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RULES AND ROUTINES IN ORGANIZATIONS AND THE MANAGEMENT OF SAFETY RULES

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Abstract

This thesis is concerned with the relationship between rules and routines in organizations and how the former can be used to steer the latter. Rules are understood as formal organizational artifacts, whereas organizational routines are collective patterns of action. While research on routines has been thriving, a clear understanding of how rules can be used to influence or control organizational routines (and vice-versa) is still lacking. This question is of particular relevance to safety rules in high-risk organizations, where the way in which organizational routines unfold can ultimately be a matter of life and death. In these organizations, an important and related issue is the balancing of standardization and flexibility – which, in the case of rules, takes the form of finding the right degree of formalization. In high-risk organizations, the question is how to adequately regulate actors' routines in order to facilitate safe behavior, while at the same time leaving enough leeway for actors to make good decisions in abnormal situations.

The railroads are regarded as high-risk industries and also rely heavily on formal rules. In this thesis, the Swiss Federal Railways (SBB) were therefore selected for a field study on rules and routines. The issues outlined so far are being tackled theoretically (paper 1), empirically (paper 2), and from a practitioner's (i.e., rule maker's) point of view (paper 3).

In paper 1, the relationship between rules and routines is theoretically conceptualized, based on a literature review. Literature on organizational control and coordination, on rules in human factors and safety, and on organizational routines is combined. Three distinct roles (rule maker, rule supervisor, and rule follower) are outlined. Six propositions are developed regarding the necessary characteristics of both routines and rules, the respective influence of the three roles on the rule-routine relationship, and regarding organizational aspects such as participation in rule creation.

Paper 2 makes use of extensive empirical data collected at three different fields of work within SBB (signaling, shunting, and construction and maintenance). Using

both interviews and observation methods, four cases of contested safety rules (i.e., rules that are often bent or broken) are analyzed in detail. For each case, the different aspects of the rule and the routine are disentangled and put in relation to one another. In this manner, the precise way in which rules influence routines (as well as the limits of this influence) is uncovered. Additionally, different ways of sensemaking of rules in the different fields of work are identified and put in relation to the cases of contested rules.

Finally, in paper 3, most of the research covered so far is built upon in order to address the question of what should be done to adequately manage safety rules in high-risk organizations. Drawing from organization theory, safety rules are conceptualized as instruments for organizational control, as coordination mechanisms, and as a codified forms of organizational knowledge. With these three functions in mind, four common challenges with safety rules are outlined, as well as four typical measures of good rules management. The relationship between these measures and the challenges and their implication for rules as control, coordination and knowledge are discussed.

Zusammenfassung

Diese Dissertation behandelt das Verhältnis von Regeln und Routinen in Organisationen und die Frage, wie erstere genutzt werden können um letztere zu beeinflussen. Regeln werden verstanden als formale Artefakte, während organisationale Routinen definiert sind als kollektive Handlungsmuster. Trotz eines grossen Wachstums an Forschung über Routinen in Organisationen fehlt bis heute ein klares wissenschaftliches Verständnis davon, wie formale Regeln Routinen beeinflussen können (und umgekehrt). Diese Frage ist besonders relevant in Bezug auf Sicherheitsregeln in Hochrisiko-Unternehmen, wo die Ausgestaltung der korrespondierenden organisationalen Routinen mitunter eine Frage von Leben und Tod sein kann. Eine damit verwandte Frage ist die, wie es solchen Hochrisiko-Organisationen gelingen kann, eine Balance zwischen Standardisierung und Flexibilität zu erreichen. Bezogen auf Regeln bedeutet dies das Finden eines angemessenen Grades an Formalisierung. Hochrisiko-Organisationen stehen vor der Herausforderung, einerseits Routinen beeinflussen zu müssen, indem sicheres Verhalten mittels Regeln vorgeschrieben wird, und andererseits genügend Handlungsspielraum für Akteure zu lassen, um in ungewöhnlichen Situationen eigenständig Entscheidungen fällen zu können.

Eisenbahnunternehmen gehören zu den Hochrisiko-Organisationen und stützen sich zudem stark auf formale Regeln. Deswegen wurden für diese Dissertation die Schweizerischen Bundesbahnen (SBB) für eine Feldstudie über Regeln und Routinen ausgewählt. Die genannten Forschungsfragen werden auf theoretischer Ebene (Aufsatz 1), aufgrund empirischer Daten (Aufsatz 2), sowie aus Sicht von Regelerstellern in Hochrisiko-Organisationen (Aufsatz 3) untersucht.

In Aufsatz 1 wird, aufbauend auf einer Literaturauswertung, das Zusammenspiel zwischen Regeln und Routinen konzeptualisiert. Es wird Literatur über Kontrolle und Koordination in Organisationen, über Regeln im Bereich Sicherheit und Human Factors, sowie über organisationale Routinen kombiniert. Drei unterschiedliche Rollen werden voneinander abgegrenzt (Regelersteller, Regelüberwacher und

Regelanwender). Es werden sechs Thesen aufgestellt über die erforderlichen Charakteristika von Regeln und Routinen, über den jeweiligen Einfluss der drei Rollen auf das Regel-Routine-Verhältnis, sowie über organisationale Aspekte wie Teilhabe der Regelanwender am Regelerstellungsprozess.

