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Unravelling the Motor of Patterning Work: Toward an Understanding of the Microlevel Dynamics of Standardization and Flexibility

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This paper examines how routine patterns are recognized as either stable or flexible and which mechanisms are enacted to maintain this patterning work. We address this question through an ethnographic case study analyzing how a catastrophe management organization enacts routines in a highly dynamic setting. Our findings first of all reveal that patterns described by the participants as either stable or flexible were nevertheless both performed differently in each iteration of the routine. Our microlevel analysis shows that to enact patterns that participants perceive as stable, participants had to carry out specific aligning and prioritizing activities that lock-stepped performances. In contrast, participants perceive patterns as flexible when they enact specific selecting and recombining activities. Building on these observations, we add to extant routine literature by (1) differentiating between stability, standardization, flexibility, and change of routines and by (2) providing new insights on mindfulness in accounting for the microlevel activities enacted to orient toward a pattern that enhances standardization or flexibility in dynamic contexts. Moreover, (3) our insights point to the centrality of knowing for the enactment and recognition of patterning work.

Keywords: patterning work; stability; standardization; flexibility; knowing; effortful enactment; catastrophe management
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Introduction

Routines are traditionally associated with stability, reliability, and efficiency, since they respond to *ex ante* defined stimuli in a likewise *ex ante* defined process (March and Simon 1958, Cyert and March 1963, Nelson and Winter 1982). Seen this way, stable and reliable outcomes can be ensured, and recurring tasks can be accomplished efficiently (March and Simon 1958, Ashford and Fried 1988, Nelson and Winter 1982). Over the last decade, the practice-based understanding of organizational routines has substantially challenged this traditional perspective privileging stability (Feldman and Orlikowski 2011, Parmigiani and Howard-Grenville 2011). In particular, Feldman (2000) pioneered conceptualizing routines as sources of endogenous change. According to this perspective, routines are by no means stable and mindless patterns of behavior; they are generative systems with internal dynamics that can produce both stability and change (Feldman 2000; Feldman and Pentland 2003; Howard-Grenville 2005; Pentland and Feldman 2008; D'Adderio 2008; Pentland et al. 2010, 2011; Rerup and Feldman 2011; Turner and Rindova 2012; Dionysiou and Tsoukas 2013; D'Adderio 2014).

By building on this conceptual and methodological shift from analyzing standard operating procedures to exploring the actual performances enacted by actors, scholars are now able to observe and understand “performance

variety” of routines. Relying on the conceptual differentiation between ostensive, performative, and material aspects (artifacts) of routines (Feldman and Pentland 2003; D'Adderio 2008, 2011), numerous studies have been conducted seeking to accomplish a better understanding of routine dynamics. These studies have revealed that routines exhibit a high degree of performance variation; i.e., each iteration of the routine differs from the previous one. Even highly standardized invoice processing routines were found to have a high degree of variety in their performance (Pentland et al. 2011). Similarly, research on information systems has shown that even if routines are inscribed into software with the intention to standardize workflows, they still reveal a considerable amount of variation (Pentland et al. 2011).

Moreover, the question of how patterns of stability or change actually emerge—despite diversity among individuals, groups, or communities engaged in the performance—is attracting increasing attention in routine theory (Zbaracki and Bergen 2010, Turner and Rindova 2012, D'Adderio 2014, Dionysiou and Tsoukas 2013, D'Adderio 2014). These and other studies have shown that, based on the different roles actors may have as routine participants, they have different perceptions of what belongs to a routine pattern and what does not (Feldman and Pentland 2003, Turner and Rindova 2012, D'Adderio 2014). Turner and Rindova's (2012) study, for example,

has revealed that customers and employees have different perspectives regarding how a waste collection routine has to be performed. What was perceived as a standardized pattern by the employees was interpreted as a changing pattern by the customers. Seen this way, routines might be perceived as stable or changing depending on the perspective of routine participants.

However, we still lack an understanding of *why* patterns are recognized as stable or changing and *how* these patterns are actually enacted by routine participants. Our paper adds to this dynamic perspective by exploring which mechanisms routine participants enact to create patterns that they recognize as stable or changing. This exploration enriches our understanding of the mechanisms that actually fuel and enact the motor of “patterning work” in organizations (D’Adderio 2014, p. 1346).

We address our research question through an ethnographic case study investigating the performance of organizational routines carried out by a so-called high-reliability organization (Weick and Sutcliffe 2007). We believe a high-reliability organization to be an interesting setting to study the recognition and enactment of routines since this kind of organization has to skillfully handle the tension between carrying out error-free, reliable (stable) performances while being able to constantly respond to the dynamic (changing) setting (Bigley and Roberts 2001, Faraj and Xiao 2006, Farjoun 2010, Bechky and Okhuysen 2011).

Our findings complement and enrich the debate around routine dynamics by exploring how routine participants recognize and enact stable and/or changing patterns. As our study reveals, the recognition and enactment of patterns that were perceived as stable or flexible is enabled by a complex sociomaterial mixture of artifacts, training, and knowing. Based on these observations, we suggest a model that extends research on routine dynamics by accounting for specific microlevel activities that have to be enacted to maintain patterns that are perceived to follow a standard or be flexible. These insights help us understand the difference between change and flexibility of routines on the one hand and standardization and stability on the other hand. Moreover, our study reveals that patterns that enhance standardization are the result of an effortful enactment that demands performance variety. This also contributes to a processual understanding of organizational routines by accounting through which mechanisms stability and change coexist within each other (Emirbayer 1997). Finally, we theorize on the importance of knowing in the recognition and enactment of organizational routines.

Our paper is organized into four main sections. In the first part, we briefly review the debate around routine dynamics and patterning. In the second part, we introduce our case study and discuss our methods of data collection and analysis. The third part presents the findings of our study of a high-reliability catastrophe management

organization. In the fourth part, we discuss our findings in light of theory and indicate how we add to and depart from current research.

Routines and Patterning Work

Organizational routines are a well-established construct in organizational theory. Traditionally, routines have been conceptualized as organizational programs that provide generalized answers and solutions to recurring problems (March and Simon 1958, Cyert and March 1963). Following this line of thought, routines enable organizations to rely on prior knowledge for processing *ex ante* specified problems, turning them into *ex ante* specified, quasiautomatic solutions (Pentland 1995). Routines thereby ensure efficiency, legitimacy, accountability, and reliability in organizations, which is why they are perceived as a source of stability (Cyert and March 1963).

This view, however, has been substantially challenged by Feldman’s (2000) study, which was originally designed to address stability and recurring patterns, but instead found evidence that organizational routines are sources of endogenous change. This performative turn, building on a practice-based perspective (Gherardi 2000, Feldman and Orlikowski 2011, Parmigiani and Howard-Grenville 2011), has shifted our focus away from understanding routines as structural, representational entities toward studying how routines are actually performed by actors (Feldman and Pentland 2003). Central to this framework is the differentiation between ostensive, performative, and material aspects (artifacts) of routines (Feldman and Pentland 2003, Pentland and Feldman 2005, D’Adderio 2011). Artifacts are understood as material aspects of the routine. They appear in many different forms, such as written rules, standard operating procedures, or tools, and may be used differently in routine performances (D’Adderio 2014). The performative aspect of routines refers to “the specific actions taken by specific people at specific times when they are engaged in what they think of as an organizational routine.” (Pentland and Feldman 2005, p. 796). The ostensive aspects of routines are patterns that participants use to guide, account for, and refer to specific performances (Pentland and Feldman 2005, p. 795). This performative conceptualization of organizational routines as “repetitive, recognizable pattern of interdependent actions, involving multiple actors” (Feldman and Pentland 2003, p. 96) has radically shifted our understanding of their dynamics. Whereas stability used to be the norm and change the exception, the practice-based perspective considers routines as generative systems with internal dynamics that can produce both stability and change (Feldman and Pentland 2003).

This practice turn has inspired numerous studies investigating how the duality of stability and change (Farjoun 2010, Feldman and Orlikowski 2011) is created and maintained by enacting routines. For example, Turner

and Rindova (2012) demonstrate that different stakeholders, while having different understandings about the waste collection routine, simultaneously enact patterns of targeted consistency (standardization) and patterns of flexibility. The study identifies connections among organizational members and artifacts as crucial for enabling the balancing of pressures for consistency and change in routine functioning (Turner and Rindova 2012). Howard-Grenville (2005), interested in understanding how flexible patterns persist over time, reveals the importance of the intention and orientation of actors and the way routines are embedded in the organizational context for routine dynamics. Here, the strength of embeddedness of routines in a context and the orientation of actors toward the past, present, or future are identified as critical mechanisms influencing the stability or change of patterns. In a recent study, D'Adderio (2014) showed how conflicting patterns of copy exactly (replication) and change (innovation) can be simultaneously enacted by harnessing artifacts and communities and by striving to maintain a dynamic balance between the two contrasting patterns. The combined influence of artifacts and communities and their selective, sociomaterial configurations allow for a simultaneous performance of more flexible or more standardized routine patterns. Pentland et al. (2011) analyzed highly standardized invoice processing routines, thereby identifying hundreds of unique enacted patterns that varied significantly over time due to (among other factors) the varying degree of experience of the routine participants involved in its enactment. In a similar vein, building on a simulation model, Pentland et al. (2012) indicated that even the slightest variety in performances leads to a change of the overall routine. All of these studies point out that each routine performance can vary from one iteration to the next, and stability as well as change of routines is the result of an effortful accomplishment of routine participants (Pentland and Rueter 1994). Therefore, Pentland (2003, p. 530) conceptualizes such changing patterns as "sequential variety," Cohen (2007, p. 781) speaks of "pattern-in-variety," and Birnholtz et al. (2007, p. 316) and Pentland et al. (2011, p. 1369) refer to "the paradox of the (n)ever-changing world." On a similar note, research on information systems has shown that if routines are inscribed in software with the intention to standardize workflows, they still are performed flexibly by different users (D'Adderio 2003, Orlikowski and Scott 2008).

Research interested in understanding how routine participants understand patterns despite diversity of different actors is attracting increasing attention. Following Feldman and Pentland (2003) and Pentland and Feldman (2005), the understanding of the ostensive part of the routine can differ from actor to actor depending on her or his role in the organization or the actual context in question, so multiple ostensive aspects of routines can be identified. The study of Turner and Rindova (2012) reveals that different stakeholders may have different perceptions

on what is identified as a stable (routine) pattern. In their case of waste collection firms, the waste collection pattern remained consistent even if the firms changed the routing of trucks due to breakdowns or road construction. However, the customers identified this rerouting as a complete change of pattern (or even not a pattern at all), since they expected the truck to arrive at a specific time (Turner and Rindova 2012, p. 38). In an earlier study, Pentland et al. (1994; cited in Pentland and Feldman 2005, p. 798) compared the work of travel agents and librarians in terms of the variety of their work patterns. In this case, the librarians reported their work to be highly varied, whereas the travel agents perceived their work to be highly routinized (nonvarying). Outsiders' observations, interestingly, indicated the opposite. Whereas observers perceived travel agents to show a high degree of variety in the enacted performances, the outsiders viewed librarians as enacting "simple" repetitive interactions. Furthermore, research on technology in use has stressed that routines that are inscribed into software with the intention to standardize workflows (Latour 1992, D'Adderio 2003) are modified and enacted differently by different users who use technology in a flexible, varying manner (Orlikowski 1992, D'Adderio 2003, Orlikowski and Scott 2008). For example, D'Adderio (2003) showed how different engineers had different views of their product and the way knowledge was ordered in parts lists, which corresponded to their different training and work experience as part of different teams and functions. Thus, different users had quite different understandings of the standard and how it should be enacted. Similarly, Orlikowski (1992) speaks about interpretive flexibility (Star 1989) in pointing to the circumstance that standardized workflows inscribed into software and even technology itself can be understood and enacted differently by different actors.

These studies indicate that what is *perceived* as being a stable or changing pattern is a matter of interpretation, from the inside, by those performing the routine, as well as from the outside, by those observing the routine. As Rerup and Feldman (2011, p. 601) note, "performances that are repeated and justified as appropriate do indicate an ostensive pattern" and "ostensive aspects are a matter of interpretation." To summarize, although the perception of stability and change may vary due to different understandings of routine participants, an elaboration how and why routine participants perceive a pattern to be stable (standardized) or changing (flexible) is still missing. We are therefore in need of an empirically based elaboration of *why* performances are perceived as stable or changing by routine participants and *how* these patterns are actually enacted, despite their divergent understandings. As outlined above, if and how a routine performance is interpreted and thus recognized as either stable or changing is dependent on the actors' perspective or on the perspective of the observer. Therefore, the question of which mechanisms routine participants enact to create

and recreate patterns, which they *recognize* and identify as stable or changing, still deserves a more fine-grained understanding. This question seems particularly interesting in highly dynamic contexts, where the flow of routines is constantly challenged by unexpected events (Bechky and Okhuysen 2011). Our paper aims at addressing these questions by adding to our understanding of routines, the mechanisms that fuel and enact the motor of patterning work (D'Adderio 2014, p. 1346).

