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Adapting Safety Rules in a High Reliability Context: How Wildland Firefighting Workgroups Ventriloquize Safety Rules to Understand Hazards

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Abstract

Safety rules are unavoidable in hazardous work and are often codified insights from accidents and fatalities. Safety rules research predominantly focuses on factors that influence compliance and violation of rules (a rationalist view), but rarely examines how members draw from safety rules to take action and gain experience. This study draws from and extends an adaptation view of safety rules, which considers how members use safety rules as "tools" to inform action. The study compares how two wildland firefighting workgroups incorporate safety rules into communication practices, and specifically, how they ventriloquize them. From a communication perspective, ventriloquization directs attention to ways safety rules enable members to make sense of hazards, navigate authority, and develop experience. The findings contribute an explanatory workgroup model for how members adapt safety rules into action according to workgroup norms, complementary relationships, and practices, which extends our understanding of adaptive action and learning in hazardous work organizations.

Keywords

high reliability organization, safety rules, ventriloquism, workgroups

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Introduction

Safety rules are unavoidable in hazardous work. In general, rules prescribe what members need to do and organizations expect members to follow them or face punishment for violations (Hale & Borys, 2013a; Hale & Swuste, 1998). In some contexts, safety rules are not easy to follow as prescriptions. For instance, high reliability organizations (HROs) such as wildland firefighting, mining, and aircraft carrier operations face changing and unpredictable circumstances that require members to adapt safety rules onto the various environments and situations they face (LaPorte, 1996; Weick & Sutcliffe, 2007). Furthermore, many HROs are heavily regulated operations that depend on safety rules to standardize activities and provide a basis for evaluating performance. Yet, the unpredictability and emerging nature of HRO contexts means that safety rules cannot be "followed" or "broken" as prescribed action (Rochlin, 1993). Instead, members must use discretion, and safety rules can help them make sense of their environments and develop expertise (LaPorte, 1996).

This role of safety rules as tools for making sense and aiding in developing experience has been mostly overlooked in both safety rule and HRO research. Safety rule research tends to focus on rationalist explanations for why members might follow or break rules, typically attributing compliance and violation to management control (Dekker, 2014b; Hale & Borys, 2013a) or safety climates that encourage certain behaviors (Zohar & Luria, 2005). HRO research, however, focuses on processes of in-the-moment mindfulness about hazards and situations (Weick & Sutcliffe, 2007), but does not consider how safety rules participate in those activities.

One way to think about rules as important tools for making sense of hazards and developing experience is to consider how they are devised and used in a broader technical documentation cycle (Sauer, 2003), which is intended to help hazardous operations retain and perpetuate lessons learned from failures. In many hazardous industries, particularly HROs, catastrophes such as accidents and fatalities are key moments for organizations to learn about the shifting and ambiguous dangers members regularly face (Weick, 1987; Weick & Sutcliffe, 2007). Because these operations are not able to learn from trial and error, the technical documentation cycle is designed to codify lessons from failures into standardized rules and abstracted insights designed to fit a variety of circumstances (Sauer, 2003). The process of codifying lessons involves collapsing embodied experience, individual narratives, sensory descriptions, and illustrative kinesthetic gestures into standardized written documents, thus translating failure lessons from a lived modality into a disembodied and standardized written modality (Sauer, 1998, 2003). Adapting

safety rules from one modality to another depends on how organizations treat safety rules and other forms of technical documents. For instance, Dekker (2014a) suggested that the documentation cycle can easily fall victim to the "bureaucratization of safety" (Dekker, 2014a) in which safety documents become the basis for tightening management control, limiting worker discretion, and taking disciplinary action against workers. In effect, it matters how members use safety rules and how organizations both allow and respond to those uses.

It is generally understood in both safety rules and HRO research that many rules can be traced back to organizational failure lessons, and that safety rules both codify those lessons and serve as tools for learning (Dekker, 2014b; Hollnagel, 2014; Weick, 1987; Weick & Sutcliffe, 2007). Yet, these bodies of research rarely examine how members put those lessons back into practice through drawing on safety rules to make sense of environments in which they regularly act. This is an important activity to examine because the purpose of safety rules within the broader technical documentation cycle is to retain and perpetuate an organization's failure lessons. The success of the cycle depends entirely on whether and how members instantiate these lessons in practice, for instance, through communicatively invoking safety rules to make sense of hazards, or referencing them in individual and group learning activities. This study adds insight to this issue by foregrounding the communication by which members appropriate safety rules, allowing us to see how safety rules are active participants in organizational action.

The article proceeds as follows. First, the literature review summarizes rationalist and adaptation views of safety rules, arguing that a *rationalist* (i.e., follow/break) understanding of rules is untenable in changing HRO contexts, and that an *adaptation* view of using rules as "tools" for creative action is better suited. Second, I propose to extend the adaptation view of safety rules with the notion of ventriloquism (Cooren, 2010), which invites us to consider that safety rules are more than just directives; instead, they participate as a kind of non-human agent that makes a difference in conversations and action (Cooren, 2004, 2010). Third, the study compares how two wildland firefighting workgroups incorporate safety rules into regular communication practices generally, and specifically, how they ventriloquize them.

This study's findings lead to an explanatory workgroup model for how members adapt safety rules into action, which extends safety rules research on rule adaptation (Dekker, 2014b; Hollnagel, 2014) and enhances understandings of adaptive action and learning in HROs. While previous research on safety rules and HROs recognizes the importance of safety rules for codifying lessons learned from failures, these studies have not examined how workers use rules as tools for learning and making sense, particularly, how

they adapt safety rules anew in local contexts. The present study shows how situated ways of drawing from safety rules influence how the rules participate in helping members gain experience with understanding ambiguous hazards and navigating authority in organizational relationships.

Literature Review

Safety rules are foundational in hazardous work, unifying knowledge, and informing activity in several ways. First, safety rules are standardized; they are both recognizable across practice sites and situations, and foundational to training (Dekker, 2014a; Hale & Borys, 2013a; Sauer, 2003). Second, safety rules remain active through informing member actions in ambiguous environments (Sauer, 2003; Ziegler, 2007). Organizations often revise safety rules following fatality events, codifying new knowledge from catastrophes with the hope that such costly lessons will not be repeated (Weick & Sutcliffe, 2007; Ziegler, 2007). Third, safety rules inscribe embodied knowledge about deeply complex and highly dangerous environments. For example, in mining, safety rules bring attention to bodily senses (e.g., hearing pops, smelling gases, etc.) to help members notice and respond to common but unpredictable hazards (Sauer, 2003). In general, safety rules vary in the extent to which they are (or are not) open to interpretation. Hale and Borys (2013a) identified three "levels" of safety rules: *Performance expectations* are abstract goals that require much interpretation; *process rules* require that an activity take place, but do not identify the specific actions necessary to accomplish it; and *action rules* are the strictest type of safety rule, those for which there is the least amount of abstraction and interpretation, often taking the form of if–then statements (e.g., if operating heavy equipment, then wear personal protective equipment).