Aufsatz 2 nutzt umfangreiche empirische Daten aus drei verschiedenen Arbeitsbereichen innerhalb der SBB (Fahrdienst, Rangier, und Unterhalt und Bau). Mittels Interview- und Beobachtungsmethoden werden vier Fälle von umstrittenen Regeln (d. h. Regeln, welche oft nicht korrekt eingehalten werden) im Detail untersucht. Für jeden dieser Fälle werden die verschiedenen Aspekte von Regel und Routine entflochten und in Beziehung zueinander gesetzt. Auf diese Weise wird der genaue Prozess, wie Regeln Routinen beeinflussen können (sowie die Grenzen dieses Einflusses) aufgedeckt. Zusätzlich werden verschiedene Arten des Sensemaking in Bezug auf Regeln identifiziert und zu den vier Fällen umstrittener Regeln in Beziehung gesetzt.

Schliesslich werden in Aufsatz 3 grosse Teile der bisherigen Forschungsarbeit als Basis genutzt um sich mit der Frage zu befassen, wie Sicherheitsregeln in Hochrisiko-Organisationen adäquat gemanagt werden sollten. Unter Einbezug von organisationswissenschaftlichen Erkenntnissen werden Sicherheitsvorschriften als Instrumente für organisationale Kontrolle, als Koordinationsmechanismen, sowie als kodifizierte Form organisationalen Wissens konzeptualisiert. Mit diesen drei Funktionen im Sinn werden vier allgemeine Herausforderungen in Bezug auf Sicherheitsvorschriften erörtert, sowie vier typische Massnahmen eines guten Regelmanagements. Das Verhältnis der Massnahmen zu den Herausforderungen und deren Implikationen für Regeln als Form der Kontrolle, der Koordination und des Wissens werden diskutiert.

PART I:
INTRODUCTION

This thesis is about the functioning of rules and routines in organizations. Rules are important to almost any organization as instruments of control and coordination and are typically used to influence human action in the form of organizational routines. The papers in this thesis deal with the relationship between rules as artifacts and routines as collective patterns of action. Specifically, the question of how safety rules can be used to steer organizational routines in high-risk systems in order to meet both standardization and flexibility requirements is addressed. This question is empirically analyzed in different fields of work within a railroad company (Swiss Federal Railways, SBB). The cumulative dissertation consists of three scientific papers, found in part II.

Part I, which serves as an introduction to the scientific papers, is organized in five chapters: In the first chapter, I lay out the theoretical background of the topics addressed. Second, I formulate the research aims behind the dissertation project. In the third chapter, I briefly cover the scientific methods used. After that, abstracts of the three papers are presented, as well as some background information on the development of the papers. The last chapter covers the contribution of this thesis as well as ideas for future research.

1. Theoretical Background of the Dissertation

The dissertation is positioned within the fields of organization science and safety research. In this chapter, I briefly present four theoretical concepts on which the dissertation project is based.

1.1. Routines in organizations

The idea of viewing organizations and organizational behavior as an arrangement of routines is based behaviorist theories of organizations (Cyert & March, 1963; March & Simon, 1958). Nelson and Winter (1982) later emphasized the role of routines in their theory of evolutionary economics. Although many different definitions of routines have been developed over time, scholars agree on the following characteristics (Becker, 2004): Routines are *repetitive patterns* of *collective action*. That means that they happen more than once and that they involve the actions of multiple participants. Routines serve a number of functions in organizations. For Nelson and Winter (1982), they can serve as target (for control, replication and imitation), as organizational memory, and as a truce in intra-organizational conflict. Building on this, Becker (2004) later emphasized that routines also enable coordination and provide some degree of stability in organizations. Routines are furthermore seen as building blocks for organizational capabilities (e.g., Hodgson, 2008): By routinizing decisions and action, organizations can build up a disposition, which can then be put to use (create value) in different settings and at different times.

Addressing the question of stability and change, Feldman and Pentland proposed a novel conceptualization of routines (Feldman, 2000; Feldman & Pentland, 2003; Pentland & Feldman, 2005; Pentland & Rueter, 1994). Most importantly, they viewed routines as emergent and as generative: Routines exist through being performed by actors, and both continuity and change are embedded within (see also Parmigiani & Howard-Grenville, 2011). According to Feldman and Pentland, routines embody both cognition and behavior. Cognition is represented in the form of an ostensive

aspect, also called the *routine in principle*. This is the general idea or shared understanding of routine. The behavioral side of a routine is captured in the performative aspect, the *routine in practice*. Both aspects serve a number of functions: The principle of a routine, seen as a normative goal of how a routine should be performed, can guide action. It can also be used as an explanation for what one is doing or a reference for communication. The routine in practice, on the other hand, is essential for both establishing and maintaining a routine. Routines exist because of the continuous application of the principle into practice. This process, however, also constitutes an opportunity for flexibility and change: Each performance of a routine has to be adapted to the situation at hand, where circumstances may have changed. These adaptations can potentially modify the routine in principle, and thus the routine as a whole.