Methods

Research Setting

Studying this research question calls for an explorative, ethnographic research design (van Maanen 2011, Yin 2009). As outlined above, we theoretically sampled a high-reliability organization (Weick and Sutcliffe 2007) to answer our research question, which mechanisms routine participants enact to maintain patterns they identify as stable or changing, particularly in highly dynamic contexts. Our case study was conducted with the German Federal Agency for Technical Relief, Technisches Hilfswerk (THW). As a federal agency, this organization, founded in 1950, is subordinate to the Federal Ministry of the Interior. The main task of this organization is to provide nationwide civil and catastrophe protection. Moreover, they provide technical assistance in worldwide catastrophes, such as after severe earthquakes and tsunamis (e.g., Haiti and Japan). For this purpose, the THW has a special unit called SEEBA (Rapid Deployment Unit Urban Search and Rescue). This team is part of a network of disaster-prone and disaster-responding countries and organizations, the International Search and Rescue Advisory Group (INSARAG), which was established under the auspices of the United Nations.

As part of our study, the first author had the opportunity to participate in an international earthquake training and real-case simulation, where several international teams worked together. This setting allowed the first author to observe closely the simulated training and real-case performances necessary in the aftermath of a severe earthquake. This training and simulation event lasted eight days, in which the team first trained multiple earthquake scenarios, and on the last day the real-case simulation took place. In this simulation, search and rescue teams had to operate in almost completely collapsed structures under high-time pressure. During the simulation, the trainees had to search and rescue several buried persons in a collapsed warehouse and a collapsed parking garage. Whenever a victim was rescued, the team continued searching for others missing in the rubble. This repetitive process allowed the first author to observe several iterations of these search and rescue operations.

Data Collection

Consistent with our ethnographic approach, observations were the most important source of data (Feldman and Orlowski 2011, van Maanen 2011). It was of utmost importance to observe closely the training and simulation activities to understand how routines are actually enacted, how they are adapted to particular situations, and why they are adapted (Gherardi 2006, Feldman and Orlowski 2011). This research approach required a deep embedding in the field.

Our process of data collection unfolded in five steps. First, the first author started with a familiarization stage, during which she was recruited as a volunteer member of the THW. During the first three months of the study, the first author participated in a basic training program for new members to be allowed to participate in emergency situations, to become familiar with the rules, procedures, safety and security regulations, and culture of this group and to establish a trustful relationship with other members (Kirk and Miller 1986). Second, the first author continued to participate as an embedded observer for more than 16 months (in total). She participated in weekly meetings and some additional weekend meetings where members were trained for search and rescue operations. Third, the main part of data collection focused on observing the rescue operations during the training and simulation week in the United Kingdom. Even though the first author could observe the activities of the THW during the training and simulation sessions, she mainly focused on the real-case simulation, since the simulation was very close to real catastrophes, as our interview partners confirmed (other data were used as supportive data). Nevertheless, we are aware that we observed a simulated scenario and not a real catastrophe, which proved to be impossible due to safety and security concerns inherent in those situations, ethical considerations (the first author would just observe instead of helping the affected residents), and the absence of an actual incident (this is similar to the work of Bechky and Okhuysen 2011, who studied SWAT teams). Although a real catastrophe might pose notable differences from the simulation, data triangulation based on observations and interviews suggests that a real catastrophe would unfold in a similar manner. These three data collection steps resulted in 356 hours of observation in total, of which 154 hours were spent observing the training and simulation week. During and after all observations, the first author took extensive field notes, which resulted in 166 pages. In an additional fourth step, 12 formal and 45 informal interviews were conducted. The formal semistructured interviews were of utmost importance in reconciling our observations with the team members' experiences from real catastrophic events and to deepen our understanding of how they recognize patterns. Table 1 provides an overview of the functions our interview partners occupied within the THW and their experiences with real missions. All formal interviews were taped and

Table 1 Summary of the Interview Data

Function	Interview time (hrs)	Experience (years)	Retrospective cases
Logistics manager	5	3	Chile, Haiti, India, Japan, Switzerland
Media	2	4	Chile, Haiti, India, Japan, Switzerland
Administration	1	16	England, India, Japan
Liaison officer/trainer	1	8	Japan, Switzerland
Medical	3	10	India, Indonesia, Luxembourg, Pakistan, Switzerland, Thailand
Team leader	1, 5	24	Algeria, Armenia, Chile, Haiti, Japan, Mexico, Pakistan
Squad leader	2	24	Armenia, Columbia, El Salvador, England, India, Iran, Japan, New Orleans, Macedonia, Mexico, Poland, Taiwan, Thailand, Turkey
Medical	1, 5	7	Senegal, England, Haiti, Japan

Table 2 Summary of Simulation Participants

Name ^a	Function
Team leader	Bill
Group leader	Thomas
Squad leader	Michael, Martin, Phil
Liaison officer	Nicholas
Logistics officer	Alex
Coach	Patrick
Medic	Jonathan
Members	Dave, John, Marc, Tim, Chris, Matthew, Eric, Dan, Olaf, Mike, Barry, Jan

^aNames have been changed due to a confidentiality agreement.

transcribed, which summed up to 293 pages. Table 2 provides an overview of the simulation participants, who also served as our informal interview partners. In a fifth step, we collected 5,000 pages of documents, including guidelines, handbooks, training documents, log books, press releases, and annual reports. These artifacts helped us to gain a better understanding of the context the THW works in and provided us with codified descriptions of standard operating procedures for search and rescue operations.

Data Analysis

Our analysis of the data progressed in five stages. In a first step, we started to code our immense data set with *in vivo* codes using the THW language. This step was helpful for categorizing the different phases and routines in an earthquake operation (Glaser and Strauss 1967). Consistent with our definition of routines as repetitive action patterns, we coded all actions that occurred more than once (repetitive) in our data as a routine. Table 3 provides a brief description of the five routines observed: (1) setup of base of operation, (2) triage, (3) marking, (4) search, and (5) rescue. It was of utmost importance for us to observe multiple iterations of all the identified routines to account for potential performance differences between the iterations. Only the routine “(1) setup of base of operation” could not be observed in multiple iterations during our observations, since the camp had to be erected just once. However, we reconstructed action

steps of other iterations from interviews with participants who shared their experiences of setting up the camp on different occasions with us. In the second step, we started a more focused analysis of our data, concentrating on the performances of the five identified routines. The first author wrote a chronological case narrative (vignette) for each routine, which we used as a basis to create narrative networks. Narrative networks are a method to represent and visualize specific actions (Pentland and Feldman 2007, p. 787; Pentland 1999). Using this method was of major importance since it allowed us to compare different iterations of the same routine and thus to identify performance differences. Third, while analyzing the data with an inductive (Miles and Huberman 1994), “grounded theorizing” approach (Glaser and Strauss 1967), an early finding was that routine members described some routines as stable, whereas others were described as flexible (see Table 4 for examples). This contradicted our own observations indicating sequential variety in all routines, following the operationalization of Pentland (2003). In the fourth step, we were interested in why THW members’ recognition of the patterns differed from our own observations. Therefore, we coded our data again, focusing on emerging aspects that could explain the differences. Consistent with a grounded approach, we first used empirical codes, which were then clustered into second-order codes based on similarities and differences (Strauss and Corbin 1990). Tables 5–7 indicate the coding scheme and provide empirical examples for each theme. Fifth, after the coding and analyzing described above, we held a meeting with our main contact persons from the THW to present our results and to receive feedback. This feedback session was an additional important step to check the descriptive validity of our findings (Yin 2009), because the members themselves had the opportunity to discuss and reflect on the results.

Findings

In this paper, we explore how participants recognize and enact stable and changing patterns over time. We do so by

Table 3 Description of the Observed Routines

Routine	Description
Setup of base of operation	Setup for the base of operation includes building the management area, medical treatment area, communications center, food preparation area, personnel lodging area, and sanitation and hygiene area.
Triage	Triage is the process of prioritizing work sites to save as many lives as possible. In some cases, the order of priority is obvious from the number of people missing in each building. When the order of priority is not obvious, a systematic procedure of categorizing work sites based on an estimation of voids, an evaluation of stability and available information on missing persons, can be applied to facilitate the decision-making process.
Marking	The process of marking and signaling systems provides specific information regarding assessment and operational results to ensure optimal coordination on a work site.
Search	The search process includes detecting and locating live victims with technical equipment, such as specialized cameras, acoustic and seismic devices, and search dogs.
Rescue	The rescue process includes lifting and lowering loads with hydraulic, pneumatic, and mechanical equipment; cutting metal debris; timbering; breaking and breaching concrete; and assembling vertical, horizontal, and diagonal shoring systems. The medical process includes life support, using equipment to care for the team (including search dogs) and to rescue casualties.

Table 4 Routines Described as Standardized or Flexible

First-order code	Example
Routines described as standardized	<p>Nicholas, the liaison officer, explained that no matter which country the team is called in to help, the first thing they do is to set up the base camp: "It is predescribed which tent has to be set up first, and the logistics team is responsible to comply that with all strengths. It has to be that way! No matter where we are."</p> <p>Alex, the logistic officer, explained in an interview: "In the beginning, when you arrive it looks totally chaotic and overwhelming. We roll out our routines and start operating in the trained and prescribed way. This way we cope with chaos and focus on the most important aspects first.... We cannot start experimenting here but have to rely on our standards."</p> <p>Alex explained: "Setting up the camp always means to first erect the management tent. This is really important. The next one is the medical tent, then the communication and kitchen tent, then the tents for the team members and last the hygiene tent."</p> <p>Bill, the team leader, stated: "For the camp setup a certain structure has evolved, and we learned a lot over the years. The medical tent is a bit further away from the other tents, and the management tent is close to the community tent to ease contact among the leaders and the rest of the team."</p> <p>Jonathan, the medic, described the camp setup the following way: "The management tent and the medical tent have to be ready first for the operation. This way the management can already start to work. And just in case something happens to one of our guys, the medical tent is important as well. All other tents follow then."</p> <p>Jonathan reported: "It does not matter where we are. The camp looks always the same. Sure, we have to arrange that with the place at hand, but the order in which we set the tents up, and the place for each tent, is fixed."</p> <p>John, a team member, explained: "Every catastrophe is different. However, as you see it here, we always approach it in the same way."</p>
Routines described as flexible	<p>Matthew, a team member, stated: "The individual problems start as soon as you enter the buildings structure. You don't know what you have to expect."</p> <p>Bill, the team leader, explained that it is impossible to plan the order of a search and rescue process beforehand: "We are trained to perform certain activities. In each situation we encounter we have to decide which of these actions we have to enact. Think of it like a belt of tools we are carrying with us and in each situation we pick the right action from the belt and use it as we have been trained. Which action we will have to enact is determined by the situation. But as soon as we are in the situation we exactly know which actions we have to enact in which order."</p> <p>Michael, the attending squad leader, compared two instances: "You have seen that search and rescue here in the parking lot was a different thing; we had to do very different actions as compared to searching in a collapsed warehouse.... Not a single site is the same, and you have to be flexible in what you do. This is what we are trained for."</p> <p>Patrick, a senior coach, explained: "I always compare this to antsiness. You see lots of people running around, doing all kinds of things. But at the end of the day, only this way we achieve what we want and this is to rescue people, that's why we are out here.... The outcome is not changing, only the way we do it."</p>

illustrating how routine participants engage in patterning work that, according to their own description, on the one hand maintains a more stable pattern and on the other hand supports a more flexible (but not changing) pattern. Our analysis reveals that the recognition and enactment of these patterns requires the (re)creation of dedicated artifacts, training, and knowing. The THW members described one set of routines (camp setup, triage, marking) as rather stable, and they described another

set of routines, the actual searching and rescuing of victims (search and rescue), as flexible. Building on this differentiation, we first introduce each routine set with a brief vignette illustrating the performances, based on our own observations. We then contrast our own observations with the retrospective accounts of the THW members from interviews. When comparing different iterations of the same routine, we observed sequential variety (Pentland 2003) of the respective routine, whereas the team members

recognized these routines as either stable or flexible, but nonchanging. In a second step, we elucidate the role of artifacts, training, and knowing to explore the mechanisms how participants recognize and enact such stable and flexible patterns.