Rationalist Versus Adaptation Views of Safety Rules

Two views of safety rules dominate theory and practice: a rationalist view and an adaptation view. The rationalist view considers safety rules as top-down prescriptions for action (i.e., unambiguous *action rules*). The rationalist view stems from principles of scientific management (F. W. Taylor, 1911), in which safety rules break down tasks into smaller controllable actions that reflect the "one best way" to do something. Safety rules restrict member action through codifying all possible hazards and prescribing ways to avoid them (Hale & Borys, 2013a; Hale & Swuste, 1998; Hopkins, 2011). Deviations from safety rules constitute "violations" and are considered willful and deliberate, even when motivated by production pressure or lack of

knowledge about the rules (Lawton, 1998). Occasionally, deviations from safety rules become commonplace ("normalization of deviance"), which can contribute to large-scale accidents, such as the Challenger space shuttle explosion (Vaughan, 1996). When accidents happen, investigations seek to prevent future incidents through identifying rule violations, tightening enforcement, administering disciplinary action, and developing new rules (Hale & Borys, 2013a). Ultimately, these responses to accidents further standardize operations, strengthen management control, and limit worker discretion at the scene (Dekker, 2014a).

The primary advantage of the rationalist view is that it reduces harm to members through both codifying common problems and best practices, and providing operational transparency (Dekker, 2014a; Hale & Borys, 2013a; Sauer, 2003). However, this view can become dangerous when safety rules overly restrict activity, tighten control, or render circumstances so predictable that members are not equipped to handle surprises creatively (Dekker, 2014a). These drawbacks are particularly relevant in HRO contexts, in which conditions are regularly unpredictable and often require innovative responses.

The second, *adaptation*, view of safety rules addresses limitations of the rationalist view and is more appropriate in the HRO context. Several versions of an adaptation view have surfaced in recent years, each proposing in slightly different ways that safety rules should be used as "tools" to inform action, rather than as prescriptions that dictate it (see Dekker, 2014b; Hale & Borys, 2013a, 2013b; Hollnagel, 2014). The adaptation view asserts that members should use rules as tools in a generative manner. Instead of relying on the potential of rules to exert top-down control, adaptation scholars are interested in seeing how safety rules might operate more widely and idiosyncratically in member learning. That is, safety rules can help members see and make sense of environmental conditions, and should facilitate (rather than limit) work processes (Dekker, 2014a; Hale & Borys, 2013b). When considering how safety rules are tools, the focus is not on how members *follow* rules, nor on how rules *dictate* action (as with the rationalist approach). Instead, the focus is on how members appropriate safety rules—how they *draw from* safety rules to access lessons from catastrophes, and how they use safety rules to *make present* or *visible* organizational priorities and lessons.

Adapting Safety Rules in Workgroups

I propose that one critique of the emerging adaptation view of safety rules is that adaptation is conceived generally as using rules as "tools," without sufficient explanation about how exactly rules are drawn from and used locally, how those uses are enabled and constrained, and how using safety rules

contributes to learning about hazards. Following workgroup literature, I argue instead that adapting safety rules as "tools" does not refer to generic possibilities for action open to anyone, but rather to local accomplishments that workgroups render acceptable or unacceptable according to their situated values and practices (Barker, 1993; Jahn, Putnam, & Myers, in press; Myers & McPhee, 2006; Seibold, 1998). For instance, some HROs are large, consisting of workgroups that operate in a decentralized manner (Weick & Sutcliffe, 2007), and workgroups with varying levels of collective experience might draw from safety rules differently. We know from self-managing teams literature that workgroups develop consensus around collective values (Barker, 1993). Values are the principles, qualities, or ideals that are considered desirable (Keyton, 2010). Values inform the normative expectations for appropriate behavior that become instilled in organizational practices and that members enforce locally (Barker, 1993). Following this logic, we might expect that workgroups with less experienced members would hold collective values around training novices and would engage in normative communicative practices that call on safety rules to enable training (e.g., explicit discussions about how to use rules); however, workgroups with more experienced members might value their advanced expertise, and engage in communicative practices that call on safety rules to deepen their repertoire for handling complex situations and navigating authority (e.g., developing ways to communicate to make a difference in interactions).

To date, safety rules and HRO literature have not explained why certain ways of appropriating rules (as tools) might be taken up or not in workgroups, and to what effect. Addressing this issue would contribute to the adaptation view of safety rules by showing how and why workgroup expectations and communication practices make some safety rule appropriations locally possible, while rendering others unacceptable. Addressing this issue would also contribute to our understanding of HROs, particularly how workgroups generate local practices for using safety rules that facilitate (or possibly inhibit) members' ability to learn about and make sense of emerging, ambiguous hazards. The first research question asks,

> **Research Question 1 (RQ1):** What are the practices for using safety rules in two wildland firefighting workgroups?

Ventriloquizing Safety Rules to Make Sense of Hazards

Theorists proposing an adaptation view argue that organizations need to place more trust on workers at the scene to draw flexibly from safety rules and their deep embodied experience to manage hazards (Dekker, 2014b;

Hollnagel, 2014). Yet, although the adaptation view foregrounds the importance of member experience, it does not say how safety rules participate in developing or exercising it.

Developing our understanding for how members communicate to draw from safety rules requires us to attend to ways that safety rules are active participants in members' efforts to negotiate meaning, action, and authority. The notion of *ventriloquism* brings attention to ways various *figures* (such as safety rules) actively participate in organizing (Benoit-Barné & Cooren, 2009; Castor & Cooren, 2006; Cooren, 2004, 2010). A *figure* refers to anything that is made present and makes a difference in a conversation's direction or outcome, and can include objects, professions, and organizational positions (Bergeron & Cooren, 2012; Brummans, Cooren, Robichaud, & Taylor, 2014). For example, workers might reference safety rules in their everyday communication with each other to make present the lessons that safety rules inscribe, or they might invoke the organizational authority of the rules to propose (or dissent against) a course of action. Safety rules are the figures of primary concern in this study, but other figures (e.g., organizational positions, professional concerns, etc.) might participate in organizing in equally important ways. Hence, safety rules are figures that participate in (a) negotiating meaning and (b) bolstering authority.