In the scientific papers of this dissertation, routines are understood as "repetitive, recognizable patterns of interdependent actions, carried out by multiple actors" (Feldman & Pentland, 2003, p. 95). By distinguishing between the routine in principle and the routine in practice, the dynamics between those aspects and, most importantly, their relation to organizational rules can be studied.

1.2. Rules in organizations

In the context of this dissertation, rules are understood as formal, written artifacts – in contrast to organizational routines (cf. Pentland & Feldman, 2005). Formal rules are an essential aspect of most organizations as they fulfill a number of organizing functions: As a form of organizational control, they are used to steer human action by aligning individual and collective behavior with the organization's goals (Cardinal, Sitkin, & Long, 2004; Ouchi, 1979). As such, rules are always a form of power in organizations (Clegg, Courpasson, & Philips, 2006; Gouldner, 1954; Mintzberg, 1983). Next to this "vertical" function, rules also work "horizontally" as a coordination mechanism. By defining responsibilities, allocating resources and helping to develop agreement, they enable actors to collectively reach a shared goal (Okhuysen & Bechky, 2009; Thompson, 1967; Van de Ven, Delbecq, & Koenig, 1976). However, rules also have drawbacks: Too many rules can hinder innovation

and lead to inertia (van der Steen, 2009). This phenomenon is also called “red tape” and has been defined as “formalization (in the form of burdensome rules and procedures) [that] is detrimental to the organization” (Pandey & Kingsley, 2000, p. 782). Finding the right degree of formalization is therefore a challenge to every organization (Walsh & Dewar, 1987). Whereas classic bureaucratization theory (Weber, 1978) argues that formalization has a self-promoting tendency to create ever more rules, Schulz (1998) found that rules do not infinitely “breed” more rules – instead the production of new rules slows down as more rules are already in place. Adler and Borys (1996) proposed the concept of *enabling bureaucracy* (in contrast to *coercive*) as a healthy form of formalization. However, Adler later revised his position, arguing that bureaucracies are always *simultaneously* enabling and coercive (Adler, 2012). Cardinal, Sitkin and Long (2004; 2010) contrasted formal forms of control (e.g., written rules or directives) with informal ones (e.g., values, norms or beliefs) and showed how organizations over time can move from one extreme to the other, trying to find the right balance.

Besides the discussion of the right degree, or right type of formalization, organizational scholars have long found that rules are not always being followed and that violations are part of every rules system (Lehman & Ramanujam, 2009; McLean Parks, Li, & Gallagher, 2010; Robinson & Bennett, 1995; Veiga, Golden, & Dechant, 2004; Warren, 2003). Interestingly, some scholars have focused more on the harmful side of rule violations (MacLean & Behnam, 2010; Phipps, et al., 2008; Tyler & Blader, 2005; Umphress & Bingham, 2011), while others have shown how rule violations can benefit co-workers or customers (e.g., Dahling, Chau, Mayer, & Gregory, 2012; Morrison, 2006) or can represent an indicator of necessary change (e.g., Desai, 2010; Olin & Wickenberg, 2001). Most recently, Martin et al. (2012) differentiated rule violations on two dimensions: first, whether rule-breaking is contested or instead unofficially permitted, and second, whether rule-breaking is organized by a (low-level) individual, on a work group level, or at the level of top organizational managers.

1.3. Safety rules in high-risk industries

High-risk systems (e.g., in aviation, healthcare, power generation, or transportation) employ rules for control and coordination as well – specifically in regard to safety. Issues with rules, such as rule violations, are pinnacled when they become a matter of safety, whether for employees, customers, or third parties. It is therefore no surprise that high-risk industries have shown a tendency towards using rules and other forms of restriction as opposed to "softer" forms of control or coordination (Grote, 2004, 2012). Accordingly, research on safety rules often takes the appropriateness of rules for granted and focuses on the antecedents and consequences of rule-following (e.g., Bruns, 2009; Choudhry & Fang, 2008; Iszatt-White, 2007; Phipps, et al., 2008; Reason, Parker, & Lawton, 1998; Simard & Marchand, 1997).

A much-cited typology of safety rules has been proposed by Hale and Swuste (1998). They differentiate rules on the level of action regulation: *Action rules* define prescribed behavior on a detailed level, leaving little to no scope for individual decision-making; *process rules* specify the procedure of how a solution is to be reached; lastly, *goal rules* only define a desired state or goal without prescribing the way to achieve it. The adequate type of rule generally should be chosen in accordance with task uncertainties and rule followers' level of competence.