Performance Patterns

Vignette 1. Observations of the Camp Setup, Marking, and Triage Routines.

The camp setup routine. In the real-case simulation we observed, the SEEBA team, consisting of 21 volunteers, arrived at the disaster site and registered with the local authorities. The local authorities, who coordinated the operation, advised the team to erect their camp on the playground of a soccer stadium. Immediately, the team members started unloading the cargo boxes from the vehicles and sorted them by functions (tents, food, instruments, etc.), which were indicated by a color code on the boxes. Then, all team members helped to carry the boxes with the tents, recognizable by a yellow stripe, and to display them on the ground at that place where the respective tents were supposed to be erected later. Bill, Michael, Marc, and John started setting up the management tent while Jonathan, Dave, Tim, and Chris set up the medical tent. Suddenly, a local inhabitant approached the four, desperately shouting that his family was missing in his collapsed house and that he needed immediate help to rescue them. Dave went to the man and spoke to him, trying to calm him down. While talking to the man and listening to his needs, he made a note in his journal and wrote down what the man said. He then told the man to leave and to go back to his house. Help would soon be coming but not now. The man still insisted on getting immediate help, but Dave explained to him patiently that they were currently not ready to help and that he had to wait. None of the bystanding team members made any attempt to help the man; they simply continued to erect the tents. Phil, Matthew, Eric, and Dan set up the communication tent and kitchen tent next to each other. Other team members erected the personal tents and the hygiene tent. Barry and Jan were going around the camp site looking for a place to install the power generator, which needs to be set up at some distance from the camp because of its noisiness. To place the power generator at some distance from the camp, stones and debris had to be removed before the generator could be placed and installed. After that, Barry and Jan connected the electrical cables and installed huge lights to illuminate the entire camp site.

The triage and marking routines. After having erected the camp successfully, a first triage team consisting of four members left the camp to perform a first triage at a collapsed two-story warehouse, which had been assigned to them. As the triage team arrived at the warehouse, John and Marc first performed a 360° tour around the

warehouse, keeping some 20 meters distance from the building. Marc started to walk left around the building while John started the triage from the right, both drawing a map of the building and the surrounding area. After returning to the front of the building, John went closer to the building and shouted very loudly, "Search and rescue! Is there anybody?" Following his loud call, he heard a victim crying for help from inside the warehouse. However, neither of them made any attempt to help the crying person. They told the victim that help was on the way. John documented in his journal that a living victim was detected inside the building. On a discarded door he leaned at the entrance wall, Marc wrote the team number, time and date of the triage they had just performed, a symbol indicating that they did not find any hazard (fire, gas leakage) around the warehouse, and the information that they had detected a victim. After that, he sprayed number 22 on the front wall of the building with spray paint and John cordoned off the area with barrier tape.

To account for the flexible or stable nature of the patterns, we compared the action patterns of the triage and marking routines described above with another observed iteration of these two routines. As alluded to above, we were able to observe the camp setup only once during the simulation. But we reconstructed action steps from other camp setup iterations by relying on interviews in which team members recollected their experiences. Our analysis of these different iterations revealed that the routine sets showed variance in the performed action steps in what Pentland (2003, p. 531) calls "sequential variety," since action steps were repeated but not in a similar sequential order (see Figures 1 and 2).

Retrospective Account of These Performances by Routine Participants: Stability Despite Sequential Variety.

Despite the observable sequential variety, routine participants retrospectively, in reflecting about the routine performance in interviews, described the camp setup as well as the triage and marking routines as stable patterns. Alex, the logistics officer, explained in an interview that as soon as the THW rescue team arrives in an affected country, getting ready to work as quickly as possible is of utmost importance. Following this phase described by Alex, the team follows a pretty much standardized approach, which is needed to create order from chaos:

In the beginning, when you arrive it looks totally chaotic and overwhelming. We roll out our routines and start operating in the trained and prescribed way. This way we cope with chaos and focus on the most important aspects first.... We cannot start experimenting here but have to rely on our standards.

According to Alex, the camp is set up in a similar, very specific order, which the team sticks to irrespective of the place of deployment:

Figure 1 Narrative Network for the Routine Camp Setup

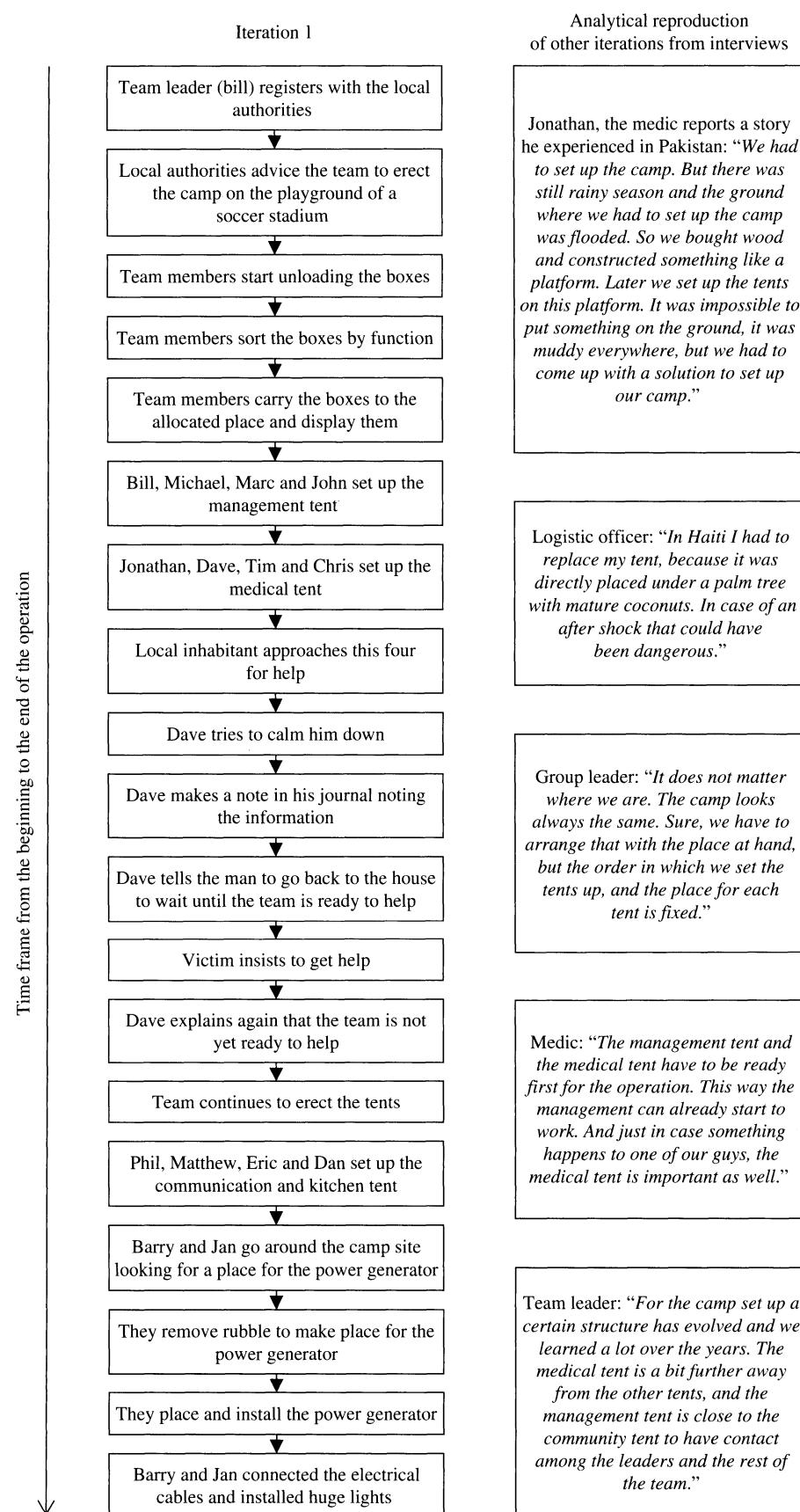
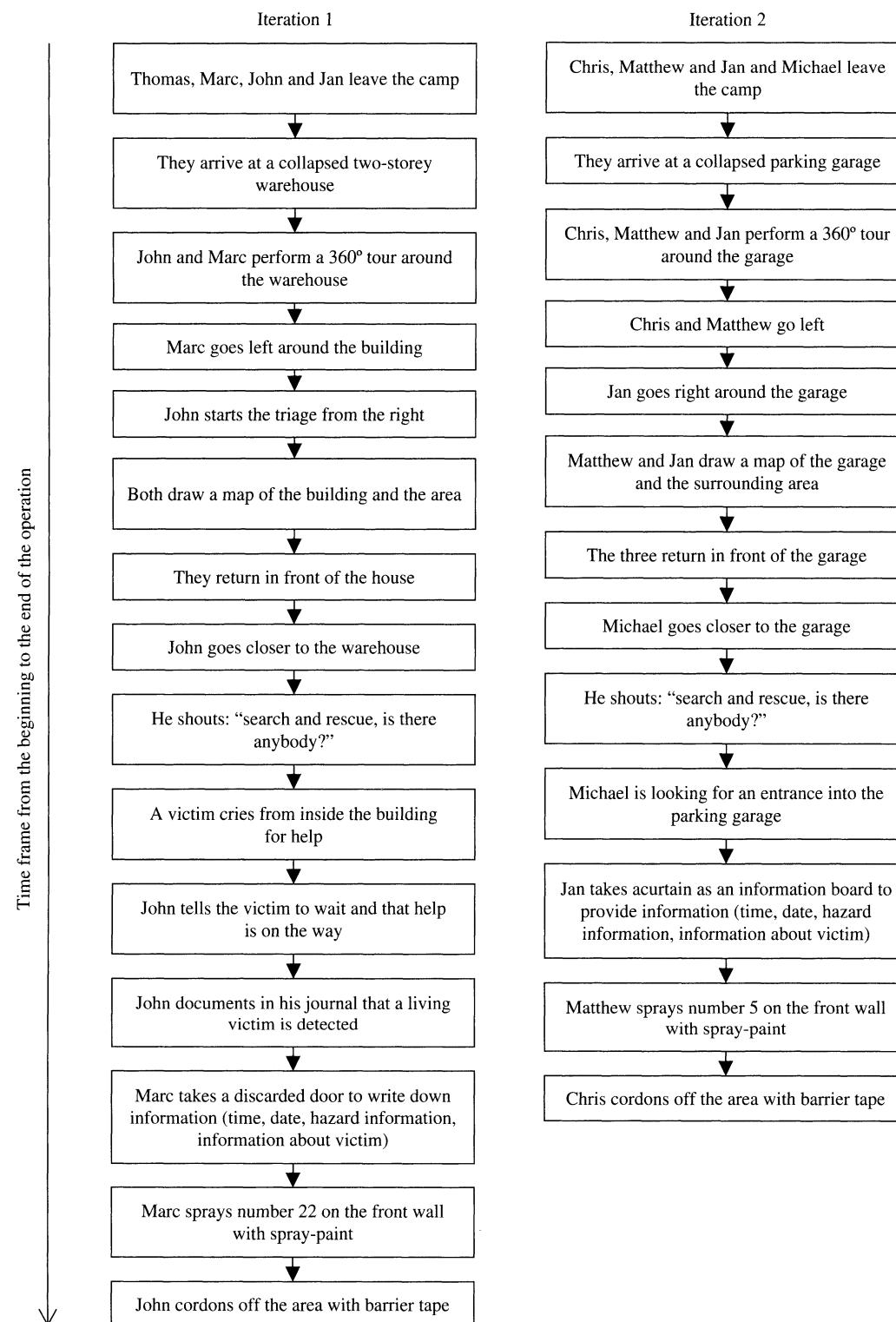


Figure 2 Narrative Networks for the Routines Triage and Marking



Setting up the camp always means to first erect the management tent. This is really important. The next one is the medical tent, then the communication and kitchen tent, then the tents for the team members and last the hygiene tent.