Safety rules participate in negotiating meaning when members ventriloquize or speak on behalf of them to make them present (Benoit-Barné & Cooren, 2009; Brummans et al., 2014; Castor & Cooren, 2006; Cooren, 2010). For instance, members might speak on behalf of an organization's mission or policy documents to remind each other of the overarching goals of their work (Benoit-Barné & Cooren, 2009). Similarly, members might appropriate safety rules to make some aspect of the environment visible or present to others. For example, members might ventriloquize a safety rule that states "initiate all action based on current and expected weather conditions" to call into question whether current plans will still work given an updated weather forecast.

Figures can also bolster members' authority when invoked to change the complementarity of a relationship (Benoit-Barné & Cooren, 2009; Cooren, 2004). Complementary relationships link organization members to one another through mutual practices and obligations (J. R. Taylor & Van Every, 2000), and might be formal (supervisor/subordinate) or informal (higher status/lower status). However, complementarity and authority are not given and must be communicatively negotiated (Benoit-Barné & Cooren, 2009; Brummans et al., 2014). Challenging the complementarity of a relationship can occur when people act in the name of, or ventriloquize, a figure (e.g., their organization or workgroup, or a document, policy, or position) to

mobilize the figure's legitimacy and lend authority to what they say (Bergeron & Cooren, 2012). For example, Benoit-Barné and Cooren (2009) found that members in a distributed organization acquired authority through invoking the central mission/goals of their organization to make a difference in how their interactions unfolded. Similarly, members might gain authority in a situation through invoking the organizational authority of rules, thus changing the complementarity of a relationship. Examining the communication by which members ventriloquize safety rules helps explain how safety rules participate in members' efforts to gain experience with understanding their environments and to negotiate organizational relationships.

Research Question 2a (RQ2a): How do members ventriloquize safety rules in two wildland firefighting workgroups?
Research Question 2b (RQ2b): How does ventriloquizing safety rules help members gain experience with understanding hazards and navigating organizational relationships?

Method

Organizational Case

The U.S. Departments of Agriculture and the Interior employ around 7,000 full-time wildland firefighting personnel, and thousands more on a seasonal basis every summer (Black & McBride, 2013). As with other forms of hazardous work (such as mining and structure fire), wildland firefighting activities are subject to numerous safety rules and checklists, particularly the 10 Standard Firefighting Orders and the 18 Watchout Situations, together referred to as the "10 and 18" (Ziegler, 2007). The 10 Standard Firefighting Orders form a historical document that inscribes organizational lessons from catastrophic fires; they were developed in 1957 to identify the "common denominators" that contributed to firefighter death in numerous fatality fires between the 1930s and 1950s (National Wildfire Coordinating Group, 2003). According to Hale and Borys's (2013a) classification, the 10 and 18 are *performance goals*, the most abstract kind of safety rule. However, when investigating fatality incidents, the federal wildland firefighting agencies often treat them (particularly the 10) as unambiguous *action rules*. This has consequences. Following the South Canyon fire that killed 14 firefighters in 1994, the federal investigation report blamed the fallen for "breaking" rules and "causing" their own deaths (T. Putnam, 1995; Thackaberry, 2004). Following the Thirtymile fire in 2001, one firefighter faced criminal charges for "breaking" the 10 (Maclean, 2007). Many firefighters have expressed that treating

the 10 as *action rules* is untenable, given the emergent nature of their work (Thackaberry, 2004). However, the incident report for the 2013 Yarnell Hill fire that killed 19 firefighters advocated a shift toward treating safety rules as "principles" that apply broadly but require interpretation, consistent with the adaptation view (Arizona State Forestry Division, 2013). Furthermore, the agencies have begun to consider how HRO theorizing might inform an adaptive, principles-based approach to safety (Wildland Fire Lessons Learned Center, 2008). The shift from a rationalist to an adaptation view marks an occupational move toward reconsidering how safety rules participate in making sense of wildland fire environments.

Data Collection

I spent 8 years as a wildland firefighter, a career investment that provided in-depth understanding of U.S. wildland firefighting operations and access to participants. I was aware, from my deep experience in this context, that the dangerous and unpredictable nature of wildland fires, as that of other crises, prohibits researchers from observing communicative interactions directly and in real time (Bergeron & Cooren, 2012; Pearson & Clair, 1998). Instead, I conducted interviews with two wildland firefighting workgroups. I drew from my extensive knowledge of the organizational context to access participants, ask pointed questions, and interpret the findings.

I gained access to the research sites through personal contacts from my firefighting career. Research participants included 27 members of two wildland firefighting workgroups ("crews") that both specialize in helicopter operations. These crews comprised a criterion sample (Lindlof & Taylor, 2011) based on theoretically relevant similarities (e.g., performing similar tasks, encountering similar hazards, following the same standard safety rules), and meaningful differences: West Fork had 25 members and two helicopters; members were generally highly experienced, and were often dispersed across smaller work units and independent assignments. Manzanita employed 20 members and had one helicopter; members generally worked as a single unit and were less experienced overall than West Fork.

I first contacted West Fork, where I had worked for 3 years. I spent 2 weeks on-site at West Fork's station, conducting individual interviews with all available members except for two, who appeared apprehensive about sharing their personal experiences. I interviewed 12 males and three females, aged 26 to 40. Members had an average of 11.2 fire seasons (range = 4-21) and had spent an average of 5.6 seasons on the crew (range = 1-19).

While conducting initial analyses of West Fork's interviews, I found it difficult to detect important insights. Deep socialization into a research

context can make a researcher less sensitive to the site's nuances and culture (Tracy, 2013). I believed this to be the case for me, so I contacted Manzanita, a crew with which I had no previous history. I interviewed all available members (11 males and one female, aged 24-34) during a 2-week period, and nobody declined to interview. Members had an average of 6.7 fire seasons (range = 3-17) and had spent an average of 2.4 seasons with Manzanita (range = 1-7).

