home organizations. Although colocation and familiarity may have fostered greater understanding and trust between the ROCC teams themselves, individuals within the ROCC teams' home organizations did not have those same experiences. Hence, these latter individuals continued to hold the same parochial viewpoints and interests as in the pre-ROCC period. As a result, they often lacked the broader system awareness to fully appreciate the necessity of specific directives that came from their representatives at the ROCC. To be exact, individuals working within the home organizations did not fully understand the need for the ROCC at all times, and they feared that following directives intended to improve coordination with other ROCC teams could compromise their own organization's interests. Hence, some of these individuals felt increasingly distanced from their colleagues who now worked in the ROCC. A few ROCC members even expressed the concern that individuals within their home organizations perceived them as "estranged outsiders" who had "sold out" by getting too close with rival firms and could therefore no longer be trusted to make decisions in the best interest of the parent organization. These dynamics are reminiscent of research on how individuals in expatriate assignments are often perceived as "going native" (i.e., individuals "that socialize with locals [i.e., individuals outside the home organization], make friends among the locals and try to empathize with the feelings, thoughts, motives and behaviors of people from another culture" (van Oudenhoven et al. 2001, p. 470; see also Black and Gregersen 1992, McElroy et al. 2001)). Here are some illustrative quotes.

> The problem seemed to have shifted to contacts with our home departments. While we used to struggle with communicating with other groups, we now created distance between our home departments and ourselves. —Interviewee 27, rail traffic control
> Some employees could just not accept that we are now centrally located in the ROCC. ... That became increasingly apparent. When something is new, other people obviously wonder whether they do their work correctly and whether they interfere with somebody

else's actions. But many things were also rather personal. I could notice a large difference in how former colleagues would respond to my actions. They thought I was personally attacking them when I asked them a critical question. —Interviewee 20, asset management

Given these concerns and suspicions, it is perhaps not surprising that a number of ROCC members reported difficulties persuading their home organizations to comply with ROCC directives—and these difficulties had tangible implications for the ROCC's ability to achieve coordinated disruption responses. In short, if an ROCC team cannot count on individuals within its parent organization to carry out its directives, the ROCC cannot achieve its mission and becomes irrelevant. Such problems were particularly salient for teams from ProRail. Teams within ProRail itself had significant discretion in deciding how to control rail infrastructure within their geographical domains. As a result, a lack of trust between ProRail employees in the home organization and ProRail representatives in the ROCC meant that important decisions emerging from the ROCC did not consistently get implemented at times. An example is illustrated in the following quotation.

> We had a train near Driebergen with engine problems. ... If [the engine] gets stuck, the train will go nowhere, it will sit where it sits, blocking all traffic. Well, we were about to hit that point. The train was sitting on the tracks of an important rail corridor. ... So we started to think about our options, and had thought it through. Contingent on whether the train would roll, we would push it a little bit forward, switch tracks, push it backward, and get it transported from there. Everything was agreed upon. But what happened, the train starts to roll backwards and without us knowing about it, the train continues to drive towards Utrecht station. The train driver and personnel from home organization had not done what we at the ROCC thought they would do. At the moment it seemed to go well, but just imagine what would have happened if that train would have seized up right before Utrecht, one of our most important and busiest stations. We had calculated these risks, but they were simply ignored. —Interviewee 4, rail traffic control

Solution 2: Home Organization Realignment. The problems described made it clear that reestablishing and maintaining strong and trusting boundary relations with home organizations were indispensable for the ROCC's success. ROCC teams therefore adopted a number of practices intended to enhance communication with and demonstrate their value to their home organizations and to illustrate that parent organization interests were their foremost concern. For example, some ROCC teams instituted regular phone calls with their home organizations immediately after a shift had commenced to communicate who was on call in the

ROCC, to mutually provide relevant updates, and to agree on the situations that would lead them to reach out to one another. ROCC rail traffic controllers, for instance, agreed with regional controllers to call one another if a train broke down on intersections in the rail network. Similarly, passenger carriers decided with their regional offices to call one another if they encountered a stranded train with passengers aboard. In addition to these regular calls, ROCC teams would often call their home organization contacts immediately after a disruption occurred to keep them updated, exchange information, and discuss the planned response strategy. The following quotes illustrate efforts to achieve home organization realignment.