Bill, the team leader, and Jonathan, the medic, elucidated that this process follows a standard, which

has been learned over the years, following a clear rationale:

For the camp setup a certain structure has evolved, and we learned a lot over the years. The medical tent is a bit further away from the other tents, and the management tent is close to the community tent to ease contact among the leaders and the rest of the team. (Bill)

The management tent and the medical tent have to be ready first for the operation. This way the management can already start to work. And just in case something happens to one of our guys, the medical tent is important as well. All other tents follow then. (Jonathan)

Jonathan continued his explanation by describing that the camp structure looks the same way no matter where the team actually operates. Even though he recollected in an interview an instance in Pakistan in which the team had to buy wood and construct a platform on which the tents could be erected (because of the rainy season), for him the camp setup still followed the usual order:

It does not matter where we are. The camp looks always the same. Sure, we have to arrange that with the place at hand, but the order in which we set the tents up, and the place for each tent is fixed.

John made a similar argument for the triage and marking routine by saying the following:

Every catastrophe is different. However, as you see it here, we always approach it in the same way.

As these quotes reveal, routine participants had at least retrospectively the impression that they followed the standard and that this approach did not change, irrespective of where and under what conditions the routine was performed. According to their understanding, the routine was executed in a fairly stable way at all times.

Vignette 2. Observations of Search and Rescue Routines.

The search routine. Upon completing triage and marking, the entire team set out to the collapsed two-story warehouse John and Marc had explored before. Now the team started to actually search for and rescue victims from the collapsed structure. Standing in front of the two-story warehouse where the front wall had not collapsed, the first two team members, Eric and Jan, decided to enter the building through the front door. Upon having entered, they found the entrance hall of the building totally destroyed. On the floor were wooden beams, steel tubes, and rubble, but it was still possible for them to climb over the debris to reach the next door. Here they removed the broken door so they could go on. Once the entrance was cleared, Eric crawled through the entry where, in the next room, the ceiling had collapsed. A moment later, he came back to report to Martin, waiting outside the building, that there was a stone wall blocking the access and that a pneumatic hammer, oxygen (because it is rare in confined space), and a team for assistance were needed to break the wall. Martin sent Olaf and Mike into the building to help with the breakthrough. They started the breakthrough by first breaking a small hole into the wall through and inserting a microcamera so they could assess the situation behind the wall. From this breakthrough, the team was able to establish verbal contact with the person who was buried. The buried woman told them that she could not move but that she was far away from the wall. On the

basis of this information, Mike enlarged the hole until a person could get through it. Eric immediately crawled over to the woman and assessed her health condition. He reported that a medic was needed, and Jan took care of the woman while Eric searched the room for other victims.

The rescue routine. Jonathan, the medic, arrived and checked the vital signs of the victim. Because she was stable, he requested a hand barrow and two other members to carry her out of the building. Jonathan instructed the others on how to best lift the woman onto the barrow. Jonathan, Jan, and Eric carried her to the hole in the wall and handed her over to Olaf, Mike, and two other waiting members who then transported her out of the building. Jan and Eric continued exploring the next room where an iron girder blocked their way.

To account for the changing or stable nature of the pattern, we compared the described action pattern with other iterations of search and rescue routines we could observe. Again following Pentland's (2003, p. 531) pattern analysis framework, we found that the described workflow exhibits high sequential variety since action steps were never repeated in a similar sequential order (for a graphical representation, see Figure 3).

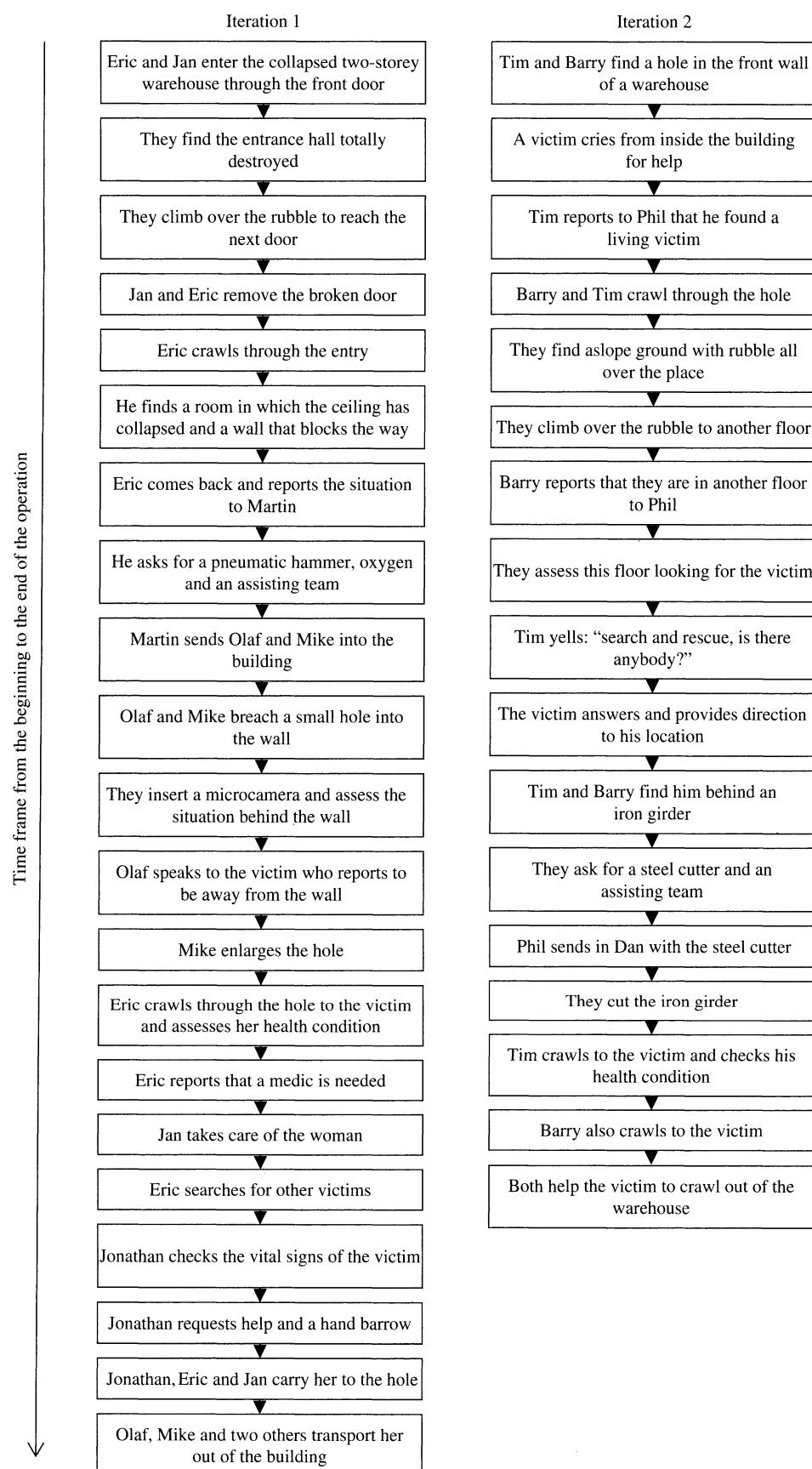
Retrospective Account of These Performances by Routine Participants: Flexible But Nonchanging.

Unlike camp setup, triage, and marking, the routine participants retrospectively described search and rescue routines as highly flexible, even as they were nonchanging. Bill, the team leader, stated in an interview that it is impossible to plan the order of a search and rescue process beforehand, and thus the team expects that they have to respond flexibly to the situation at hand. Nevertheless, as his interview also reveals, the team executes activities for which they have trained prior to the operation:

We are trained to perform all kinds of activities. In each situation we encounter we have to decide which of these actions we have to enact. Think of it like a belt of tools we are carrying with us and in each situation we pick the right action from the belt and use it as we have been trained. Which action we will have to enact is determined by the situation. But as soon as we are in the situation we exactly know which actions we have to enact in which order.

Seen this way, the team knows that a flexible approach is necessary, but for executing it, they rely on already known and well-trained actions. Another example for how search and rescue routines were accounted for as being flexible is the scenario in which Chris and Matthew were searching for victims on top of the ruins of a parking garage. Michael, the attending squad leader, compared that scenario to the situation where the team entered the two-story warehouse to search for victims by saying the following:

Figure 3 Narrative Networks for the Routines Search and Rescue



You have seen that search and rescue here in the parking lot was a different thing, we had to do very different actions as compared to searching in the collapsed warehouse.... Not a single site is the same and you have to be flexible in what you do. This is what we expect and what we are trained for.

As Michael's account reveals, the team expected search and rescue routines to be flexible, depending on the specific characteristics of the site. Team members knew that to be able to perform search and rescue in a reliable way, flexibility in the approach is needed. Their perception of the outcome of the search and rescue routine, however, remained unchanged, as a senior coach expressed the following:

I always compare this to antsiness. You see lots of people running around, doing all kinds of things. But at the end of the day, only this way we achieve what we want and this is to rescue people, that's why we are out here.... The outcome is not changing, only the way we do it.

In retrospect, the team members were aware that flexibility was needed to arrive at predefined ends. All these examples nicely illustrate that the team is aware that being flexible allows them to meet different and varying situational needs to carry out predefined, unchanging ends.

The Role of Artifacts, Training, and Knowing

To enact and maintain the described patterns, which were either recognized as stable or flexible, artifacts, training, and knowing played a key role. Following our data analysis, we distill how each of these aspects contributed to the emergence of specific mechanisms that steered the recognition and maintenance of these patterns.

The Role of Artifacts in Supporting Standardization and Flexibility.

Artifacts played an important role in all of the observed routines. Artifacts ranged from standard operating procedures provided by the international INSARAG network to the tools the team needed to perform search and rescue of victims (e.g., pneumatic hammers, shovels, search dogs). In particular, the specification and codification of the guideline differed significantly for the different sets of routines: for routines that were perceived as stable by the participants, the artifact codified the workflow; for routines which were perceived as flexible, the artifact only codified the tasks that should be enacted. As a consequence, artifacts were used differently in both performances. Table 5 provides further examples for the role of artifacts in supporting standardization and flexibility.

Supporting standardization. The guideline released by the INSARAG provided very detailed descriptions of the workflow for how to set up the camp and for how to perform marking and triage. These detailed process descriptions were complemented by symbols and drawings in the guideline. For example, the guideline specified the exact order in which the camp had to be set up. This

again was illustrated by a drawing indicating where which tent had to be erected (see Table 5 for an example):

Select and set up the site based on mission priorities... :
 1.9.1 Management area; 1.9.2 Equipment and maintenance area; 1.9.3 Medical treatment area; 1.9.4 Communications centre; 1.9.5 Food preparation and feeding area; 1.9.6 Personnel lodging area; 1.9.7 Sanitation and hygiene area; 1.9.8 Search dog areas; 1.9.9 Transportation access areas; 1.9.10 Vehicle parking; 1.9.11 Briefing area; 1.9.12 Generators and lighting should be strategically placed to ensure a safe and secure environment. (International Search and Rescue Advisory Group 2011, p. 58)

The intention behind standardizing these processes by the INSARAG was to support a structured approach, particularly in the first, chaotic phase to avoid chaos. Alex, the logistics officer, reported the following:

If we would not stick to our standards we would even produce more chaos as is already happening around us.

Another key reason for codifying the workflow was to support collaboration between different international teams. Thus, the guidelines contained international standards, like signs and symbols the teams are supposed to use during triage and marking. For example, the guideline contained a specific form (Urban Search and Rescue (USAR) team fact sheet) the teams had to complete to register. By standardizing the kind of information teams had to transmit, the form supported collaboration between different international teams. Bill, the team leader, explained the following, while filling out the form:

It is important to report in the right way as well as qualified information, so that a higher level management can work with the results.