Lawton (1998) turned to the issue of rule violations and studied shunters' motives for committing violations, in a UK railroad company. Interestingly, most violations "were perceived to be the result of a well-intentioned desire to get the job done" (p. 77). She constructed a typology of four different kinds of violations: *Erroneous violations* are usually unintentional and mainly due to a lack of understanding or experience. *Exceptional violations* can happen when under unusual circumstances new and uncommon actions need to be taken. These violations are usually very risky. *Situational violations* are "provoked" by lack of the correct tools or understaffing and are usually regarded necessary by workers. Finally, *routine violations* constitute a shortcut which has become regular behavior. They are quite common and usually concern actions deemed less risky. The author further proposed a general model of rule violations, in which they can be explained by

considering three aspects: knowledge about the rules, situational factors, and attitudes and norms towards rules.

Most recently, Hale and Borys (2012) addressed the limitedness of safety rules in an extensive review of the literature on safety rules in high-risk industries. They identified two opposing paradigms: Model 1 employs a top-down approach, based on rationality and control. In this line of thinking, rules are necessary, binding, and made by experts. Rule violations are to be eliminated. Model 2, however, recognizes the fact that no rules system is perfect and that violations are, to a certain extent, necessary (e.g., in unforeseen situations). This paradigm acknowledges operators' practical knowledge, which should therefore be used in creating and adapting safety rules. In short, "model 1 sees the solutions in modifying reality to match the rules, while model 2 advocates changing the rules and their definition fundamentally to match reality" (Hale & Borys, 2012, p. 8).

1.4. Rules and the management of uncertainty

The issues around routines and rules outlined so far can furthermore be described in a broader sense in terms of the management of uncertainty (Grote, 2004, 2009). Generally speaking, organizations have two ways of dealing with uncertainty: They can either try to *minimize uncertainty* by extensive planning, standardization and/or automation – or they can provide actors with scope for decision-making and sufficient resources in order to enable *coping with uncertainty* at a local level. Minimizing uncertainty means reducing operative degrees of freedom; disturbances (such as rule violations) are viewed as to be avoided symptoms of inefficient system design. In contrast, the strategy of coping with uncertainty views plans and rules less as binding control mechanisms but rather as a resource for situated action. Disturbances are viewed as learning opportunities (either on an individual or on a system level). These contrasting approaches are not to be understood as either/or alternatives. Instead, organizations need to find a balance between both.

High-risk systems have, however, shown a strong leaning towards the minimizing uncertainty approach by developing rules and regulation in more and more detail (Amalberti, 2001; Perrow, 1984). Rules are often developed as a direct consequence

of incidents and accidents, which could pose a problem when too many rules created incrementally do not make up a good system. Furthermore, especially in states of abnormal operation more flexible guidance is needed (Dekker, 2003; Woods & Shattuck, 2000). However, it is clear that high-risk systems cannot abolish safety rules altogether. This raises the question of how rules – rather than further promote the minimizing uncertainty approach – can instead be used to achieve a balance between standardization and flexibility.

In a pre-study to this dissertation project (Grote, Weichbrodt, Günter, Zala-Mezö, & Künzle, 2009), the authors tried to find some first answers to this question. Along with interviews and observation at the Swiss Federal Railways (SBB), a selection of the official rule book was analyzed. Rules for shunting operations and for train traffic were categorized and compared, based on Hale and Swuste's (1998) typology of safety rules. In addition to the rule type, rules were categorized as to whether or not they provide decision latitude, whether they are phrased as advice or command, and whether exceptions were part of the rule or not. Overall, the majority of rules analyzed were action rules, with very few goal rules. Within the shunting rules, 71 per cent were rules with decision latitude, compared to 30 per cent within the rule for train traffic. Shunters furthermore had more process rules (21 per cent) than signalers and train drivers (12 per cent). This result was evaluated critically because it raises the question whether shunters are trained well enough to handle the relatively high level of decision latitude. Signalers and train drivers, in contrast, have a higher level of professional training, but have to work under a relatively higher level of restriction. Both shunting and signaling, it seemed, were showing their own kind of imbalance with regard to rules.

2. Research aims

At the starting point of this dissertation was the question of how organizations can find and maintain a balance between standardization and flexibility through rules. It quickly became apparent that for this endeavor, a more detailed and precise conceptualization of the relationship between rules and routines is needed.

Therefore, the first research question is concerned with the rule-routine relationship, while the second addresses the balancing of standardization and flexibility.

2.1. How can the relationship between rules and routines be conceptualized?

While some authors (e.g., Bruns, 2009; Kieser, 2008; Reynaud, 2005) have previously addressed the relationship between rules (as formal artifacts) and routines (as patterns of collective behavior), a clear description of the theoretical relationship between the two concept is still lacking. Combining the idea of routines as outlined by Feldman and Pentland (2003) with the idea of rules as a mechanism of formal control (Cardinal, et al., 2004) brings about some open questions on their relationship: Firstly, if rule violations are part of every rules system, how can this phenomenon be described in terms of the rule-routine relationship? Secondly, if routines are seen as having a source of change embedded within, how does this relate to rules as a means for stability? How can formal rules "cope" with the flexibility of routines? And can changing routines, reversely, influence rules? Lastly, if routines are comprising principle and practice, this means that they are themselves a form of informal control (through the routine in principle). How then can they be controlled by rules, exactly?