I conducted semi-structured respondent interviews, which are best suited for gaining in-depth understandings of participants' experiences in a context (Tracy, 2013). I began each interview by asking participants to recount a critical incident (Gremler, 2004), meaning a particularly memorable experience that contributed to his or her firefighting expertise (e.g., times when they took on a position of responsibility or leadership, or experienced an incident going well or badly). I was interested in their interpretations of these incidents, in line with a sensemaking approach (Weick, 1995). In my initial five interviews, I did not specifically cue members to talk about safety rules; however, I began to see a trend in which participants' critical incidents involved recalled conversations that centered on them, including discussions and debates about how to implement safety rules, and instances that resulted in new or altered understandings of rules. These recalled conversations addressed how safety rules were incorporated into workgroup practices as "tools" and ventriloquized (or invoked) in their recalled conversations to make a difference (RQ2). In subsequent interviews, the majority of participants' critical incidents focused on rules in some ways (without my cueing them to talk specifically about them); however, I asked probing question about the rules. To understand the workgroup context informing how they use safety rule, including local expectations and practices (RQ1), I then asked all interviewees to elaborate on professional pressures they felt during the incident(s) they recounted and sources of those pressures (e.g., workgroup reputations). I asked specifics about each workgroup to understand their collective values, complementary relationships and practices: What makes this crew unique? What do new members need to adjust to so that they can be successful on this crew? How does your crew talk about members' fire experiences?

All interviews took place in a private, closed-door office; lasted 30 to 60 min; and were recorded, transcribed, and labeled with each participant's pseudonym. West Fork's interviews were slightly longer and more detailed than Manzanita's (17.4 1.5-spaced pages per participant on average, compared with 15.3 pages on average). This might have been because West Fork members were generally more experienced, and because I was a familiar crew alumnus.

Data Analysis

I employed an iterative analysis (Tracy, 2013) in which the initial focus of the study was broad and took shape as emerging findings caused me to refine research questions and revisit literature that could help explain the emerging findings. In particular, the original goal was to examine how workgroups provided a context for firefighters to interpret their firefighting experiences. However, initial findings caused me to narrow my focus toward two emerging issues: First, the incidents recalled by members from both workgroups centered on recalled conversations about appropriating safety rules. This finding emerged unprompted from the initial interviews. The ubiquity of safety rules as a central preoccupation for my participants warranted closer analysis, leading me to consider a theoretical lens that could explain how safety rules were functioning for firefighters beyond a rationalist "follow/break" understanding. Considering safety rules as figures that members ventriloquize to make a difference in interactions (Cooren, 2004, 2010) helped explain why members drew from safety rules in the ways they described (RQ2). Second, I detected differences between Manzanita and West Fork in the tone of the recalled conversations. The majority of Manzanita's recalled conversations were dialogue-based, whereas the majority of West Fork's were conflict-based. This focused my attention on ways that uses of safety rules were situated in the two workgroups (RQ1). Having two workgroups for comparison helped clarify these distinctions; I specifically looked for within-workgroup similarities and between-workgroup differences. I constantly asked analytical questions: How did members incorporate safety rules into workgroup practices? How did they describe ventriloquizing the safety rules, and to what effect? How does the participant characterize the complementarity of their relationship in the recalled interaction? What patterns emerged in the complementary relationships across Manzanita's and West Fork's interviews? How might I attribute similarities and differences between how the crews appropriated safety rules to each group's collective values, complementary relationships, or the nature of their practices (e.g., learning-oriented, autonomy-focused)? Once analyses were complete, I conducted member reflection validity checks (Tracy, 2013), presenting to participants findings from their own crew and requesting feedback. Overall, participants reported that the findings reflected their crew experiences.

Findings

This study involved in-depth comparison of how members of two wildland firefighting crews that specialize in helicopter operations recalled appropriating

safety rules through incorporating them into local communicative practice and ventriloquizing them. The two crews conducted the same tasks and were subject to the same rules; however, the findings revealed key differences in how they described drawing safety rules into their firefighting activities.

Overall, the findings revealed three practices common to both Manzanita and West Fork that involved communicating about or with the help of safety rules: *briefings, debriefings*, and *safety rule enactments* (see Table 1). In general, briefings took place at the beginning of each workday and prior to engaging in firefighting activities, while debriefings took place at the end of the workday and following firefighting activities. Safety rule enactment refers to the ways members recalled using safety rules when actively involved in firefighting activities. Both workgroups conducted all three practices but did so differently. Overall, both crews conducted briefings and debriefings. In both crews, members talked generally about incorporating safety rules into briefings. Only Manzanita members talked about ventriloquizing specific safety rules in debriefings, while West Fork members talked generally about incorporating safety rules into their debriefings. For both crews, specific instances of ventriloquism emerged in relation to safety rule enactments. This is probably because rule enactments were more memorable than routine briefings and debriefings.

As is typical for U.S. wildland firefighting crews, Manzanita and West Fork were decentralized and able to define for themselves how best to conduct their work, similar to self-managing teams (Barker, 1993). Workgroups set expectations for members who informed the character of their practices and defined how members oriented toward each other in complementary relationships. The findings revealed two distinctive models for making sense of hazards through communicating with and about safety rules (see Figure 1). One model built foundational knowledge (at Manzanita) by extending a spirit of instruction through their briefing, debriefing, and rule enactment practices, and reinforcing a teacher/learner complementary relationship between more and less experienced members. The other model allowed members to test their expertise (at West Fork) through setting an expectation to act autonomously by drawing from their experience in briefing, debriefing, and rule enactment practices, and fostering an expert/expert complementary relationship between the crew's highly experienced members. Findings for the research questions are closely related and are reported relative to each workgroup in this section.

Manzanita's Complementary Relationships and Practices

Of the two crews studied, Manzanita's members had less firefighting experience overall. Manzanita also had higher annual membership turnover. At the

Table 1. Workgroup-Specific Models for Adapting Safety Rules Through Communicative Practices.

Workgroup model	Complementary relationships	Communicative practices for adapting safety rules		
		Briefings	Rule enactments	Debriefings
Foundational model Manzanita	Teaching/learning Complementary relationship	Exchange fire information	*Demonstrating* safety rules scaffolds conversations that configure space—reading the rules against the terrain	*Perpetuating* safety rules through retrospective discussions helps members make sense of their experiences and environments
Testing model West Fork	Expert/expert Complementary relationship	Exchange fire information Enact expert role by giving a briefing Judge expertise of others based on their briefing quality	*Embodying* safety rules involves acting into the environment and making sense later; sensory process *Leveraging* safety rules establishes/changes the complementarity of a relationship	Challenge higher management through voicing concerns

time of the interviews, nearly half of the members were in their first year on the crew. However, they were not entirely new to firefighting. Nearly everyone had spent time on other crews before joining Manzanita. Their experiences elsewhere attuned them to Manzanita's collective values that informed the complementary relationships by which they oriented toward work and each other (see Figure 1).