For marking routines, the guideline advised teams how to use signs and symbols in the following way:

Structural marking should be applied on collapsed structures assessed by USAR teams. The marking should be placed near the point of entry on the exterior of the collapsed structure that offers the best visibility...: 1. The marking consists of a 1 × 1 meter square box. 2. Inside the box: Go if deemed safe to enter; No Go if it is deemed unsafe to enter; Team identification; Date and time start; Date and time finish. 3. Outside the box: Hazard information (top); Missing persons (bottom); Live victims rescued (left); Dead victims extricated (right). (International Search and Rescue Advisory Group 2011, p. 95)

During triage and marking, as outlined above, John and Marc used the symbols outlined in the guideline to report the result of their triage to other teams and the local authorities. Nicholas, the liaison officer, emphasized the importance of using the symbols provided by the guideline during performance:

Table 5 The Role of Artifacts in Supporting Patterns of Standardization or Flexibility

Second-order theme	First-order theme
The role of artifacts in supporting patterns of standardization	<p><i>Workflow inscription in the guideline:</i> "To ensure an effective international mission, USAR teams should adhere to the prescribed procedures that clearly identify the critical steps that support the successful integration into the affected country's disaster response operations."</p> <p>"Structural marking should be applied on collapsed structures assessed by USAR teams. The marking should be placed near the point of entry on the exterior of the collapsed structure that offers the best visibility.... 1. The marking consists of a 1 x 1 meter square box. 2. Inside the box: Go if deemed safe to enter; No Go if it is deemed unsafe to enter; Team identification; Date and time start; Date and time finish. 3. Outside the box: Hazard information (top); Missing persons (bottom); Live victims rescued (left); Dead victims extricated (right)".</p> <p>Symbol used for marking (providing information about the team and the victims):</p> <p><i>Enacting workflow provided in the guideline:</i> Marc, a team member, drew a pictogram on a discarded door that provided information to other teams. He explained that the number on the left side of the circle stands for live victims inside the building and the number at the bottom of the circle for missing persons. All teams have to know and to use the same signs and symbols, so that they can read and understand the messages from other teams.</p> <p>Bill, the team leader, went to the local authorities to register the team. For registering he completed a designated form (given in the INSARAG guideline) to provide information about the team size, the capabilities, and the equipment they brought. As he explains while registering: "You have to confirm your arrival with the management via this form. This way each team provides the same information."</p> <p>John and Marc performed a 360° tour around the warehouse from some distance and drew a map of the surrounding streets and area (for drawing this map they use standardized symbols, which are explicated in the INSARAG guidelines). Later Marc marked the streets and buildings with spray paint (the signs are again given in the guideline). John explained the importance as follows: "If one team works on a site and moves on they leave signs and messages for other teams in the form of pictograms. They have to fit a standardized form to understand them."</p> <p>Ruth, an intern, reported the following story: "My project started because the management realized that the documentation process in terms of triage wasn't uniform. The project was a cooperation with other countries as well. I participated in some trainings to get a first overview but I lacked experience from real operations. Thus I worked with many experienced members who told me what they need and how the guideline should look. This experience exchange was very important."</p> <p>Bill explained how artifacts change over time: "One source is always experiences from operations. In Haiti, for example, we realized that we need a different structure to network with all the other organizations. Another source is a meeting once a year with all the team leaders. We have different workshops to different topics, of course, the need for these actions comes from experience again."</p> <p><i>Task inscription in the guideline:</i> "A Heavy USAR team is required to have the technical capability to cut structural steel typically used for construction and reinforcement in multi-storey structures...." "A Heavy USAR team is required to have the equipment and manpower to work at a Heavy technical capability at two separate work sites simultaneously."</p> <p><i>Enacting task provided in the guideline:</i> During one of our feedback sessions with the THW, Patrick, the coach, explained to us that the guidelines cannot prescribe each step for search and rescue operations because they are all so different. But the team has so many training sessions back home that each member of the SEEBA team knows the possible actions and can enact them accordingly.</p>
The role of artifacts in supporting patterns of flexibility	

Our marking system is an important tool. When a team is working in a house and moves on, they leave a message for other teams, pictograms. They all have the same look, so that you know them.

The workflow descriptions and symbols codified in the guideline were used to standardize team performance to reduce variation. This standardization should ensure effective communication in collaborating with other teams as well as safe and efficient procedures for getting ready in the beginning of the operation. Thus, artifacts played an important role in the observed routines (setting up the camp, triage and marking). Participants' orientation toward the standard, as codified in the artifact, helped in stabilizing the workflow. Here, practitioners envisaged an approach to standardization based on templates, rather than principles (Baden-Fuller and Winter 2005).

Supporting flexibility. Opposed to the camp setup, marking, and triage routines, for the search and rescue routines the guideline specified only what the search and rescue teams should be able to perform, not how the tasks had to be performed. For example, in the case of the search routine, the guideline simply stated the following:

A Heavy USAR team is required to have the technical capability to cut structural steel typically used for construction and reinforcement in multi-story structures. (International Search and Rescue Advisory Group 2011, p. 116)

In this case, the guideline simply specified the necessary capabilities of the team, but it provided no guidance how these capabilities had to be enacted. This supported flexible performances, as Bill, the team leader, explained below:

It is impossible to plan search and rescue operations beforehand. The team never knows the structure of buildings, relatives approaching you, possible after shocks, day and night shifts...there are too many unpredictable factors. But the goal of the whole team is to rescue victims.

The guideline as artifact did not provide any standardization on how the team is supposed to perform tasks; it only defined the task in principle *ex ante*, rather than how it should be performed in the sense of a process description, which comes close to the concept of principle-based replication (Baden-Fuller and Winter 2005). Throughout our observations, the guideline did not play a major role in the actual enactment of searching and rescuing, which helped in supporting flexible performances.

The Role of Training in Enhancing Standardization and Flexibility.

The THW puts great emphasis on training the SEEBA team members to prepare them for potential deployment in the best possible way. Just like the SWAT team Okhuysen observed, training was considered as being of major importance for developing the necessary capabilities to act under extreme circumstances (Okhuysen 2005, Bechky

and Okhuysen 2011). The coaches were quite aware that simply reading the guidelines would not be sufficient for the team members to learn how to enact performances. Not only the coaches, but also the entire SEEBA team, perceived training as very important, as Alex, the logistics officer, told us:

The THW and especially the SEEBA develops through each operation and training. This is a process inside the team, we are all willing to learn. It's not that someone from the management comes to dictate us a learning schedule.

However, the content and also the aim of the training sessions were fundamentally different for the enactment of standardized or flexible patterns. Table 6 provides further examples for the role of training in enhancing standardization and flexibility.

Learning to enhance standardization. The THW was quite aware that particularly in the beginning of the operation it is of major importance to become operational as fast as possible. Learning by doing was not considered an option, as one of the coaches explained below:

Improvising and thinking about what to do would waste too much time which we don't have in the beginning of the operation.

The training session aimed first at developing the necessary knowing how to enact the workflow in the beginning of an operation (how to set up a camp, how to perform triage, how to mark buildings) and, second, at the team members knowing why sticking to a particular workflow is important and why it cannot be compromised. For developing the necessary knowing how, the THW held dedicated training sessions, for example, to rehearse the erection of the camp. Alex, the logistic officer explained the following:

We have to train the camp setup to be very fast in a real operation. This is also important to new members, so that they know where to set up which tent and in which order and do not have to start thinking how this works in a real case.

Similar sessions were held for practicing triage and marking performances. Frequent rehearsals during training sessions on weekends contributed to an embodiment of the necessary "knowing how" by the team members (Polanyi 1966, Gherardi 2000, Strati 2007). The second aim of the training was to develop an understanding of why it is important not to compromise the workflow. From their experiences from previous missions, the coaches were aware that it always proved to be difficult to team members to not start helping immediately once confronted with disastrous situations and people in need. In dedicated training sessions, team members were therefore specifically sensitized for those situations. Alex described in an interview a situation he encountered in Haiti, where he acted differently because of a lesson he learned during a simulation:

Table 6 The Role of Training in Enhancing Patterns of Standardization or Flexibility

Second-order theme	First-order theme
The role of training in enhancing patterns of standardization	<p><i>Learning how to enact the workflow:</i> During one weekend training session, the management crew unpacked their cargo boxes (which usually are packed in the logistics center) and inspected each piece. Several new members and potential candidates who were attending listened to the experienced members explain the equipment, the content of each box, the meaning of the colored labels outside of the boxes, and where to find the list naming all the equipment.</p> <p>From time to time, the team erects the entire camp as a training session. Alex, the logistics officer, explained, "We have to train the camp setup to be very fast in a real operation. This is also important to new members, so that they know where to set up which tent and in which order."</p> <p><i>Learning how to prioritize actions:</i> Alex, the logistics officer, described a situation he encountered in Haiti, where he acted differently because of a lesson he learned during a simulation: "In Haiti, there was a mother with her baby and you could see that her skin was completely dried out wherefore you knew that they both needed water. I had water in my backpack. Normal human behavior would be to give her the water. But if I would do that, I would endanger the woman and the team because all other 1,500 people would bear down on her and on us to get water to survive. I encountered exactly the same situation in a simulation in Hamburg where I gave a woman water and this happened. So I learned from this."</p> <p>Jonathan, the medic, remembered another experience: "During a simulation the coaches played the resounding calls of a muezzin at sunrise to wake us up. In that moment you think, oh my god, the simulation does not need to be so realistic. But, when you are lying in your tent in Indonesia and you wake up at 5 a.m., you think that is familiar. That might sound ridiculous but in Indonesia it was like in a ghost train."</p>
The role of training in enhancing patterns of flexibility	<p><i>Learning how to enact the tasks:</i> On a weekend training session, the coaches used workstations where members could train to cut an iron girder. At another session they trained how to shore a wall. During a third session, they rehearsed using the acoustic equipment used to detect victims.</p> <p>During one of our feedback sessions with the THW, Patrick, the coach, explained that the guidelines cannot prescribe each step for search and rescue operations because they are all so different. But the team has so many training sessions back home that each member of the SEEBA team knows the possible actions and can enact them accordingly.</p> <p><i>Learning how to select and recombine actions:</i> The coaches prepared a tunnel system with different barriers, such as furniture, an iron girder, or wooden beams. The team first had to assess the challenge and then had to use the right instrument/task to overcome the barrier. This practice session trained their ability to assess situations and to evaluate the appropriate next actions.</p> <p>One coach of the English team elucidated how they design the training site: "We will soon build a new building here which is a recreation of a school we saw in Haiti. Interestingly, the building from outside looked totally intact, but inside everything was destroyed. We have not seen a building structure like that before, which is why we recreate that building here to teach others this experience."</p>
Creating cross-member expertise and building a team	<p><i>Learning through narratives:</i> During a training weekend, we observed many times that small groups came together, and more experienced members told stories about their operations to new members. This happened usually in the evenings or sometimes in breaks between the sessions. One time Phil told the following story. While he was searching for victims in a building, his dog (search dog) was running out of the building. First he was not sure why that happened, but then he realized that the dog must have recognized something. So he crawled under a table, and seconds later an aftershock started. Barry, standing next to that group, confirmed that animals have a good sense. He said that he always watched the ravens. As soon as they flew away he knew an aftershock would come.</p> <p><i>Learning from experience:</i> Patrick, the coach, explained: "I have never taught things that I have not experienced myself. In case there is a subject like this I ask other group members, who I know had the experience already, if they will come as a guest coach." Dave explained: "We all know each other pretty well and in principle we have the same basic education since we all went through the same training program.... Sure, some have more experience or more knowledge in certain areas, but we try to share it within the group."</p> <p><i>Identifying as a team:</i> Members of SEEBA were proud and honored to be part of the SEEBA team. As Alex explained: "Of course, each one is proud to be in SEEBA. Due to the selection process it is very special to be one of the selected which demonstrates that you have special skills and experience."</p> <p>Alex, the logistics officer, recounted the following: "The THW and especially SEEBA develops through each operation. This is a process inside the team; we are all willing to learn. It's not that someone from the management is coming to dictate a learning schedule to us."</p>

In Haiti, there was a mother with her baby and you could see that her skin was completely dried out wherefore you knew that they both needed water. I had water in my backpack. Normal human behavior would be to give her the water. But if I would do that, I would endanger the woman and the team because all other 1,500 people would bear down on her and on us to get water to survive. I

encountered exactly the same situation in a simulation in Hamburg where I gave a woman water and this happened. So I learned from this.