These questions are addressed in both paper 1 and paper 2. By reviewing selected literature on rules and routines, the first paper aims to tackle these questions from a theoretical standpoint. Six propositions on the relationship between rules and routines in organizations are made. The second paper makes use of the collected data (interviews and observations) from field research at SBB. In this way, an empirically founded concept of the rule-routine relationship is developed.

2.2. How can safety rules be used for balancing standardization and flexibility?

Some of the difficulties of using rules to achieve safety have already been addressed in chapters 1.3 and 1.4. While rules are needed for stability and predictability, using them to achieve safety also bears the risk of over-regulation. Grote et al. (2009) have suggested loose coupling (Orton & Weick, 1990; Weick, 1976) as a measure to achieve such a balance, but it is unclear how loose coupling

through rules can be achieved in practice. The second research aim is therefore characterized by a number of questions around the management of (safety) rules: How can find organizations the right amount of rules and the right type of rule for individual and collective tasks? How should the creation and adaptation of rules be organized in order to achieve such a balance? What is the influence of rule followers' views on rules and their way of sensemaking of rules? What role does education about rules play? Answers to these questions are highly relevant to both safety researchers and safety managers (i.e., rule makers).

The issues are addressed mainly in paper 2 and 3. Paper 2 offers empirical insights on the sensemaking of rules and their everyday use by different workers at SBB. Paper 3 is particularly concerned with questions of successful rules management. Answers are provided by a juxtaposition of organization theory and safety research and by addressing common challenges with safety rules as well as typical measures of good rules management in high-risk industries.

3. Methodological approaches

The empirical methods described in this chapter and the data collected were used for paper 2. The other two papers are of theoretical nature, with a review of literature on rules and routines (for paper 1) and on safety rules and their management (for paper 3) being the "method".

3.1. The setting: SBB as a highly-regulated organization

The company studied were the Swiss Federal Railways (Schweizerische Bundesbahnen, SBB). SBB is the largest railroad company in Switzerland, employing about 28,500 people and covering a network of 3,138 km of track lines, with more than 300 million persons and around 50 millions net tons of freight being transported each year (SBB, 2012). The company is a stock corporation but wholly owned by the Swiss Confederation.

Two characteristics of railroad companies were determinant for choosing one such company for collecting empirical data: First, the railroads are a high-risk industry. The main task of a railroad company is the movement of large amounts of people and goods at high speeds in a tight system of headway. Operation of a railroad network demands the precise alignment of countless details, and even seemingly marginal processes need to be paid a high level of attention to (for example, for maintenance work, detailed schedules and communication is required). In Switzerland in particular, rail traffic has increased over the last decade with the implementation of the Rail 2000 project (Preston, 2009). Switzerland has one of the densest railroad networks worldwide and the Swiss are using public transport more than any other European nation (Moser, 2000). Even though, as a passenger, traveling by train is one of the safest ways of transport (European Transport Safety Council, 2003), railroad companies generally score only average in terms of worker safety (Hale & Heijer, 2006).

The second reason for choosing a railroad company for this thesis is that railroad companies are particularly “rule-driven” organizations. Historically, rules, plans and timetables were the only reliable form of coordination for railroad companies as they were stretched out over large geographical areas. This has lead to the development of extensive and highly effective processes for planning and coordination, with some even calling railroads “innovators in modern business administration” (Chandler & Salsbury, 1965). Building on this rule-based form of coordinating, automation became an increasingly important aspect (Hürlimann, 2007). Today, the railroads are still highly regulated (Hale & Heijer, 2006), if not over-regulated, as some have argued (Amalberti, 2001).

Within SBB, three fields of work were selected for collecting empirical data: signaling, shunting, and construction and maintenance. A previous cooperation with ETH, including interviews, observations, and an analysis of rules in signaling and shunting, offered the data and insights for the pre-study (Grote, et al., 2009). In order to build on this, the two fields of work were selected again for this thesis. In addition, SBB asked to include construction and maintenance, because the number

of rules had previously increased in this field of work, and it also had not been included in many safety studies before.

In signaling, the ongoing train traffic within a geographically specified area (often a railroad station) is being managed. A large part of the work is automated. Signalers' task is to monitor automated activities as well as to actively manage delays or other deviations from the plan. Rules in signaling concern, for example, the process of blocking a section of a train line for maintenance work, or how to deal with conflicting demands from passenger traffic, freight traffic, and local shunting maneuvers. Although signalers do work in shifts, most of the workload is being handled during daytime.

The field of shunting is characterized by manual labor, outside work, and shift work. For example, assembling and preparing commuter trains for the next morning needs to be done at night. Shunting is a dangerous activity (Elms, 2001), with getting caught between or run over by rail cars representing the greatest risk. Many employees are have only limited training (compared to workers from other fields within SBB). In some contexts (e.g., shunting yards), tasks are highly repetitive. Rules in shunting cover both worker's personal safety (e.g., prescribing personal protection equipment) as well as the safety of trains and the rail system (e.g., the correct assembling and testing of a train's brake system).