Members noted Manzanita's unique learning environment, saying, "This crew is unique because all of us have a voice, and we want to hear what each other have to say," "We're all here to learn," and "We try to learn as much as we can from everything we do, whether it's a fire assignment or just a day clearing brush." Members said that their crew was known within the occupation for fostering learning, asking questions, receiving guidance, and bolstering their firefighting experience. As a result of viewing firefighting assignments as opportunities to learn, members saw each other as teachers and learners.

The Manzanita crew had a distinctive teacher/learner complementary relationship that members performed in their practices for briefing, debriefing, and enacting safety rules. This complementary relationship stemmed from the crew's composition of roughly half veteran members (who acted as teachers) and half newcomer members (who took on the student role). Manzanita's teacher/learner complementary relationship reflexively fostered teaching and learning activities throughout fire assignments and routine tasks. The complementary relationship set

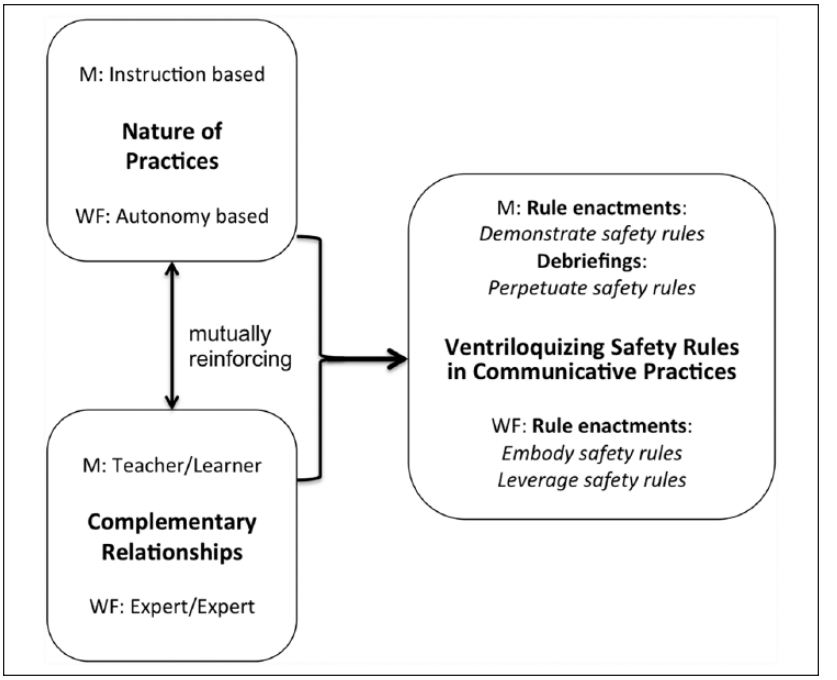

Figure 1. General workgroup model for adapting safety rules.
Note. M = Manzanita's foundational model; WF = West Fork's testing model.

up a script for teaching and learning interactions, whereby newcomers asked questions, voiced concerns, and expressed discomfort, while veteran members explained decisions, articulated how they interpreted fire situations, and openly admitted mistakes. Furthermore, there was pressure to foster and adhere to relational interactions geared toward instruction by minimizing social costs related to asking questions and admitting mistakes. Eric said, "We're all here to learn, so you have to step out of your comfort zone to ask questions and explain things." A focus on teaching and learning prioritized dialogue, instruction, and inquiry. Engaging in an instructive manner meant reenacting and reinforcing the teacher/learner complementary relationship. Expertise and authority were clear and relatively stable.

Manzanita's Foundational Model for Adapting Safety Rules

The second set of research questions asked how members ventriloquized safety rules in each workgroup (RQ2a), and how those ventriloquizations helped members gain experience with understanding hazards and navigating

organizational relationships (RQ2b). Manzanita's teacher/learner complementary relationship enabled members to build a foundation of essential knowledge through actively engaging the safety rules. Overall, this workgroup's activities were centered on instruction. For instance, Philip described an example of instructive dialogue between teacher and learner that was typical for the crew. He said that, on a recent helicopter flight to a fire, "there was quite a bit of dialogue as far as Plan A, Plan B . . . [W]e talked extensively about what the fire was doing and tactical decisions . . . the scenario and the options that we have." Instructive dialogue kept members' attention in the moment, focused on articulating possibilities for firefighting response, and was carried through the workgroup's briefing, enacting safety rules, and debriefing practices (see Table 1).

Briefings. When not on fire assignments, the crew conducted informal briefings at the beginning of each workday. When working on fires, they conducted an initial briefing at the beginning of the fire to inform everyone about the fire situation, and they conducted them at the beginning of each work shift. Formal briefings on all fire incidents involved systematically going through the safety rules to note specific measures that were in place to address them, discussing details such as the chain of command, communication channels, likely hazards, and safe areas to go if the fire suddenly escalated. As Stan said, referencing several of the 10 Fire Orders, the "standard briefing is the basis for engagement, right? You've got your escape route down that way, safety zone is back to the black [burned area], communications on this [radio] channel. Then you feel like you're covered [prepared to engage]." In general, briefings incorporated safety rules to prompt members to think about fire situations they were about to face, and for deciding on tasks for the day. However, while briefings were important for gathering information, they did not appear to be focal opportunities for deepening understandings of hazards.

Rule enactments. Rule enactment refers to the ways the workgroups put rules into action in the fire environment in general, and in particular, how they ventriloquized safety rules when taking action. Manzanita members enacted safety rules through *demonstrating* them.

Demonstrating safety rules involved deliberate efforts to teach how to implement them. Members ventriloquized rule content against the observed environmental circumstances, namely, terrain features, fire behavior, and weather. One of the most heavily emphasized safety rules was that firefighters must have an adequate safety zone, ideally a large area of cleanly burned "black," because it would not burn again. Dean described instructing newcomers on how to identify an adequate safety zone:

> With all of our newer people, you've definitely got to be looking out the [helicopter] window and saying [to newcomers], "Okay, the wind's pushing [the fire] this way. And look how it's burning on that side. We're landing here. The first thing we've got to do: Where's the best black to get into?"