The THW puts great emphasis on creating a "close to real" scenario in the training sessions to affect not only cognition, but also the emotions and feelings of

Table 7 The Role of Knowing in Enacting Patterns of Standardization or Flexibility

Second-order theme	First-order theme
The role of knowing in enacting patterns of standardization	<p><i>Knowing how to align the workflow:</i> As the first triage team arrived at the warehouse, Thomas simply said, "John, you go right, Marc, you take a left turn around the warehouse," and both knew what to do without asking. They knew how to enact the 360° tour around the building.</p> <p>Bill, the team leader, commented: "There is no need for me to tell them what to do. All are experienced and they know how to set up the tents. This runs pretty smooth as you can see."</p> <p>Alex, the logistics officer, explained in an interview that as soon as they arrive in an affected country they have to start working because they have just 72–100 hours to find victims alive, and everyone knows that. So they start enacting their routines: "In the beginning, when you arrive it looks totally chaotic and overwhelming. We roll out our routines and start operating in the trained and predescribed way. This way we cope with chaos and focus on the most important aspects first."</p> <p>Learning by doing was not considered an option, as Patrick, one of the coaches, explained: "Improvising and thinking about what to do would waste too much time, which we don't have in the beginning of the operation."</p> <p>Martin, a squad leader, explained the need to first send a triage team to the affected area and why it is so important to act according to the workflow: "Before we start to search and rescue victims we have to assess where the damage is the greatest. We have to prioritize the sites, and we can do that the fastest if we stick to our procedures."</p> <p><i>Knowing how to prioritize:</i> While Jonathan, Dave, Tim, and Chris erected the medical tent, a man desperately in need of help approached the team, shouting that his family is missing in their collapsed house. Dave went to the man and calmed him down, noting what he said. He then told the man to leave and to go back to his house. No one made any attempt to actually help searching for his family; the team simply continued with erecting the medical tent. The logistics officer Alex explained the situation by saying: "There are different ways to help; at this point the team has to get ready and only then we can start helping victims."</p> <p>During triage and marking, John and Marc went around the warehouse, already hearing victims crying from inside. However, at this stage neither of them made any attempt to help; they just documented that they found victims. It took them almost 30 minutes to complete the triage. At no point in time did any other member question this approach, although they acknowledged: "Of course it is difficult to send victims away since we are called in the first place to help them. But we have to get ready ourselves before we can help, otherwise we produce even more chaos."</p> <p>Martin, a squad leader, explained the need to first send a triage team to the affected area and why it is so important to act according to the workflow: "Before we start to search and rescue victims we have to assess where the damage is the greatest. We have to prioritize the sites and we can do that the fastest if we stick to our guideline."</p>
The role of knowing in enacting patterns of flexibility	<p><i>Knowing how to enact tasks:</i> As Eric and Dan started to break through the wall, they had to use the pneumatic hammer together since the instrument is heavy. There was no verbal communication between them, since both knew how to use the pneumatic hammer and how to enact this task.</p> <p>During the simulation Chris, Matthew, and John worked on top of the ruin of a collapsed parking garage, where they had to use the acoustic equipment. They laid out the probes, but none of them instructed the other. They all knew how to use the probes.</p> <p>During the simulation, which continued for many hours, the team worked in a shift system while performing search and rescue. Thus, many different team members were the first ones in a new situation. The first one who assessed the warehouse was Eric, who found a wall blocking his way. Later in the process, Chris was assessing the next room. All of them first assessed the situation and then transmitted the information. Thus, they all had the same knowing how to proceed in a new situation, no matter which member actually was the first one to arrive.</p> <p><i>Knowing how to select and recombine actions:</i> When the team proceeded into the warehouse, Eric assessed the first room. He found a wall in his way and transmitted the information to Martin, waiting outside. Martin, the squad leader, instructed Olaf and Mike to bring the pneumatic hammer and an oxygen hose to Eric. Both knew the process, and nobody explained the next steps. The performance continued without any interruption.</p> <p>Marc, coming out of the warehouse, explained that he first had to evaluate the stone wall because stone can be really hard or soft. The right size of hammer depends on that information. He therefore scanned the wall with his team mate John. They touched the wall and knocked on the wall, said loudly that it is stone, and agreed on a medium sized pneumatic hammer.</p> <p>Martin, the squad leader next to the entrance, described that if the team broke through the wall really fast they would break a huge hole. If the victim was directly behind the wall, they could possibly harm or even kill the victim. The team knew that, and no one wanted to take that risk. Thus, Eric and Jan had to be careful and first broke a small hole to put a camera through to assess the situation in the next room.</p>

the team members (Gherardi 2000). For example, the coaches frequently used professional actors, who simulated desperate victims in need and approached the team during the camp setup or marking to make team members aware of the possible dangers as well as the difficulty of refusing help. Simulations were carried out as realistically as

possible to address the emotions and feelings of team members and to prepare them for possible stressful situations. For example, Jonathan, the medic, remembered the following experience:

During a simulation the coaches played the resounding calls of a muezzin at sunrise to wake us up. In that moment

you think, oh my god, the simulation does not need to be so realistic. But, when you are lying in your tent in Indonesia and you wake up at 5 A.M., you think that is familiar. That might sound ridiculous but in Indonesia it was like in a ghost train.

Learning and embodying the workflow and developing a knowing of the importance of not compromising the workflow during training sessions provided an orientation toward stabilizing.

Learning to enhance flexibility. In contrast, the training for the search and rescue routines focused on learning the spectrum of tasks and selecting and recombining the appropriate actions for each situation. Here the training focused on familiarizing the team members with specific knowing on how to perform search and rescue routines. For instance, on a weekend training session, the coaches used workstations where members could train cutting an iron girder. At another they trained shoring a wall. On a third station they could rehearse with the acoustic equipment used to detect victims. In addition, the trainees learned how to select which task or instrument is appropriate in which situation. For example, during one training session, the coaches prepared a tunnel system. Search teams had to crawl into the tunnel to assess and report what was going on inside. Based on the information that a large iron girder was blocking their way, a new team was sent in to cut the girder with special tools. This way, team members learned how to select and recombine the appropriate tasks for any given situation they might encounter. Bill explained the following:

We are trained to perform certain activities. In each situation we encounter we have to decide which of these actions we have to enact.

This way team members learned how to enact tasks and learned how to select from the variety of tasks and recombine them depending on the specific situation. Thus, learning how to enact tasks and learning how to select from this variety of tasks depending on the specific situation provided an orientation toward enabling flexibility.

Creating cross-member expertise and building a team. Moreover, the THW team training sessions had the additional benefit of developing cross-member expertise of workflow and task activities (for similar observations in SWAT teams, see Bechky and Okhuysen 2011, p. 254; Okhuysen 2005). Team members always trained as a group and were expected to accomplish tasks as a team. Joint training sessions enabled them to develop a shared understanding of workflow expectations and task activities and their potential recombination. Since searching and rescuing victims following earthquakes can only be accomplished by teams, creating cross-member expertise (Bechky and Okhuysen 2011, p. 235; Liang et al. 1995; Moreland and Myaskovsky 2000) among team members had a high priority. Team members placed a high value on

the joint training sessions and made all possible attempts—like scheduling their holidays according to the training schedule or long road trips to training grounds—to be able to attend the training sessions as a group, which reflected the emphasis they placed on developing their expertise. Dave explained the following:

We all know each other pretty well and in principle we have the same basic education since we all went through the same training program.... Sure, some have more experience or more knowledge in certain areas but we try to share it within the group.

This sharing of expertise is fostered through dedicated sessions in which experienced members train other, less experienced members. For example, during one weekend session, an expert in using the radio taught others how to use it. Another example is that each member had to pass various workstations, as alluded to in the example above, to become familiar with all possible tasks, even though in the actual operations, team members carried out the tasks they were best skilled in performing. In addition, team members used the training sessions not only to acquire cross-member expertise, but also to build a team. During weekend training sessions with sleepovers, enough time was reserved for socializing activities like sitting around a campfire or having a barbecue. These events were used to chat with other members to learn more about each other and to share experiences. Moreover, members of the SEEBA were proud and honored to be part of the SEEBA team; as Alex explained below:

Of course, each one is proud to be in the SEEBA. Due to the selection process it is very special to be one of the selected which demonstrates that you have special skills and experience.

This sense of identity was apparent as team members always spoke about “*us, as the SEEBA, we...*” when referring to themselves. The SEEBA team was recognized as a special group by insiders of the team and by outside THW members. As part of socializing, team members also shared their experiences with other team members in the form of stories that covered not only cognitive, but also emotional elements (Brown and Duguid 1991, 2001; Geiger and Antonacopoulou 2009; Geiger 2010). For example, during a training weekend, a small group was sitting together, and members recollected stories from their experiences with operations and shared them with their fellows. One time Josh told the following story:

While I was searching for victims in a building, my dog [search dog] was running out of the building. First I wasn’t sure why that happened but then I realized that the dog must have recognized something. So I crawled under a table and seconds later an aftershock started.

These experiences shared via narratives were important to complement and enrich the knowing team members acquired during the training sessions.

The Role of Knowing in Enacting Patterns of Standardization and Flexibility.

Through intensive training and ongoing experiences members had on real missions, the team developed specific knowing, which was constantly enacted and reenacted to bring about either standardized or flexible performance patterns. An orientation toward standardized patterns was achieved by enacting aligning and prioritizing activities, whereas an orientation toward flexible patterns was achieved by enacting selecting and recombining activities. Table 7 provides further examples for the role of knowing in enacting standardization and flexibility.

Enacting standardization through aligning and prioritizing. Through training and experiences from real deployments, the SEEBA members had developed a shared workflow knowing. By *shared workflow knowing* we mean, building on Bechky and Okhuysen (2011), a shared understanding of how action steps follow one another. Team members of the SEEBA group knew the sequence of tasks; i.e., they knew which action steps followed one another in setting up the camp, triage, and marking (Thompson 1967). Team members aligned their actions toward this workflow knowing. For instance, while setting up the camp, no one had to give instructions to the team members. Team members aligned their actions by the shared workflow knowing. As Bill, the team leader, commented below:

There is no need for me to tell them what to do. All are experienced and they know how to set up the tents. This runs pretty smooth as you can see.

Or, once the team performed the triage of the collapsed warehouse, Thomas simply said, “John, you go right. Marc, you take a left turn around the warehouse,” without any further explanation. Such a smooth alignment of each other’s performance was possible because team members shared a common expectation of how the workflow unfolds. During interactions, team members did not negotiate or discuss what had to be done next, they simply acted on the basis of the shared expectation how to move on. With aligning we therefore refer to activities performed to ensure the workflow unfolds as expected. However, to enact the workflow following the shared workflow knowing, aligning was not sufficient; the continuous flow of enactment also had to be protected from possible interferences. Olaf illustrated the importance of protecting the camp setup from interferences, since this provided the team with a safe platform to operate from:

The most important thing for the team is to create a fort which is our comfort zone from which we can operate; it is the eye in the hurricane.

Thus, team members knew that the workflow had to be prioritized. Over the course of trainings and experiences, team members developed knowing about the priorities, which were reflected in specific, observable

actions conducted to enact these priorities and to protect the workflow from disruptions. For example, the team sent the desperate victim in need of help away to not disrupt the erection of the camp. The logistical officer, Alex, who witnessed the situation in which Dave sent the victim away, explained it as follows:

There are different ways to help; at this point the team has to get ready and only then we can start helping victims.

Once this happened, no discussion occurred. Whether or not it was correct behavior to send the victim away, no one questioned the decision. Nicholas explained it in the following statement:

Of course it is difficult to send victims away since we are called in in the first place to help them. But we have to get ready ourselves before we can help, otherwise we produce even more chaos.

Similarly, erecting wooden platforms to protect the camp from floods also represented an action that was undertaken to prioritize the camp setup despite unstable and wet grounds. In referring to the triage routine, Martin, a squad leader, explained the need to first perform a sound triage of the affected area before they could actually help victims. As he explained below, sticking to the workflow allows the team to help quickly and effectively:

Before we start to search and rescue victims we have to assess where the damage is the greatest. We have to prioritize the sites and we can do that the fastest if we stick to our procedures.

Team members who detected or foresaw a possible disruption carried out prioritizing actions. Over the course of our observations, no one had to ask them or tell them explicitly what to do. Instead, there was an unspoken consensus that prioritizing is indispensable, even if it means acting against one’s immediate feelings and emotions (Strati 2007). Prioritizing and aligning therefore contributed to an orientation of routine participants toward a standard.

Enacting flexibility through selecting and recombining. Through training and real deployments, the SEEBA team developed shared task knowing. By *shared task knowing* we refer to, again building on Bechky and Okhuysen (2011, p. 249), knowing that is enacted and reenacted by multiple group members in accomplishing particular aspects of tasks. For instance, team members were capable of cutting iron girders, breaking and shoring walls with pneumatic hammers, detecting buried victims with acoustic equipment, and so on. All these different actions build particular aspects of the overall task of searching and rescuing victims. This shared task knowing is the basic precondition for the successful performance of search and rescue operations. However, since each search and rescue operation differed significantly from others, the different actions had to be selected based on the situation and then recombined with other actions to fit the specific situational

demands. This was nicely illustrated by Bill, who we quoted above comparing the action set with a belt of tools to pick and choose the appropriate tools from at any given point of time. For picking and choosing from this belt of tools, the THW members enacted and reenacted specific knowing on how to select and recombine appropriate actions in novel situations. For example, by searching the collapsed warehouse, the team proceeded stepwise: Before breaking the wall, Mike first broke a small hole into the wall and inserted a microcamera to assess the situation behind the wall. Only after having confirmed that no victim was lying directly behind it, he started enlarging the hole with the pneumatic hammer. He later explained the following:

Since we do not know what we can expect in each situation, it is important to carefully assess first and then decide what to do.