> The communication has to remain strong. The ROCC has to keep ventilating to home organization groups—to Zwolle, to Eindhoven, to Amsterdam, to Rotterdam, and to Utrecht. They have to know that somebody works over here. —Interviewee 11, passenger services

> I always consult others [in my home organization]: "Do you have time? Are you going to make it? Is there anything I can do for you?" … If he indicates he has two disruptions at the same time and is alone, I already know he's not going to cope. Then I start to look around. If it's the regional traffic controller in Alkmaar, I will call Amsterdam, and indicate that Alkmaar is not coping and ask them if they could contact each other, assist each other, take stuff from their plate. … If everybody is too busy, I could always step in myself. But the danger is that if I go into detailed train operations, I will lose my overall perspective. —Interviewee 7, rail traffic control

> We used to be unwelcome at our home departments. But we had to work with them because that was our assignment. We really had to engage in conversations to get somewhere. —Interviewee 30, passenger services

Reestablishing strong and open boundary relations with home organizations served two key purposes. First, it increased the ROCC's external visibility and the transparency of its decision making, so that home organizations had a better appreciation for how specific countermeasures were in the best interest of all of the organizations within the national rail system. This reassured home teams that their ROCC representatives had not "sold out." Second, these efforts increased the visibility of home organization operations so that ROCC teams could monitor whether home teams were adequately implementing ROCC directives and take timely action when these directives were ignored.

> In the beginning, the contact with our home departments did not go well at all, but now it goes fine in most cases. Our contact with home departments improved because we now communicate with each other, because there is contact. I can now explain what I am adjusting. —Interviewee 26, passenger information

> The regional traffic controller is on the other side of the phone line and you can place demands on these people, but once they hang up the phone you can only hope that he or she will do what you would like them to do. We don't have the kind of organization in which that is certain. The regional traffic controller might just as well think: "really important center we have [the ROCC], but I will do as I please," and that happens as well. But you would not find that out immediately, because if he or she does something different, I will only notice when things go wrong. … I therefore always check with other people [from home teams] if they actually understood what I said and if they are going to do it. Without that, it is useless. —Interviewee 7, rail traffic control

Discussion of Part 1: Integrated Pluralism Within the ROCC

Part 1 of our study suggests that the ROCC came to enable effective disruption responses over time, as teams learned to dynamically manage the various boundaries within their multiteam structure. Boundary relations within the ROCC were initially hindered by parochial viewpoints and interests, which were gradually overcome as colocation and exposure fostered familiarity, trust, and an understanding of the broader system. Although these changes enabled greater system integration, they also led to new problems of collaborative overload and home organization misalignment. To solve these problems, the ROCC teams introduced new barriers to interaction (without falling back into their previous isolation), and they rediscovered the importance of sufficiently considering their home organizations' interests. In other words, boundary relations within the ROCC first transitioned from *parochialism* to *system integration* and then, developed into a state that we labeled *integrated pluralism* (as summarized in Figure 1).

Integrated pluralism at the ROCC was about leveraging the benefits of colocation and familiarity to enable richer and more frequent communication (i.e., integration) while simultaneously respecting and defending each team's distinct operational environment and home organization concerns (i.e., pluralism). Doing so helped ROCC teams to implement a configural approach toward boundary work that enabled them to balance cooperative and competitive elements (see Langley et al. 2019). Importantly, however, realizing integrated pluralism required an ongoing process of adjustment and correction as ROCC teams dealt with pushes and pulls from other ROCC teams and their home organizations. Because achieving that balance was challenging, structural solutions like *provisional hierarchy* and *home organization realignment* were critical stabilizing forces. Through these mechanisms, integrated pluralism within the ROCC set the stage for efficient task execution within ROCC teams, effective coordination between ROCC teams, and

reliable and timely execution of response strategies by home organizations.

In sum, part 1 of our investigation suggested that the ROCC had substantial benefits for joint disruption response in the Dutch railway system but that these benefits emerged only gradually, as ROCC teams learned to manage the boundary challenges that arise in a complex, interdependent multiteam structure. In part 2, we examine how the dynamics we observed affected system outcomes. Specifically, we examined longitudinal time to recovery data before and after ROCC implementation to evaluate (1) whether the ROCC improved joint disruption response performance and (2) whether these improvements emerged gradually over time, consistent with the learning dynamics we observed in our qualitative findings.