Because each fire presents a new set of circumstances, each implementation of the safety zone rule will be different from previous ones. Dean's instructive dialogue reinforced the veteran/newcomer complementary relationship. It enabled the "newer people" to notice fire behavior and terrain features, and to verbalize how factors such as wind direction and fire spread inform and justify the placement of a safety zone. Dean walked members through the logic involved with identifying an adequate safety zone by pointing out relevant terrain features. Safety rules participated in configuring the spatial terrain for firefighting. Noticing the fire's current location, and reading the fire behavior and weather to anticipate where it would go next, shaped where the safety zone should be established on the terrain. Safety zones both enable and constrain what firefighters are able to do within a given space and time. Demonstrating safety rules established and articulated these capabilities and limits.

Debriefings. Debriefings occurred at the end of work days (when not on fires) and at the end of work shifts when on fires. Overall, debriefings[1] were an opportunity to air challenges, problems, concerns, questions, and successes at the end of the shift. The purpose was to let people know what was going on in all areas of the fire, so they could make necessary changes in the next shift. At Manzanita, members actively ventriloquized the safety rules in their debriefings, which *perpetuated* the lessons embedded in them.

Perpetuating safety rules occurred through deliberate practices of debriefing the previous shift or fire assignment in which members used the safety rules. Manzanita's debriefings perpetuated safety rules as members verbalized the events of the day, their observations, and their concerns. Members said that they held each other accountable for their daily debriefings, and noted that there was pressure for everyone to contribute. Stan said that, as a result, "people are watching, looking for things to bring up at the end of the day." In debriefings, they retrospectively discussed their actions as a group, articulating for newcomers important activities and cues while drawing the safety rules into the discussion, either explicitly or abstractly. For example, Stan (supervisor) explained,

> [The 10 and 18] have always been the basis for judgment and error . . . You're encountering multiple Watchouts [the 18] on any given incident and sometimes

> it's hard to follow all the Orders [the 10]—so, it's a matter of identifying them, being aware of them . . . and going over that with the group.

The daily debriefing was a key activity that fostered the teacher/learner relationship. Stan continued, "After every assignment, we go over with everyone how they thought it went." Learners emphasized the importance of these activities, too, commenting, "It's important to hear how others saw [an event] because maybe they saw something you didn't and you need to be aware of that." Daily debriefings also reinforced teaching and learning scripts. Generally, members recalled previous actions and read them against the safety rules, as if to ask, "Are these actions consistent with the spirit and content of the safety rules?" These discussions made visible safety rule appropriations that worked well. Daily debriefings habituated members to notice events from the day and bring them up in later discussions. The conversations emboldened newer members to overcome hesitations, while also resensitizing more experienced members to hazards.

To summarize the foundational model, ventriloquizing safety rules through rule enactment and debriefing practices demonstrated and perpetuated (respectively) the content and spirit of safety rules through cooperative dialogues and stable complementary relationships. These efforts helped members learn about and anticipate common hazards. Overall, the foundational model of adapting safety rules tended to subject members to relatively conservative action that adhered closely to a rationalist view of "following" safety rules as directives.

West Fork's Complementary Relationships and Practices

Most West Fork members were highly experienced and had worked on the crew for several years. One defining aspect of the crew was that members frequently accepted independent assignments that took them away from the crew for up to 2 weeks at a time. A strong expectation was to use their expertise by demonstrating that they could think and act independently when implementing safety rules, and by showing that they were comfortable asserting themselves to offer a different interpretation for implementing a rule. They viewed fire assignments as opportunities to influence and improve operations. As Stuart said, "When we get to an incident . . . we put our folks into key positions, and it usually ends up running better." Members described themselves and fellow crew members as "all fairly strong Type A" personalities (i.e., forceful, self-directing) and said that they were notably assertive about influencing firefighting activities. For example, Jack said that West Fork often "took over" the planning and execution of helicopter missions,

which run out of a *helibase*. He said, "We come in and we steamroll a helibase. In a matter of an hour, someone's running cargo; someone's running the [radio communications]; we got a guy setting up the deck [marking helicopter parking spots]." Furthermore, acting independently was just as important to being a West Fork member as acting assertively. Crew expectations included the following: "You don't need to have your hand held" and "You can stand on your own two feet." Owen said, "You need to think independently because you might be *the* helicopter expert people turn to."

West Fork members viewed each other as equals, saying that everyone is "on an equal playing field." Members oriented toward each other in an expert/expert complementary relationship. Peter explained, "The hierarchy is there on paper, but it shifts around. You might be telling your boss what to do because you might have more knowledge on something." Hence, the collective workgroup goal of using members' extensive expertise meant that the nature of practices emphasized autonomy, particularly the expectation to take action without the need for supervision. Furthermore, the collective value of using members' expertise created the assumption that fellow crew members were knowledgeable equals.

West Fork's "equal" expert/expert complementary relationship reflexively reinforced crew practices of acting autonomously and asserting their expertise. Their idea of equality referred to recognizing that everyone had extensive, if different, firefighting backgrounds. However, seeing each other as equals meant that authority was not clear and often needed to be established. As a result, the expert/expert complementary relationship was characterized by conflicts in which one member attempted to overpower another. The pressure to act not only as experts but also autonomously ("not needing [one's] hand held") seemed to motivate members to be the more authoritative participants in a complementary relationship. The conflict interactions most members recalled suggested that they were attempting to prove their expertise and their deserved position on the crew (rather than engaging in conflict for conflict's sake).

West Fork's Testing Model for Adapting Safety Rules

West Fork complementary relationships and practices pushed members outside their "comfort zones" and tested their expertise. However, members did not come to the crew already comfortable with taking charge of situations. The conflict interactions most members described appeared to be an important way to test expertise. Most of West Fork's critical incidents reflected members' struggles to test themselves by acting in the expert capacity. Their recalled critical incidents centered on ways they ventriloquized safety rules

through their rule enactments, while members talked generally about briefings and debriefings.

Briefings. As with Manzanita, briefings were the routine way to start work shifts, whether on a fire or at the home base. Formal safety briefings informed members about fire environments, whereas informal briefings assigned tasks for the day. However, at West Fork, briefings also allowed members to act out their expertise. For example, Owen said that new members to the crew sometimes struggled with giving briefings because

> people come from other crews and they aren't used to having their opinion count, and suddenly, we're telling them they need to give the briefing or do something else where they're in charge, they're the expert and people ought to listen to them . . . so we throw them in there, make them do it, make them get over [their fear].

Giving the briefing put members in the spotlight where they demonstrated their ability to be in charge and think through possible hazards and problems thoroughly. Later in the interview, Owen said that giving a "good briefing" was something the West Fork crew took into account when "sizing up" (or assessing) the competence of firefighters they encountered on their crew and others.