In construction and maintenance (the two tasks are being handled by one single department at SBB), work is usually organized in teams of various sizes. Work tasks can range from simply re-filling gravel on rail tracks to large and complex construction projects. Most work is done at night, while train traffic is reduced, though not completely stopped. For this reason, teams usually work with a designated lookout, whose single job is to watch and warn about trains approaching the work site. Rules cover a whole range of safety aspects, from communication about planned work tasks, to dealing with electrical lines, or how to handle ongoing train traffic at work sites.

The safety division at SBB has to oversee and manage safety in these (and more) different fields of work. Rules are one measure for them to achieve safe operations.

Although many rules are issued by the Federal Office of Transport (Bundesamt für Verkehr, BAV), SBB nevertheless issues a number of rules themselves as well, and furthermore collaborate very closely with the BAV. For SBB's safety division, rule making is an important organizational "tool". Because of this, they were interested in how they could they could improve the rules themselves, as well as the process of how rules are created and changed.

The cooperation between ETH and SBB for this thesis lasted from 2007 to 2011. SBB did not pay for the study. They offered access to worksites and interview time of their employees in exchange for results. I presented and discussed my findings both at the company's safety division (top level) and at departmental levels, and wrote a 64-page research report (Weichbrodt, 2011).

3.2. Interviews and observations used as field research methods

After describing the context in which empirical data for this thesis was collected, in this section I briefly explain the methods being used for both collecting and analyzing data. The methods are explained in more detail in the methods section of paper 2.

Pentland and Feldman (2008) discuss issues in the studying of routines and argue that in most cases, both interview and observation data, as well as studying artifacts such as log files or rules, are necessary to identify and analyze organizational routines. In very general terms, the routine in principle is usually identifiable by listening (either during dedicated interviews, or by listening to actors talking with each other), while the routine in practice is only identifiable by actually observing how work is being done. A combination of interviews, observations, and document analysis is also typical for field studies in organizations (Locke, 2011; Yin, 2003).

I used semi-structured interviews as a form of qualitative data collection, because they provide information about actors' interpretations, and because they strike a balance between a standardized and an unstructured research approach. (Flick, 2009; Kvale & Brinkmann, 2008). As such, an interview guideline was developed

that formed the basis for all planned conversations with railroad employees. It included the following points: the types of rules relevant to the interviewee, his or her perspective on the function and meaning of rules, how rules are enforced, and examples of conflict around rules. These broad topics proved to be applicable to all interview partners (from regular workers to department heads) from all three fields of work. Interviews were tape recorded and transcribed, with interviewees given assurance that their identity would not be revealed. I conducted 10 interviews in signaling, 11 in shunting, and 12 in construction and maintenance. In each field of work, employees at different hierarchical levels were interviewed. Interviews lasted between 20 and 100 minutes, with a mean of 38 minutes.

Observation took place during twenty field visits. During each of these visits (usually half a day or a full shift), I accompanied a team of workers during their regular work. Observation was mostly non-participant, as I did not take on any other role in the field besides that of the researcher. I was generally met with ample willingness to let me get a good insight into the employees' work world. Without disturbing them too much, I was able to ask questions about what was going on and what the reasons for particular actions were. I took extensive written field notes and sometimes recorded short conversations with correspondents' consent. Overall, the approach I took can also be described as focused ethnography (Knoblauch, 2005).

Already during the interviews, participants were asked to identify specific rules that were difficult to follow. Together with contacts at SBB in leading positions, four cases were selected for observation: In the field of signaling, the use of a checklist for blocking line sections was reported to be difficult to use (1). In shunting, the handling of an automated conveyer system for pushing together rail cars seemed to pose problems (2). In construction and maintenance two cases were selected because of the diversity of work tasks within this field: Keeping a minimum distance of one meter to powered electrical lines in overhead line work (3), and a new rule about warning signals for work teams in cases of approaching traffic (4). After observation had started, I identified three additional cases of contested rules which I chose for further analysis: The action sequence of coupling two rail cars together in shunting (5), a rule that prohibits lookouts in construction work from doing other

work (6), and a procedure prescribing interrupting one's work and facing approaching trains while working on tracks (7). Cases no. 1 to 4 were analyzed for the report I wrote for SBB, whereas cases no. 5 to 7 were mentioned, but not covered in detail. For paper 2, however, I further examined the additional cases, ultimately using cases no. 1, 5, 6, and 7. Analyzing these cases of contested rules meant sharply distinguishing between what is prescribed in the rule (artifact), how it is actually carried out (routine in practice) and the different ideas and intentions behind it held by different organizational actors (routines in principle). In this way, reasons for divergence between routine and rule became apparent.