Part 2—ROCC Performance Improvement over Time
Data and Method
We extracted the data for part 2 from a shared information exchange system that Dutch rail organizations use to exchange real-time information regarding rail disruptions. Each time a disruption occurs, personnel from ProRail register its type, location, and onset in the system. Personnel from other organizations, in turn, register the actions they have taken in response. Because traffic controllers and personnel from carrier organizations critically rely on this information to make decisions during disruptions, information is entered with great care for completeness and accuracy. For the present study, we were able to obtain daily disruption records for the period beginning in January 2007 and ending in August 2012 (i.e., 2,029 days). This period covers 45 months preceding the October 2010 introduction of the ROCC and 22 months following that introduction. It therefore allowed us to establish a baseline of performance (i.e., time to recovery) patterns preceding the ROCC's introduction and to examine whether those patterns changed after the ROCC was launched.

We calculated time series based on time to recovery data for two separate parts of the Dutch rail network. The "core rail network" comprises all vital routes that connect important cities and enable long-distance travelling, whereas the "peripheral rail network" consists of all remaining portions of the network. Although managing disruptions within the core and peripheral networks involves the same key organizations (e.g., ProRail, Netherlands Railways, Nedtrain, etc.) (see Table 1), these networks operate largely independently from each other. Specifically, (a) no passenger train movements are allowed between peripheral and core rails; (b) different carriers operate on these distinct networks;[5] (c) the core network falls under the national government's jurisdiction, whereas peripheral rails fall under the jurisdiction of regional governments; and (d) rail infrastructure in the core and peripheral network is managed by different ProRail traffic controllers. Moreover, whereas the core network shifted to a multiteam structure in 2010 with the ROCC, the peripheral network did not. Hence, by using separate time series for the core and peripheral networks, we can compare the effectiveness of a multiteam structure for rail disruption management with a more formalized and centralized approach.

Measuring Performance: *Time to Recovery.* In consultation with managers from carrier organizations and ProRail, we identified *time to recovery* as the most relevant performance indicator for the management of rail disruptions. *Time to recovery* refers to the overall time it takes to identify a disruption, coordinate repair and train recovery operations, and then restart or resume train operations on the affected part of the rail system. Longer *time to recovery* means that affected trains are delayed for a longer period of time, which results in greater costs: for example, in terms of passenger reimbursements and fines because of delayed cargo delivery. We computed *time to recovery* from the start times (i.e., time and date on which a disruption was first registered) and end times (i.e., time and date at which train operations resumed on the disrupted part of rail network) for all disruptions that occurred during the study period (over 20,000 individual disruptions between January 2007 and August 2012) and then averaged *time to recovery* scores over each 24-hour interval (2,029 daily criterion values). Our daily criterion value therefore represents the average *time to recovery* for all disruptions that started on a given day (in minutes), regardless of whether the disruption was resolved on that same day. Higher values indicate that it took longer to resume rail operations following disruptions that began on a given day (i.e., lower performance).

Measuring Key Covariates. Because a variety of exogenous conditions can influence *time to recovery*, we included a number of covariates, following suggestions by key informants in the rail system. First, we controlled for the *severity* of the disruptions that occurred during each day, which indicates how much of the rail system is likely to be affected. Every disruption is classified in the system based on its severity, from "A" (minor) to "D" (system wide). To account for possible severity effects, we controlled for

the number of each type of disruption (A–D) that occurred on a specific day. Second, we considered the number of *simultaneous disruptions* that occurred on a given day (i.e., disruptions that overlapped in time), as prior research has indicated that managing simultaneous disruptions introduces considerably more coordination complexity (Rudolph and Repenning 2002). Finally, we included a dummy variable that indicated whether the day in question was a weekday (zero) or weekend (one) because limited staffing on weekends can complicate disruption management efforts.