Another example is the instance in which Eric crawled into the collapsed warehouse and his way was blocked by a wall. He reported this to the squad leader, Martin, waiting outside. Martin instructed Olaf and Mike to bring the pneumatic hammer and an oxygen hose to Eric. Thus, they selected to use the pneumatic hammer to break the wall and recombined this with the use of an oxygen hose since oxygen was scarce in the building. Another example is the situation in which Chris and Matthew were searching for victims on top of the ruins of a parking garage. To detect buried persons, they first used the audio equipment. Upon hearing signs of a living person it became apparent that a slab of concrete had to be removed to reach the victim. Because the concrete slab was heavy, an inflatable air cushion was used to lift the concrete.

None of these recombinations of different action sets had been trained or experienced before in this exact way. Each situation demanded newly created combinations, as John describes below:

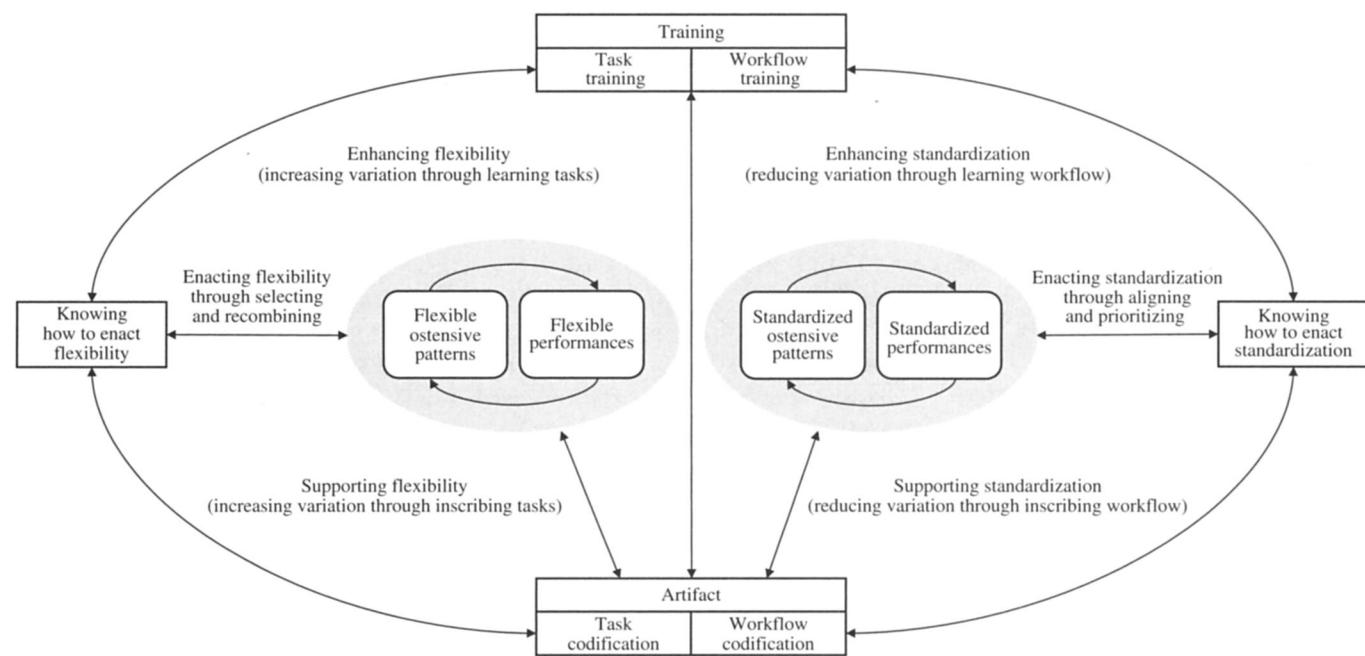
As each scenario is so different from the other, we have to adapt to the situation. Not any search and rescue operation would look the same.

This knowing how to select and recombine was related to the actual problem at hand and therefore situation based. It was created and recreated by its enactment in actual deployments. Members knew the possible spectrum of actions beforehand, which enabled the team to respond flexibly to the different needs of the situations at hand. Thus, to orient toward flexibility, team members enacted two related mechanisms: First, they carried out specific actions to select the appropriate action set from a spectrum of possibilities, and second, they recombined these actions in a novel way to respond to the respective situation.

A Framework for Conceptualizing Patterns of Standardization and Flexibility

The evidence above demonstrates how routine participants recognize patterns as either stable or flexible and sheds light on the mechanisms needed to enact standardized and flexible patterns. The framework in Figure 4 illustrates and summarizes the main findings by articulating the sociomaterial mechanisms (Orlikowski and Scott 2008) for supporting and enacting patterns that are recognized as standardized and flexible. As the framework shows, routine participants were harnessing templates as artifacts to support standardization, whereas training enhanced

Figure 4 A Framework for Recognizing and Enacting Standardized and Flexible Patterns



their capabilities to carry out aligning and prioritizing activities, which enabled routine participants to enact patterns they recognized as standardized. Likewise, they used principles as artifacts to support flexibility, whereas training enhanced their knowledge to carry out selecting and recombining activities, which enabled routine participants to enact patterns they recognized as flexible. Our findings add to our understanding of the role of artifacts (D'Adderio 2008, 2014) and training (Bechky and Okhuysen 2011) on routine performances and show that the particular mechanisms of selecting, recombining, aligning, and prioritizing activities build the microlevel motor for enacting patterns that are either recognized as standardized or flexible.

Supporting, Enhancing, and Enacting Standardization

Orienting toward the standard was first achieved because during intensive training sessions, routine participants were *learning the workflow*. This cross-member understanding of the workflow built a mechanism to prospectively guide the team members' orientation toward which actions have to be performed in which sequence. This mechanism was supported by *inscribing the workflow* into the artifact. In building on D'Adderio (2014, p. 1343), we name this mechanism "inscription," since the INSARAG delegated knowledge on how to perform the camp setup or how to perform triage into the guideline. The artifact supported standardization since the inscription was used in performances; routine participants referred to the guideline for justifying why the camp setup looked the way it did ("we stick to our procedures"). Moreover, the artifact supported standardization since routine participants made use of standardized symbols in routine performances: for example, when marking buildings the marking team used the standardized symbols from the guideline as outlined.

Learning and inscribing the workflow built the grounds for the enactment of specific knowing, which we named *aligning* (*knowing how to align*) and *prioritizing* (*knowing how to prioritize*). We named all activities that routine participants carried out to ensure that the workflow unfolded with an orientation toward the standard "aligning." For example, team members first arranged the cargo boxes on the ground prior to erecting the tents to align them with the appropriate layout. These alignment activities were complemented by prioritizing activities. We named all activities routine participants enacted and reenacted to protect the workflow from interruptions as *prioritizing*. Activities like sending victims away or building stable platforms to erect tents in the expected order were carried out with the intention to protect the workflow from interruptions. Routine participants knew that not compromising the workflow was of utmost importance for an effective and safe operation (e.g., "the team [has] to create a fort... it is the eye in the hurricane"). As our findings have shown, this knowing about the priorities,

which was cognitive as well as emotional, enabled the enactment of prioritizing activities.

Knowing how to align and prioritize was not only used to enact the standardized pattern, but also contributed to the retrospective recognition of the evolving patterns as stable. As our interviews exhibit, when routine participants referred to the camp setup, triage, or marking in retrospect, they pointed to how they align their activities with the standard to explain why the performances are always basically similar. Here, knowing how to align was used retrospectively to account for the performances as stable since they corresponded with the knowing that the workflow unfolds in standardized ways (e.g., "we always approach it in the same way"). Following this understanding, actions carried out to protect the workflow, like sending victims away or erecting wooden platforms, were not considered as variation from the standardized workflow, but as actions necessary to keep the workflow on track (e.g., "there are different ways to help; at this point the team has to get ready"). As a result, the pattern routine participants retrospectively reconstructed appeared to them as being stable, since it corresponded to their expectation of the standardized workflow. We therefore speak of enacting standardization if specific activities (aligning, prioritizing) are carried out to keep the workflow on track. The correspondence of enacted patterns with the standard leads to the recognition of patterns as stable. Stability is therefore a recognized state, whereas enacting standardization refers to activities to keep the workflow on track and to lock-step performances.

Supporting, Enhancing, and Enacting Flexibility

Enhancing flexibility was first achieved by intensive training, during which routine participants were *learning about tasks*. This provided routine participants with the necessary knowledge to skillfully enact the action steps necessary to search for and rescue victims. Tasks included learning how to use pneumatic hammers, how to lift concrete with inflatable air cushions, and so on. This learning of shared task knowing helped in increasing the variation of performances since it equipped routine participants with a broad spectrum of potential actions. This enhancing of flexibility was further supported by *inscribing the task* into the artifact. Here, only the task in principle, searching and rescuing victims, was inscribed in the guideline. This prospectively guided the orientation of routine participants toward flexibility since in principle all activities carried out to search and rescue victims were seen as corresponding to the inscribed task.

Learning and inscribing tasks were prerequisite for the enactment of specific knowing, which we named *selecting* (*knowing how to select*) and *recombining* (*knowing how to recombine*). We named all activities routine participants enacted to decide which action step should be carried out next, depending on the situation, as *selecting*. These were actions like using a microcamera to first inspect what the

team had to expect behind a collapsed wall. Only after this assessment of the situation could routine participants actually select the suitable task from their spectrum. Selection was supported by recombining activities, which ensured that task activities were assembled in a meaningful way, suitable for each respective situation. For example, in one situation, a concrete slab got lifted with an inflatable air cushion to move it; in other situations, slabs got destroyed with a pneumatic hammer. Recombining again enacted flexible patterns since it allowed a flexible recombination of tasks depending on the situation at hand.

However, knowing how to select and recombine was not only used prospectively to enact flexible patterns, but was also used retrospectively to account for the flexible nature of search and rescue routines. As our interviews show, when referring to search and rescue routines in retrospect, routine participants pointed out that they know that they have to select and recombine in novel ways to meet the different situations. Having to select from a spectrum of tasks and combine them in novel ways is part of their understanding of the search and rescue routines. Consequently, the pattern routine participants retrospectively referred to as flexible corresponded with their knowing of that pattern.

Overall, these findings help in distilling specific mechanisms that support and enhance routine participants' ability to enact and recognize stable or flexible patterns. Whereas training and artifacts are the fuel for the motor of patterning work (they support and enhance), aligning, prioritizing, selecting, and recombining are the actual engine to enact patterns. These insights have the potential to enrich routine theory by allowing us to theorize on the difference between routine stability and standardization and flexibility and change. These findings provide fresh insights on how patterns of standardization and flexibility are effortful enactments, and they allow us to theorize on the role of knowing in the enactment and reenactment of routines.

Discussion

Motivated by the central debate in routine theory about how patterns are recognized and enacted, our study sets out to explore the fuel and engine of this patterning work. Our findings contribute to routine research in areas that have been highlighted as critical and promising, such as the debate around stability and change of organizational routines (Feldman and Pentland 2003, Pentland et al. 2011, Turner and Rindova 2012, D'Adderio 2014) and the question of the role of knowledge in routine performance (Feldman and Rafaeli 2002, D'Adderio 2003, Feldman 2004, Miller et al. 2012).

Standardization and Flexibility vs. Change

Research on routine dynamics has pointed out that stability and change of routines are outcomes of effortful accomplishment (Pentland and Rueter 1994, Feldman 2000).

Even routines that produce stability exhibit variety in their performance. Our study contributes to this perspective by outlining why routine participants perceive routines as stable or changing despite observable performance variety.