All interview data was later also formally analyzed using Qualitative Content Analysis (Gläser & Laudel, 2009; Mayring, 2005). This method allows the development and continuous adaptation of a system of categories, which the interview text is being subjected to. Categories regarding the meaning and functioning of rules were applied and the results compared between the three fields of work. The aim of this analysis was to identify the specific ways of sensemaking of rules in each of the three fields. For example, it became evident that for signalers, rules have a very different meaning (as necessary support for their collective tasks) than for workers in construction and maintenance (necessary for safety, but also in conflict with production pressure).

4. Summaries of the scientific papers

In this chapter, abstracts are listed for all three papers and a short development history for each paper is presented.

4.1. Summary of paper 1

Title: How to shape behavior in organizations: From rules to routines and back

Authors: Johann Weichbrodt and Gudela Grote

Abstract: Rules are meant to control behavior in organizations and elsewhere. From this perspective, rule following is seen as a virtue and rule violation as a vice.

However, recent discussion around the concept of organizational routines has in fundamental ways questioned the adequacy and even existence of mindless, strict routines as the outcome of rule-following. How, then, can rules be used to control routines in organizations at all? We argue that in order to better understand the interaction between rules and routines in organizations, three roles need to be considered: rule maker, rule supervisor and rule follower. Six propositions are developed regarding those roles, the necessary characteristics of rules and routines, and their relationship. Research and practical implications are discussed.

Development: The first version of this paper was written in 2009 and then accepted for presentation at the 2010 Academy of Management Annual Meeting in Montréal, Canada (Weichbrodt & Grote, 2010). We also presented it at the Fourth International Conference on Organizational Routines in Nice, France, in the same year. Comments and criticism from participants of both conferences were used to improve and expand the paper. Feedback from Michael Cohen, Sidney Winter, Pablo Martin de Holan, and Martin Schulz was particularly helpful. After reworking large parts of the paper, it is now under review at the journal *Group & Organization Management*.

4.2. Summary of paper 2

Title: When the formal and the informal do not align: Exploring the rule-routine relationship in three fields of work in the railroads

Authors: Johann Weichbrodt and Gudela Grote

Abstract: How do formal rules function as measures for controlling organizational routines? While research on organizational routines has been thriving in the last decade, a clear understanding on how they can be steered and controlled is still lacking. Drawing on literature on rule violations and organizational control, we view rule violations as misalignments between formal rules as artifacts and organizational routines as collective patterns of action. In order to understand how organizational routines can or cannot be controlled, we studied rules and routines in three fields of work within a railroad company (shunting, signaling, and construction and

maintenance) focusing in particular on four cases of contested rules (i.e., rules that are often bent or broken). By mapping out these rules and routines in detail, we show how actors' routine in principle (i.e., the shared understanding about how exactly the rules should be followed) can diverge from envisioned processes. The routine in principle, we furthermore demonstrate, is therefore the key to managing routines through rules. Additionally, we found how different ways of sensemaking of rules can lead to vicious or virtuous circles of rule violations and rule change. The paper contributes to literatures on organizational routines and organizational control by suggesting an integral understanding of rule-routine interactions. Practical implications for formal rules as measures for organizational control are also discussed.

Development: Preliminary findings of the empirical research at SBB were written up and presented at three conferences: The 2007 Annual Cambridge Conference on Regulation, Inspection & Improvement in Cambridge, UK (Grote & Weichbrodt, 2007); the 2008 EGOS Colloquium in Amsterdam, The Netherlands (Weichbrodt & Grote, 2008); and the 2009 International Conference on Rail Human Factors in Lille, France. This last conference paper has now been published as a book chapter (Weichbrodt & Grote, 2012).
The final paper that is part of this thesis very loosely builds on these earlier findings. The research report written for SBB (Weichbrodt, 2011) was also used as a basis. The paper was written mainly in 2011, with Gian-Claudio Gentile contributing to the first ideas of its structure and main aims. Silja Sollberger contributed by transcribing interviews. Useful feedback on draft versions of the paper was also given by Michaela Kolbe, Nadine Bienefeld, Daniel Boos, Denniz Dönmez, Mary Waller, Georg von Krogh, and Brian Pentland. The paper has been submitted to *Organization Science*. After the first round of reviews, the journal offered us a "revise and re-submit".

4.3. Summary of paper 3

Title: Safety Rules as Instruments for Organizational Control, Coordination and Knowledge: Implications for Rules Management

Author: Johann Weichbrodt

Abstract: Recent research in the field of safety science on the limitedness of rules as a measure to achieve safety has coincided with new research in organization science on rules and routines, and their mutual relationship in particular. The present article is an attempt to uncover what the former can learn from the latter. It outlines three functions of rules in organizations (as a means for organizational control, as coordination mechanism, and as codified organizational knowledge) and applies these to safety rules in high-risk industries. Four common challenges of safety rules, as well as four typical measures of good rules management are illustrated by discussing examples from safety research. These challenges and typical measures of rules management are furthermore examined in terms of the three functions of rules in organizations. The article demonstrates how safety science, by taking a broader perspective, can benefit from organization theory.