Analytical Methods. We used interrupted time series analysis (McDowall et al. 1980, Shadish et al. 2001) to evaluate (a) whether time to recovery changed significantly following the shift to the ROCC, (b) whether any lasting change happened quickly or gradually, and (c) whether such changes differed between the core and peripheral rail networks. The first step in an interrupted time series analysis is to identify a model that fits the time series, such that serial correlation is reduced and assumptions of nonindependence are not violated (McDowall et al. 1980, Tabachnick and Fidell 2007). To achieve this, researchers need to identify an autoregressive integrated moving averages (ARIMA) model that fits with the time series data (McCleary and Hay 1980). An ARIMA model can include autoregressive functions (ARs) to control for correlations between adjacent data points (e.g., an autoregressive function with a lag of one (AR_{t-1}) in a daily time series controls for dependencies between a daily value and its direct predecessor) as well as moving average functions (MAs) to control for correlations between adjacent data points' random components (Jebb and Tay 2017). A nonsignificant Ljung–Box statistic indicates that there is no remaining serial correlation and thus, that the identified ARIMA model appropriately fits the data. After serial correlation has been correctly modeled, intervention parameters are added to the model to assess the impact of an intervention (Tabachnick and Fidell 2007, Jebb and Tay 2017).

We identified an ARIMA model with AR_{t-1} and MA_{t-1} functions as best fitting our data. This model effectively controlled serial correlation in both the core network (Ljung–Box Q = 11.57, degrees of freedom (df) = 16, nonsignificant (n.s.)) and the peripheral rail network (Ljung–Box Q = 14.35, df = 16, n.s.). We further log transformed our criterion values because standardized residual plots from preliminary ARIMA analyses suggested that normality assumptions were violated (McCleary and Hay 1980). Next, we assessed the impact of the ROCC by adding specific intervention parameters and examining their significance and size. Specifically, we added an *intervention* dummy to the time series, denoting whether values reflected daily time to recovery values before (zero) or after (one)

October 8th, 2010, when the core rail network shifted to the ROCC. We subsequently included a scale parameter (ω) and rate parameter (δ) to our ARIMA model. A significant scale parameter indicates that there was a performance change at the exact time the ROCC was implemented (i.e., when the intervention dummy variable took on the value of one). The rate parameter indicates the trajectory of that change, with values close to zero suggesting that effects occurred abruptly after the shift to the ROCC and values close to one indicating that effects emerged gradually over time (McCleary and Hay 1980, Yaffee and McGee 2000, Tabachnick and Fidell 2007). We conducted these analyses separately for the core and peripheral networks and then interpreted differences in scale and rate parameters between the core network (which adopted a multiteam structure) and the peripheral network (which continued to coordinate through standardization and centralization).

Addressing Alternative Explanations. As Shadish et al. (2001, pp. 179–180) noted, the major threats to internal validity of interrupted time series analyses are *history* ("the possibility that forces other than the treatment effect under investigation influenced the dependent variable at the same time at which the intervention was introduced"), *instrumentation* (when a change in the dependent variable can be explained by a change in how criteria for success and failure are defined), and *selection* ("if the composition of the experimental group changes abruptly at the time of the intervention"). To rule out such confounds, we added a "no treatment" time series from a control group (i.e., the peripheral region). This method has been identified as "perhaps being the best" for controlling history effects (Shadish et al. 2001, p. 179). If the changes identified in the intervention time series cannot be replicated in the no treatment control time series, we can conclude that history is unlikely to have influenced our results. Moreover, because both the core and peripheral region used the same system to register the dependent variable (time to recovery), these results would also indicate that instrumentation biases are unlikely.

To further account for any possible history effects, we asked our ROCC informants to list alternative explanations (other than ROCC implementation) for possible time to recovery changes. Interviewees could not think of any viable alternative explanations. Finally, to assess the potential for selection confounds, we asked interviewed ROCC members to describe their jobs in both the pre-ROCC and post-ROCC periods and to indicate whether they had been involved in rail disruption management before the implementation of the ROCC. All interviewed members indicated that they had worked on similar tasks in rail control before they were transferred to the ROCC,

except for the national rail coordinators.[6] Also, personnel records and interview results indicated that one new member had been added to the "passenger information" team during our study period, two members had been added to the "incident management" team, and one "back office" member had changed positions within the back office team. We deemed it unlikely that these relatively minor compositional changes affected the effectiveness of the ROCC.

Results
Table 2 presents means, standard deviations, and bivariate correlations for our study variables in both the core and peripheral parts of the rail network. As shown, daily time to recovery was significantly and negatively correlated with the intervention variable in the core rail network ($r = –0.08$, $p < 0.01$) but not in the peripheral rail network ($r = –0.04$, n.s.), suggesting that time to recovery only improved within the core network at the time of the ROCC's implementation. Given the nonindependence of the time series data, however, these correlations should be interpreted with caution (Tabachnick and Fidell 2007).