As our findings illustrate, routines that exhibit sequential variety in performance (Pentland 2003) may be perceived as either stable or flexible by routine participants. In other words, from "inside," varying processes may appear to be flexible or stable, whereas our observations (from "outside") revealed performance variety. This finding resonates with insights from process theory, which holds that the distinction between structure (pattern) and process is one of an observer (Chia and Holt 2007). From an "inside" perspective, routine participants simply enact different performances, whereas the notion of structure, i.e., recognizing patterns within the flow of actions, requires an observational perspective (Nicolini 2009, p. 1407; Reckwitz 2002, p. 255; Tsoukas and Chia 2002), or as Luhmann (1995) put it, a second-order observation. Following this understanding, patterning refers to an ongoing, self-referential accomplishment, whereas recognizing patterns requires observing and accounting for the ways patterns are accomplished. Patterns can be recognized by external observers (like researchers studying routines), but more importantly, routine participants have the capability to observe and recognize their own performances (Tsoukas and Chia 2002, p. 575; Luhmann 1995; Geiger and Schröder 2014). As our findings show, routine participants used knowing retrospectively to recognize patterns as either stable or flexible. In cases where the enacted pattern corresponded to their knowing, participants did not perceive routines as having changed. In cases where participants recognized routines as stable despite performance variation, they did not attribute change because they incorporated a variety of prioritizing actions into their knowing of the routine. Routine participants recognized search and rescue routines as flexible but nonchanging because the performance variety corresponded to the retrospective expectation of routine participants. Although performances were recognized as flexible, this flexibility and the resulting performance differences were incorporated in the knowing routine participants developed of the pattern. As long as this knowing was not disrupted or disappointed in the course of routine performances (Gherardi 2009, Geiger 2009), the interpretation of the routine pattern remained unchanged over time for those enacting it.

It is, however, important to note that what is recognized as a flexible or stable pattern and thus nonchanging is not a fixed recognition of routine participants. Quite the contrary, it is again dynamically created and reproduced by ongoing performances. As our findings have shown, participants constantly reproduced the knowing they developed through training in actual performances. Team members constantly updated and renewed their

knowing (Gergen 1985) of what it meant and what it entailed to enact standardized or flexible patterns through continuous training and actual deployments. What is therefore recognized as stable or flexible but nonchanging is constantly and dynamically constituted and reconstituted in actual routine performance.

As a result, we suggest differentiating between stability and standardization and flexibility and change. Stability, on the one hand, is a *recognized state*, whereas *standardization refers to the varying performances* needed to protect the standard and to lock-step performances. Flexible routines, on the other hand, are not necessarily perceived to be of a changing nature. The recognition of stability or change requires an observational perspective, which compares the enacted pattern with the *enacted expectation*. Only in the case of a mismatch might change be attributed. Consistent with process theories (Emirbayer 1997, Hernes 2008), our study reveals that stability and change are not entities that have specific, fixed characteristics. Enacting standardized patterns requires flexibility, and enacting flexible patterns does not imply a recognized change of patterns. Whether the observable patterns are perceived to be of a changing or stable nature depends on the perspective of the observer. Observable patterns are therefore specific instances that can be pointed out by observers from the underlying process. Seen this way, the question is no longer whether routines reveal stability or change, but through which mechanisms routines are recognized as stable or changing patterns.

Standardization and Flexibility as Effortful Enactment
 Our findings significantly depart from traditional notions of routines as providing quasiautomatic, mindless processes where stability is the norm (Langer et al. 1978, Ashford and Fried 1988). Quite to the contrary, our study shows that performances that are perceived as stable require much effort in their actual enactment. Enacting patterns that are recognized as stable by routine participants requires first of all knowing about how to align activities (Bechky and Okhuysen 2011, p. 258) according to the workflow to sequentially enact interdependent tasks (Thompson 1967). This corresponds with Turner and Rindova's (2012, p. 44) observation that sequential task interdependence is a pressure for consistency in the performance of organizational routines. Sticking to the workflow is a particular challenge in hot situations, characterized by a high frequency of unexpected events, which might disrupt the workflow and thereby compromise efficiency and effectiveness (Bechky and Okhuysen 2011). But workflow compliance is of utmost importance in high-reliability contexts where muddling through and trial and error are not options (Faraj and Xiao 2006). Whereas previous studies have shown that routine participants quickly reorganize routines to meet unexpected events (Bechky and Okhuysen 2011), our study shows how routines are carried out by protecting

the workflow from getting compromised. Here, team members had to carry out specific activities to enact this prioritization. This knowing how to prioritize enables actors to suppress possible irregularities and novelties, which emanate from the context. Prioritizing means that unexpected events (like approaching victims or floods) are obscured and made irrelevant to the performance of the routine. Protecting the workflow pattern by prioritizing actions helps in normalizing the unexpected (Weick 1993) since the context from which unexpected events might come is suppressed. Doing so requires enacting specific activities, which in our case sometimes were not easy to perform since it meant acting against immediate feelings and emotions. Yet these actions ensured that the workflow could unfold according to the standard. Stability as a recognized state, as developed here, should therefore not be equated with a state of inertia or rigidity. In a state of inertia, routine participants would only be able to carry out very selected performances that would lead to a reinforcement of mindless patterns (Sydow et al. 2009). In our case, participants attributed stability since it corresponded to their expectations of how the workflow unfolds according to a standard. But unfolding this standard requires enacting manifold, oftentimes even novel and creative activities, which are not at all inert or rigid.

These insights provide an additional perspective on the notion of mindfulness (Levinthal and Rerup 2006) and effortful accomplishment (Pentland and Rueter 1994) in routine theory. Following prior research, effortful accomplishment means mindfully choosing from a repertoire of options and not falling into rigid patterns. Our observations have the potential to enrich such a concept of mindfulness. In our framework, acting mindlessly would lead to distractions of the workflow, whereas avoiding distractions of the workflow requires mindful efforts. Enacting workflows that are recognized as stable can therefore not be taken for granted; quite the contrary, routine participants have to focus much attention on lock-stepping performances. Seen this way, maintaining the recognition of a stable workflow, which orients toward a standard in dynamic contexts, requires specific, mindful performances. Seen this way and consistent with process theorizing (Tsoukas and Chia 2002), our study points out that stability is not an inert, fixed state; instead, it is dynamically created and recreated.

Enacting stability with performance variety as developed here is not similar to the distinction between process variety and task stability as it was proposed by Farjoun (2010). In his framework, a flexible approach might be needed to achieve a reliable outcome, as is the case in the patterns that enhance flexibility we observed. In the case of standardization as effortful enactment, however, performance variety results from the various, oftentimes novel actions that have to be carried out to protect the workflow. Here, the workflow unfolds according to the standard because it is protected from disturbances. Variety

in performances is here not the result of adapting to various contexts to achieve reliable outcomes, but it is a result of protecting the standard to unfold in the intended way by normalizing and obscuring the context. In our study, we could not observe instances in which the routines perceived as stable got significantly disrupted, but it is possible that extreme events, such as unexpected fires or broken material, could endanger the enactment of these routines.

Our findings also have the potential to enrich insights around the notion of flexible routines. Currently, routine theory suggests that performance variety is a result of learning processes emanating from trial-and-error learning (Rerup and Feldman 2011), from efforts to improve (D'Adderio 2014) or align performances (Turner and Rindova 2012), or because of diverse understandings of routine participants (Feldman 2000, Feldman and Pentland 2003, Turner and Rindova 2012). As argued above, our findings reveal that performance variety resulted from an intended flexible approach, which provides an additional explanation for performance variation. According to our findings, flexibility was incorporated into the knowing of routine participants. This flexibility is, like standardization, also an effortful enactment. Enacting flexible patterns required knowing how to select and recombine different tasks. This understanding of flexibility is similar to the conceptualization of routines as grammars of actions (Pentland and Rueter 1994). Following this understanding, flexibility is achieved since routine participants enact specific performances from a constrained set of possibilities, whereas the notion of grammar is used to explain how these actions are connected, i.e., according to grammatical rules (Pentland and Rueter 1994, p. 490). Our microlevel analysis can enrich this understanding by revealing that selecting and recombinining are the activities necessary to enact grammatical rules in the observed case. Here, grammatical rules require knowing how to select from a spectrum of possibilities and how to connect these possibilities in a meaningful way. Selecting and recombinining then describe the microlevel activities necessary in the enactment of flexible routines.

Routines and Knowing

Our findings have pointed to the importance of knowing for enacting patterns recognized as stable or flexible. This has the potential to enrich our understanding of the relationship between knowing and routines. Traditionally, routines have been conceptualized as the storage of procedural memory (Cohen and Bacdayan 1994). Here, procedural memory is understood as a memory for how things are done that is relatively automatic and inarticulate, encompassing cognitive as well as (bodily) motor activities (Cohen and Bacdayan 1994, p. 554). In a similar vein, routines have been equated with individual skills that are quasiamtomatically enacted (Nelson and Winter 1982). Our findings show that routines do not simply

store knowledge, nor are they similar to skills; rather, routine participants constantly enact and reenact specific knowing in performing flexible or standardized routines. As our findings show, the enactment of routines constantly produced and reproduced participants' knowing how to align, prioritize, select, or recombine. Therefore, knowing cannot be separated from actual performance; it constitutes actual doing (aligning, prioritizing, selecting, recombinining) and not a fixed resource (Gherardi 2000). Routine participants, as our findings illustrate, build on learned task and workflow knowledge and artifacts when aligning, prioritizing, selecting, or recombinining, a process Feldman (2004) has described as resourcing, which is why we use the term *knowing* instead of *knowledge* (Maturana and Varela 1998, p. 29; Orlikowski 2002, p. 251). But knowing is also conceptually distinct from the ostensive aspect of routines. Whereas the ostensive points to the patterning routine participants refer to (stable or flexible), by knowing, standardized or flexible patterns are enacted.

But knowing is also distinct from organizational schemata, which are knowledge structures that organize past and future experiences (Rerup and Feldman 2011, p. 578). Whereas schemata provide a potentiality for action (just as knowledge), knowing is inseparable from action (Gergen 1985). Furthermore, as our findings have shown, knowing is not only cognitive in nature, but also consists of emotions, bodily expressions, and feelings (Strati 1992, Gherardi 2009). These insights are commensurate with the finding that just designing artifacts and hoping for the emergence of routines is not sufficient (Pentland and Feldman 2008). Because knowing only develops and redevelops in practice, our findings have shown that training routines is of utmost importance for the emergence and maintenance of standardized or flexible patterns. Intensive training contributed to the development of the SEEBA team into a community of practice as epistemic community (Knorr-Cetina 1999, Brown and Duguid 2001), which was reflected in the specific knowing routine participants enacted and reenacted and the shared identity created as being part of an elite group. Because knowing "sticks" to practicing communities (Brown and Duguid 2001) and cannot be abstracted, learning routines requires practicing. This insight also adds to our understanding of how different individual understandings are coordinated in performing routines. Whereas previous studies have pointed to the importance of transactive memory for the formation of organizational routines (Moreland and Myaskovsky 2000, Miller et al. 2012) or the need to establish connections among routine participants (Feldman and Rafaeli 2002, Turner and Rindova 2012), our findings show how through training a shared knowing for enacting routines develops. In our case, the observed routines were performed by one community of practice that shared knowing how to enact the routine. Our observations suggest that routine participants developed a shared knowing of how to enact and

recognize routine patterns. However, we are aware that the emergence of such a shared knowing was significantly easier in our case, since we observed a relatively small team. This group could develop into a rather cohesive team, which significantly facilitated the creation of cross-member expertise. We recognize that promoting group cohesion is far more difficult in large organizations, which are characterized by diverse interests, contested goals, and heterogeneous interpretative communities (Dougherty 1992). As a result, high-reliability organizations, such as the one we studied, put great emphasis on training their members to avoid confusion and irritation in dangerous situations. We would, however, expect that if routines have to be enacted by multiple communities who then do not share the same knowing, coordination can be extremely difficult (D'Adderio 2014).

Conclusion

The goal of our study was to understand the mechanisms that routine participants enact to create and recreate patterns, which they recognize as stable or changing. This paper is based on an ethnographic study observing how a high-reliability organization enacts routines in a simulated catastrophe (earthquake). Our study fundamentally points to a processual understanding of stability and change by outlining that recognizing patterns as stable or changing depends on the perception of routine participants, which is reflected in the knowing routine participants have developed over time. Following the model developed in our paper, a complex sociomaterial mixture of artifacts, training, and knowing enables such a recognition and enactment of standardized and flexible patterns. As a result, our model points to the conceptual difference between stability and standardization and flexibility and change in routine dynamics. Such an understanding has the potential to shed new light on routine dynamics by pointing to the microlevel activities that are enacted to mindfully maintain the perception of stable or flexible patterning work. Moreover, it reveals how the knowing of routine participants is central for recognizing and maintaining patterning work. This helps in understanding the mechanisms by which routines are actually perceived as patterns within the flow of constantly varying actions.

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