Rule enactments. West Fork members' critical incidents were characterized by experiences that involved physically acting in the environment or a communicative event and gaining insights about it retrospectively, in line with Weick's (1979) notion of enactment as an interpretive process. *Embodying* safety rules involved ventriloquizing them to put forth a plan and justify its logic and worth. Through enacting their environment with the help of the rules, members were able to embody deep insights about physical landscapes and their own ability to influence action. Stuart's account from a fire exemplified how West Fork members tested their ability to wield expertise: Several West Fork members discussed a plan that included burning a section of grass to strengthen the fire line, which influenced how to implement safety rules related to identifying a safety zone and escape route.

> We debated about what to do within our module . . . One guy was resistant [to my plan] . . . but [a more experienced member] verified what my initial idea was . . . I took away that I need to be the stronger voice, not shove it down their throats, but say: "I know this is what we need to do. This is the right way to do it."

West Fork members' critical incidents depicted efforts to convince themselves that they had the necessary expertise to take the lead on decisions. By

proposing a plan, Stuart stood "on his own two feet" rather than "just doing what [he was] told." When he encountered resistance to his plan, Stuart sought confirmation from a more seasoned member. Receiving confirmation that his plan was good clarified how he should communicate in the future: "not shove it down their throats" but "be the stronger voice." Through embodying the safety rules, Stuart was able to access and act out what it meant to be an expert while gaining a deeper embodied understanding of the safety rules. Members also described ventriloquizing safety rules in ways that gave them *leverage* or helped them make a difference in interactions.

Leveraging safety rules involved invoking them as trump cards to establish authority between members. In such circumstances, safety rules were not invoked to apply the lessons inscribed in them. Instead, members mobilized the organizational authority of the safety rules to refuse to participate in another's plan. For instance, Robin described invoking a safety checklist when interacting with an overly aggressive ("gung ho") firefighter:

> We used a risk management process on a fire where one guy was gung-ho and wanted to start doing things . . . And the rest of us . . . went through the risk management checklist, just followed it down and said no, no, no, no. And we brought that up [to the "gung ho" firefighter].

Invoking the risk management checklist gave Robin the leverage to diffuse an overly aggressive firefighter's momentum and assert control over the situation. Prior to this interaction, the complementary relationship was unclear, because it had not yet been established. Robin mobilized the organizational authority of the safety checklist to enhance her own authority in the complementary relationship. Robin said that the experience was important because she realized, "When things are moving too fast, just take out your rules" to regain control. Safety rules carry authoritative weight tied to compliance and discipline (Hale & Borys, 2013a, 2013b); members can invoke these forms of authority to remind others about safe and unsafe options, or as Robin demonstrated, to change the configuration of a complementary relationship.

Debriefings. As with Manzanita, debriefings occurred formally (after fire shifts) and informally to end the day at the home base. At West Fork, however, members also considered debriefings to be an opportunity to voice difficult grievances that upper management on large fires should know about. For instance, Andy said that occasionally on large fires they receive orders to carry out tasks that are blatantly unsafe, but it can be difficult to voice dissent to the person giving the orders if that person is high in the

chain of command or "high on the totem pole." "They could punish you," he said, "because they have their mission they're trying to accomplish, and you're some low man on the totem pole getting in the way of that." He went on to say that debriefings were an opportunity to voice such concerns, but it took courage to challenge the chain of command in this way. He said, "So you end up seeing all these crews standing around at the [debriefing], and nobody says a damn thing." He said that West Fork members made it a priority to speak up in these debriefings "because someone has to tell upper management what's not working."

In sum, West Fork's testing model of adapting safety rules stemmed from a collective expectation that members should utilize their expertise by taking charge of situations they encounter. Crew practices were based on acting autonomously and "not needing to have your hand held." This resulted in communicative interactions that were conflict-based, as members asserted their viewpoints, rather than discussing them through a give-and-take form of dialogue. A weakness of this model is that members might be so preoccupied with asserting their view that they experience tunnel vision. However, the strength of the testing model was that it created a context in which members could deepen their experiential knowledge, as well as gain a voice through both asserting and defending their plans, and voicing dissent.

Discussion

The key issue in the technical documentation cycle is moving abstracted, standardized failure lessons into grounded practice (Sauer, 2003). This study provides an explanatory workgroup model for how safety rules are adapted from a written modality to an enacted one (Figure 1), which adds to our understanding of this crucial aspect of the technical documentation cycle in hazardous operations and industries (Sauer, 2003). Overall, this study explains why certain ways of using safety rules are taken up (or not) in workgroups and to what effect. This explanatory model makes two important contributions. First, the workgroup model clarifies what it means to "adapt" safety rules, showing that adapting rules involves selecting from options that become socially available in workgroups. Second, the model changes how we understand learning in self-managing teams. Adapting the lessons inscribed in safety rules from the written to the enacted modality involves ventriloquizing safety rules according to situated complementary relationships, and collective expectations and needs that create a *frame* for how members gain experience. This section discusses these contributions to the adaptation view of safety rules, in addition to hindrances to adaptation.

Adapting Safety Rules: Selecting From Socially Available Options

Safety rules research treats *adaptation* as a synonym for flexible or versatile ways of using rules (Dekker, 2014b; Hollnagel, 2014); however, this study suggests that adapting safety rules does not refer to flexible uses of them that anyone can employ. Instead, the flexibility with which members can adapt safety rules is bounded by the options for action made available in the local workgroup. Rather than think of "adaptation" as general flexibility, it can be helpful to think of it through the lens of natural selection. Karl Weick's (1979) seminal book proposes that an organization's adaptability—broadly speaking, its ability to reproduce itself in a complex environment—depends in part on the variations in action that it selects for. He argues that possibilities for action (i.e., adaptations) need to first exist in a minimal form, so that members can see certain actions as options, and then later choose (or "select") those actions.

The findings from this study show that adapting safety rules is not entirely spontaneous. Instead, workgroups make an array of actions available to members, but the options are bounded by the complementary relationships and practices members deem acceptable in the context of their workgroup (Figure 1). For Manzanita's foundational model, we might expect that members would adapt safety rules within the bounds of local expectations related to teaching and learning. That is, any safety rule adaptation would need to be defensible in the context of Manzanita's local forms of scrutiny—its instructive dialogue-based practices and the teaching/learning complementary relationship. Hence, Manzanita members adapt safety rules in particular ways knowing that they will be expected to explain and justify their actions to their co-workers for the purposes of teaching or learning. For West Fork's testing model, we might expect members to adapt safety rules within the bounds of local expectations to use their expertise and act autonomously. Here, safety rule adaptations serve members' needs to assert themselves, as well as gain and test their embodied understandings of fire environments.