Table 3 presents results from our interrupted time series analyses. Employing ARIMA models with AR_{t-1} and MA_{t-1}, we found significant intervention scale ($\omega = -0.004$, standard error (SE) = 0.002, $p < 0.05$) and rate parameters ($\delta = 0.989$, SE = 0.005, $p < 0.01$) in the core rail network (see Models 1 and 2 of Table 3). The negative scale parameter (ω) indicates that the introduction of the ROCC was associated with a permanent decrease in daily time to recovery in the core network. Moreover, the large rate parameter (δ approaching 1.0) suggests that time to recovery gradually declined after the implementation of the ROCC and did so in smaller and smaller increments over time. Overall, average daily time to recovery in the core network was shortened by 29% following the introduction of the ROCC (or by about 40 minutes). Moreover, 99% of this improvement was realized within 415 days (or about 14 months) after ROCC implementation. In contrast, a separate interrupted time series analysis for the peripheral rail network showed that time to recovery did not decrease within this part of the network after the shift to the ROCC ($\omega = -0.125$, SE = 0.809, n.s.; $\delta = 0.040$, SE = 6.230, n.s.) (see Models 3 and 4 of Table 3). Additional analyses show that our quantitative findings are robust to the inclusion of AR or MA functions with longer time lags (i.e., time lags up to t - 10).[7]

Discussion of Part 2
Overall, the results from part 2 of our study align with key conclusions from part 1. Part 1 indicated that the shift toward a multiteam structure enabled well-coordinated disruption responses—although it also indicated that these improvements only emerged over time, as participants learned to manage their boundary relations. Congruent with these findings, results from part 2 suggest that the shift from a formal, centralized coordination system to a multiteam structure in the core network was associated with a significant decrease in time to recovery. In contrast, time to recovery in the peripheral network was largely stable over this time period, suggesting that the performance improvement in the core network is likely because of the ROCC implementation rather than to general environmental changes (Shadish et al. 2001, Tabachnick and Fidell 2007). Furthermore, part 2's quantitative analyses suggested that the ROCC's benefits were not immediate but emerged gradually, over a considerable time period of about 14 months. This underlined our previous conclusion that it took time for ROCC teams to learn how to manage key boundary challenges.

General Discussion
Theoretical Contributions
Prior research on effective boundary management in multiteam structures has suggested that teams in such structures must bridge their boundaries to realize joint outcomes (i.e., collaborative boundary work) (Langley et al. 2019) but also protect and defend their boundaries to avoid detrimental collaborative

Table 2. Descriptive Statistics

Variables	Core network M (SD)	Peripheral M (SD)	1	2	3	4	5	6	7	8
						r				
1. *Disruption type A*	0.99 (1.07)	0.21 (0.48)	—	–0.07**	–0.06*	–0.03	0.14**	0.01	0.00	–0.03
2. *Disruption type B*	2.85 (2.37)	0.59 (0.84)	0.02	—	0.11**	0.06*	0.50**	–0.14**	0.01	0.02
3. *Disruption type C*	1.47 (1.43)	0.81 (0.93)	0.02	0.28**	—	0.07**	0.54**	–0.10**	0.06*	0.03
4. *Disruption type D*	0.07 (0.29)	0.02 (0.15)	0.01	0.07**	0.04	—	0.14**	0.00	0.02	0.02
5. *Simultaneous disruptions*	2.60 (1.79)	0.87 (1.25)	0.26**	0.61**	0.41**	0.12**	—	–0.12**	0.07**	0.08**
6. *Weekend*	0.28 (0.45)	0.25 (0.44)	–0.07**	–0.25**	–0.15**	–0.06*	–0.25**	—	–0.01	0.05
7. *Intervention*	0.33 (0.47)	0.34 (0.47)	0.10**	0.17**	0.09**	0.05*	0.31**	0.00	—	–0.04
8. *Time to recovery*	135.83 (144.30)	130.48 (179.22)	–0.03	–0.01	0.02	0.05*	0.08**	0.04	–0.08**	—

Notes. Peripheral network: correlations shown above the diagonal; $N = 1,720$. Core network: correlations shown below the diagonal; $N = 2,019$. M, mean.
   *$p < 0.05$; **$p < 0.01$.

Table 3. Simple Interrupted Time Series Analysis for Time to Recovery Within the Core and Peripheral Rail Networks

	Core network		Peripheral network	
	Model 1	Model 2	Model 3	Model 4
AR_{t-1}	0.998 (0.002)**	0.772 (0.344)*	0.261 (0.609)	0.055 (0.782)
MA_{t-1}	0.986 (0.005)**	0.755 (0.355)*	0.225 (0.615)	0.024 (0.782)
Disruption type A	–0.011 (0.014)	–0.011 (0.014)	–0.044 (0.042)	–0.045 (0.042)
Disruption type B	–0.033 (0.007)**	–0.034 (0.007)**	–0.013 (0.029)	–0.015 (0.029)
Disruption type C	–0.011 (0.011)	–0.011 (0.011)	–0.060 (0.026)	–0.059 (0.026)*
Disruption type D	0.019 (0.047)	0.023 (0.047)	–0.015 (0.135)	–0.011 (0.134)
Simultaneous disruptions	0.125 (0.011)**	0.127 (0.011)**	0.159 (0.023)	0.163 (0.023)**
Weekend	0.105 (0.031)**	0.106 (0.031)**	0.099 (0.046)*	0.100 (0.046)*
Intervention scale (ω)		–0.004 (0.002)*		–0.125 (0.809)
Intervention rate (δ)		0.989 (0.005)**		0.040 (6.230)
Stationary R^2	0.083**	0.093**	0.043**	0.048**
Ljung–Box Q (df)	11.567 (16)	10.364 (16)	14.351 (16)	14.673 (16)

Note. N = 1,720 (peripheral rail network) to 2,019 (core rail network) daily observations.
 *$p < 0.05$; **$p < 0.01$.

overload and other problems (i.e., competitive boundary work) (Langley et al. 2019). Our review of the relevant literature revealed that we know very little about how multiteam structures may integrate these collaborative and competitive elements and "manipulate patterns of differentiation and integration among groups to ensure that certain activities are brought together while others are kept apart, orienting the domains of competition and collaboration" (i.e., configural boundary work) (Langley et al. 2019, p. 720). We also found that existing empirical research has generally studied multiteam structures from a rather static perspective, without examining how individuals' and teams' activities dynamically evolve in response to emergent coordination problems. As a result, we know very little about the emergent processes through which individuals and teams within multiteam structures learn to effectively manage their boundaries. Our study addressed these two important issues by examining how the Dutch railway system transitioned from a centralized, arm's length structure to a colocated, multiteam structure for coordinating disruption responses (i.e., the ROCC).

The results of our study show that realizing the benefits of the ROCC was not self-evident. Effective boundary management did not come easily or automatically but required learning new assumptions and routines while unlearning entrenched perspectives (Mariotti 2012). And this learning process took time; our quantitative analyses revealed that it took over a year for teams to realize most of the ROCC's performance improvement. The framework derived from our qualitative analyses, presented in Figure 1, highlights the different phases in this process. The first phase in realizing performance improvement at the ROCC was a transition from parochialism to system

integration. Teams learned how they could improve shared understanding to span boundaries and engage in open and unmediated interactions. We found that colocation and increased familiarity were critical in this regard. These insights are largely consistent with those from past theory and research (Beck and Plowman 2014, Firth et al. 2015, Shuffler et al. 2015). Extending existing knowledge, however, our findings revealed that promoting system integration caused new problems, unanticipated in prior research, that seriously hampered multiteam structure effectiveness (i.e., collaborative overload and home organization misalignment). To overcome these challenges, the ROCC needed to transition from system integration to integrated pluralism. ROCC members had to learn how they could establish a dynamic balance between actions that defend internal team operations and home organization interests on the one hand and those that enable integrated solutions and coordinated action on the other. In other words, they had to learn how to engage in configural boundary work. These findings contribute to the limited research on the evolution of multiteam structures by comprehensively illustrating key problems, solutions, and milestones on the path to effective multiteam structure functioning that prior research has not yet depicted (Luciano et al. 2018). Such insights are important because they enable a fuller understanding of the multiteam structure processes that help to predict how such structures may evolve and become effective over time (Shuffler et al. 2015, Mathieu et al. 2018; see also Ahuja et al. 2012).