Furthermore, local complementary relationships and ways of conducting practices are mutually reinforcing, such that one workgroup's ways of communicating to use safety rules might seem inappropriate for another. For instance, Manzanita's core behaviors related to teaching and learning would be interpreted very differently at West Fork. In particular, if a member were to seek an instructive dialogue in a context that values autonomy, it would likely cast doubt on that person's expertise as fellow members question whether he or she is confident or experienced enough to act independently. Similarly, West Fork's core behaviors of acting independently without seeking feedback would likely be interpreted at Manzanita as unwillingness to

engage in an active teaching and learning process. The explanatory model for adapting safety rules depicted in Figure 1 contributes to the adaptation view of safety rules by showing how and why workgroup values and communication practices make some safety rule appropriations locally possible, while rendering others unacceptable.

Ventriloquization: Framing What Is Possible to Know and How

By foregrounding communication, specifically ventriloquization, in firefighting workgroups, this study shows two ways that crews *enact* (Weick, 1979) their environments with the help of safety rules through a process of action and reflection. These findings change the way we understand learning in self-managing teams. In self-managing teams, consensus around values generates norms for activity that members both follow and police (Barker, 1993). The findings from this study align with and extend Barker's study. Members ventriloquized more than the safety rules; they also ventriloquized the complementary relationships along with the group norms that drove those relationships. That is, adapting the lessons inscribed in safety rules from the written to the enacted modality involved ventriloquizing safety rules according to situated complementary relationships, ongoing practices, and local expectations that together created a *frame* for how to both see environments and what role to act out in them. A frame is a collective script that aids in how members organize and interpret information they receive, and is based on one's past experiences, cultural imagery, professional background, and so on (Bergeron & Cooren, 2012; Brummans et al., 2008). The communicative process of framing occurs as members define situations, and in the process, create distinctions between foreground (or focal) and background (or peripheral) concerns (Brummans et al., 2008). As members ventriloquize their workgroup's complementary relationships and practices, they define situations according to the associated issues and concerns they place in the foreground and background (Bergeron & Cooren, 2012). In effect, what is possible to learn and how depends on how workgroups take part in framing situations.

To illustrate the above point, ventriloquizing the teacher role at Manzanita generated a frame for seeing and making sense of situations through invoking expertise and anticipating questions, devising instructive explanations, while the complementary learner role created a frame of seeing environments with beginner eyes. Adapting the rules from the written to the enacted modality occurred according to the values and complementary relationships Manzanita cultivated, and member learning about hazardous environments was external and public, taking place through dialogue.

In comparison, ventriloquizing the expert role at West Fork demanded a frame through which to see situations that challenged members to make sense of environments through a form of enactment more closely aligned with Weick's (1979) definition, that is, referring to action followed by interpretation. Members reported a similar discovery process when making sense of how to navigate authority in organizational relationships. Adapting safety rules from the written to enacted modality at West Fork occurred through ventriloquizing the expert role and its attendant frame to learn about hazards. Learning took place through embodiment (rather than dialogue), and the process was private and reflective.

In sum, the foundational and testing models for adapting safety rules contribute to our understanding of adaptive action and learning in HROs, showing how situated workgroup practices for drawing from safety rules help members make sense of hazards and navigate authority.

Hindrances to Adaptation

The primary obstacle to adapting rules from a written modality to an embodied one is the rationalist frame organizations, industries, and governments place on safety rules. In particular, Dekker (2014a) referred to a "bureaucratization of safety" in which "broken" or "violated" rules are "punished." The result, he notes, is that members feel restricted in their action and unable to take the risks necessary to intimately understand their environments. The cycle of technical documentation, particularly the process of adapting written knowledge (as safety rules or another form) into action, inhibits creative possibilities for action when those written directives are meant to circumscribe action from the beginning. Further, the threat of punishment can prevent members from the important enactment (Weick, 1979) work of feeling their way through their environments, which is essential for both learning and facilitating members' ability to truly *adapt* safety rules in complex HRO environments. The dilemma that arises is how to foster practices that keep costly failure lessons present and in play while avoiding a chilling effect caused by disciplinary action. Broadly, members take an important cue from how their organizations handle failures. If handled with blame and disciplinary action, members will resort to silence and self-protection, which hinders learning (Thackaberry, 2004). If the organization handles failures with candor, openness, and a forward-looking attitude of improvement, then members might be more willing to participate in conversations around safety.

The findings from the two crews suggest that organizations interested in fostering a learning "culture" need to center their efforts on workgroups—gaining thorough understanding of the workgroup subcultures that exist and

paying particular attention to ways that local expectations, practices, and complementary relationships create (or destroy) opportunities for participation (Jahn, Putnam, & Myers, In Press).

Comparing two functionally similar workgroups clarified the findings. However, this study should be considered relative to its limitations. First, the data are derived from members' accounts of conversations in which they invoked safety rules, and as such, might contain inaccuracies. Also, these data came from two workgroups in a large organization. It is not possible from this analysis to know the extent to which observations from either crew are typical of the U.S. wildland firefighting occupation broadly.

Conclusion

Safety rules are an inherent part of hazardous work and are often the codified insights derived from failure events such as accidents and fatalities. Scholars have examined how lessons from failure events are transformed from lived experience into written directives (Sauer, 1998, 2003), and factors that influence member compliance with safety rules (Hale & Borys, 2013a; Hopkins, 2011; Lawton, 1998). However, research is sparse regarding how safety rules participate in members' efforts to both take action and gain experience. This study extends knowledge by proposing an explanatory workgroup model for how members adapt safety rules into action (Figure 1); this model contributes to the adaptation view of safety rules by showing how and why workgroup complementary relationships and communication practices make some ways of appropriating safety rules locally possible, while rendering others unacceptable. These findings also contribute to our understanding of adaptive action and learning in HROs. By foregrounding communication practices and ventriloquization, we are able to explain how specific ways of drawing from safety rules shape how members make sense of emerging, ambiguous hazards and negotiate authority.

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Note

1. One specific kind of debriefing common in wildland firefighting is an after action review (AAR), which is formal retrospective discussion based on a list of specific questions. This study discusses debriefings generally and is inclusive of both formal AARs and informal debriefings.

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