Beyond these general insights, our research advances more detailed knowledge on how effective coordination within multiteam structures can be organized and enacted. Past studies have pointed either

to the relevance of centralized coordination units in this regard or alternatively, to the utility of direct mutual adjustment between component teams' members (Davison et al. 2012, Kotha and Srikanth 2013, de Vries et al. 2016, Waring et al. 2018). Our results question the unqualified use of centralized coordination units and direct mutual adjustment. Instead, our findings highlight the importance of striking an adequate balance between concentrating coordination activities within a central ad hoc team of liaisons on the one hand and direct member interaction on the other hand through what we labeled *provisional hierarchy*. It appeared most effective to dynamically switch between a central ad hoc team of liaisons for coordinating activities during highly complex and novel tasks and direct interaction between members from different teams during less complex and more routine tasks. In other words, neither concentrated nor dispersed coordination were, by themselves, key to successful boundary management in multiteam structures. Rather, effective multiteam structures should use these coordination modes in a flexible way, depending on the information-processing requirements of the tasks at hand. These findings contribute to our understanding of how multiteam structures may effectively combine different coordination forms, thereby integrating disparate research findings in this regard (cf. Marks et al. 2005, Davison et al. 2012, de Vries et al. 2016).

Moreover, our findings widen the perspective on the role of stakeholders for effective boundary management in multiteam structures. The vast majority of research on this issue has focused on how participating teams can effectively bridge or reinforce boundaries with other actors *inside* such structures (e.g., Cuijpers et al. 2016, Porck et al. 2019, Mell et al. 2020). As a result, past studies have strongly suggested that prioritizing the broader multiteam structure's interests helps to facilitate collective performance. We found, however, that such an exclusive internal focus may cause home organizations to see their teams in the multiteam structure as "estranged outsiders," creating communication difficulties and associated performance problems. Although research on expatriates and alliances has yielded similar insights (e.g., Black and Gregersen 1992, McElroy et al. 2001, van Oudenhoven et al. 2001), our study shows how *multiteam structures* can cope with this challenge. Our findings suggest that proactively considering teams' home organization interests, offering help to home organization members, and explaining how decisions within the multiteam structure benefit the parent organization are critical. All in all, these insights provide novel and important insights on boundary management within multiteam structures by identifying home organizations as important but overlooked external stakeholders whose needs must be considered during coordination efforts, as well by identifying specific coordination behaviors that allow teams to do so.

Limitations and Future Research Directions

The combination of qualitative data from in-depth interviews and participant observations with quantitative time series data in a highly consequential field setting is an important strength of this study. There are, however, some limitations inherent in our research design that should be acknowledged. First, although our multimethod study involved rich, qualitative observations and insights combined with quantitative longitudinal data, our results are ultimately based on the analysis of a single case. Although the challenges and tensions related to configural boundary work are important for most types of multiteam structures and it was reassuring that we could replicate several important insights from prior multiteam structure research, the generalizability of our findings needs to be further examined. Given the difficulty of collecting data from a large number of multiteam structures in the same investigation, this may be best accomplished by cumulating findings across studies to see whether similar and consistent patterns emerge.

Second, we relied on interview data, in addition to field observations, to construct a picture of boundary work activities before and after the introduction of the ROCC in part 1 of our research. It is possible that the perceptions and memories of our interviewees were incomplete or selective. To minimize such biases, we selected informants who had gained extensive experience in both the pre- and post-ROCC period, thereby increasing the likelihood of accurate and detailed recollection of relevant disruption management processes. Moreover, we validated interview responses with information from participant observations, official documents, and discussions with subject matter experts. Hence, we have confidence in the reliability and completeness of our qualitative results. Nevertheless, it would be valuable to corroborate our findings using different (e.g., quantitative) methods and samples.

Third, the quantitative data for part 2 of our study allowed us to compare a treatment group (the core network, where the ROCC was introduced) with a no treatment group (the peripheral network, which continued to manage boundaries through formalization and centralization). We must acknowledge, however, that these two groups differed in a number of ways other than just their participation in the ROCC (e.g., function, rail infrastructure, personnel, etc.). So, although we found improvement within the core network but not the peripheral network over the period of this study, we cannot be certain that this

improvement was entirely because of the introduction of the ROCC (Grant and Wall 2009). Moreover, because our time series included data from only two groups (i.e., the core and peripheral network), our quantitative results are suggestive (and consistent with the conclusions from the qualitative analyses) but should not be viewed as conclusive. Evidence from randomized experiments, employing a larger number of matched treatment and no treatment groups, is needed to provide greater confidence in the causality we presume here.

Practical Implications

Despite these limitations, our findings point to several suggestions for how individuals and teams might effectively deal with the central challenge of a multiteam structure—configural boundary work or managing boundaries in ways that entail both cooperation and competition. Specifically, our results suggest that individuals and groups may enhance the effectiveness of their multiteam structure by considering the use of liaisons, especially for complex tasks and during periods with information overload. The use of liaisons facilitates coordination by creating a shared understanding of important problems, reducing information and communication overload, and temporarily concentrating the decision-making process. To effectively manage their tasks and responsibilities, liaisons need the capacity to mediate between-team interactions when needed and retract from such processes when direct mutual adjustments between different teams' members are more effective. To provide liaisons with such capacities, multiteam structures may, for example, use "strategizing" and "coordination" training programs that are designed to inform leaders on how to effectively engage in between-team coordination on behalf of their teams and how to facilitate teams' members to engage in direct coordination (DeChurch and Marks 2006, p. 313). At the same time, multiteam structures must ensure that their teams' members can engage in effective mutual adjustments with members from diverse other teams. Based on prior research, it seems, for example, viable to enhance team members' coordination abilities by allowing them to participate in job rotation or career development trajectories that provide them with diverse work experiences (see, for example, de Vries et al. 2014).

Finally, our detailed description of the way teams from different organizations transitioned from a centralized structure to an effective multiteam structure may prove useful for other organizations considering the implementation of such hybrid organizational forms. Although multiteam structures may differ widely in type and responsibilities, many of these structures will encounter similar problems associated with configural boundary work. Our "thick" description of these problems and their respective solutions, as well as the way these solutions were implemented and adapted over time in a real-life setting, may raise managers' awareness about problems that may arise during the implementation of multiteam structures and facilitate them in finding practical solutions that improve such structures' effectiveness over time.

Acknowledgments

Endnotes

[1] These conclusions are based on an in-depth review of the scholarly literature on coordination in diverse multiteam structures. This review included empirical research on "multiteam systems" (e.g., Mathieu et al. 2001), research examining coordination practices within interorganizational networks and alliances (e.g., Gulati et al. 2012), and research examining interteam collaboration in settings such as disaster response (e.g., Wolbers et al. 2018). Of the 40 empirical studies we examined, 35 primarily focused on collaborative boundary work, 4 focused on competitive boundary work, and only 1 examined configural boundary work.

[2] During our study period, all organizations utilizing the Dutch rail system were privately held companies, although shares of carrier "Netherlands Railways" were held by the Dutch government.

[3] We use the term "hierarchy" here not in reference to a formal structure of decision rights but to an informal and emergent set of asymmetric influence relations (Magee and Galinsky 2008). Specifically, despite lacking formal authority, liaison members exerted greater influence over disruption response decisions than other members of their teams because of the informational advantages resulting from their informal liaison role. We use the term "provisional" to describe this emergent hierarchy because liaisons did not have greater influence in all team decisions but primarily in those decisions related to more complex disruptions.

[4] To further explore the dynamics of provisional hierarchy, we analyzed video recordings of interactions within the ROCC during two typical rail disruptions—one more routine and one more complex. Interaction between liaisons was most frequent during the early stages of the complex disruption and emerged occasionally during its later stages, whereas such liaison-based coordination was almost nonexistent throughout the routine disruption. These results corroborate and provide additional nuance to what we heard in our interviews. Full information on the procedures and results for these video analyses are available from T.A.d.V.

[5] Netherlands Railways uses both the core and peripheral rail network, whereas other carriers (e.g., Arriva and Connexxion) only use the peripheral network.

[6] The "national rail coordinators" team had not existed before the ROCC was implemented, and the five members of this teams were therefore hired externally.

[7] Supplementary analyses indicated that the effect of the ROCC implementation was more salient for days with high disruption complexity (i.e., days with many simultaneous disruptions), relative to days with less disruption complexity. Full results from this analysis are available from T.A.d.V. upon request.

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