Development: The idea for this paper stems from the research report I wrote for SBB (Weichbrodt, 2011), which I concluded by formulating seven central challenges regarding safety rules for SBB as a high-risk organization. Gudela Grote and Daniel Boos contributed to the paper by giving feedback on earlier drafts. A shorter version of this paper, intended for a non-academic and non-safety-related audience, was written for the German human resources practitioner's journal *Personalführung* (Weichbrodt, 2012). The final paper has been submitted to *Safety Science* where it is under review.

5. Contribution

In this chapter, first the doctoral candidate's contribution to each of the papers is outlined. Next, scientific as well as practical contributions of the thesis as a whole are discussed. Lastly, opportunities for future research are presented.

5.1. Doctoral candidate's contribution to the papers

This thesis is based on a pre-study about safety rules and their management at SBB, conducted by Gudela Grote, Enikö Zala-Mezö, and Barbara Künzle. Gudela Grote then set up this project so that I could start with a basic idea, a research sketch, and a list of contact persons at different departments of SBB. My research was funded by resources of Gudela Grote's chair at the Department of Management, Technology, and Economics. In all of the papers written for this thesis, I had the main lead. The details of the contribution of each of the authors to the three papers are outlined in Table 1.

Table 1: Contributions of the authors to the three papers

	Paper 1	**Paper 2**	**Paper 3**
Authors	JW, GG	JW, GG	JW
Literature research	JW	JW	JW
Study design	–	JW, GG	–
Design of the paper	JW, GG	JW, GG, GCG	JW, GG
Data collection & analysis	–	JW	–
Writing	JW, GG	JW	JW

Note: JW = Johann Weichbrodt; GG = Gudela Grote; GCG = Gian-Claudio Gentile

5.2. Scientific contribution

The main theoretical contributions of the thesis lie in developing an understanding of the relationship between rules and routines in organizations, as well as providing insights into how a balance between standardization and flexibility can be reached by means of rules.

The ideas and propositions developed in paper 1 contribute to organization theory in general, and to research on organizational control and organizational routines in particular. By integrating rules, routines, and three relevant roles, a coherent and innovative model of the rule-routine relationship is developed. Especially the emphasis on organizational roles brings a novel aspect into the scientific

understanding of rules and routines. Differentiating rule maker, rule supervisor and rule follower is necessary in order to understand how rules can (and cannot) influence routines. The paper proposes, for example, that rule supervisors have significant influence on the translation process from rules to routines, because they are the ones deciding whether a specific behavior is within the limits of the rule or not. Overseeing routines and distinguishing rule-following from rule-breaking on a case-by-case basis is usually not feasible for rule makers, yet very important if their rules are to achieve an effect. Paper 1 furthermore states that in order for rules and routines to efficiently function in organizations, all stakeholders need to continuously work towards a common understanding of what it means to follow a rule – i.e., a shared and identical routine in principle.

Illustrating the importance and functioning of the routine in principle is also a key contribution of paper 2. The four cases of safety rules and their application in practice show how actors develop their routine in principle by incorporating the intention behind the rule together with other demands (e.g., production pressure). Rule followers' routines in principle can thus differ from that of rule makers, resulting in rule-routine misalignment and loss of organizational control. The paper shows that rules can, in fact, be used to control routines, but only if special attention is paid to rule followers' idea and understanding of the routine. The crucial finding is that this is a two-way process: Rule followers of course need to be informed about the original intention behind the rule (i.e., rule maker's routine in principle influencing that of the rule follower), but rule makers also need to pay attention to how rule followers integrate other organizational goals into their understanding (i.e., rule follower's routine in principle influencing that of the rule maker) as this can bring to light faulty and impossible-to-follow rules. Via the routine in principle, rules and routines hence influence each other.

In addition, paper 2 also highlights the importance of different ways of sensemaking of rules and their influence on the rule-routine relationship. How actors symbolize rules has an effect on how much their routines are influenced by them. Different views on rules held by different professional groups have been identified before (e.g., McDonald, Waring, Harrison, Walshe, & Boaden, 2005). In paper 2, we could

show how in one case, a certain way of sensemaking of rules (i.e., viewing them as essential, supportive, and necessary for a collective identity) sparks the initiative for change in the rules, whereas other ways of sensemaking (seeing them as irrelevant, unhelpful or bureaucratic) lead to decoupling. Taking into account the sensemaking of rules is therefore an important aspect of rules management.

The main contribution of paper 3 is the juxtaposition of organization theory on rules with safety research on rules. The four challenges summarize problems with rules as a means to achieve safety (where rules are seen as a means for organizational control, as a coordination mechanism, and as codified organizational knowledge). Most of these challenges can also be seen as the risk of an imbalance between standardization and flexibility. The four measures of good rules management that are also discussed can in turn be regarded as means to achieve and maintain such a balance.

5.3. Practical Contributions

The research presented in this thesis first and foremost provides rule makers and safety managers first-hand knowledge of the application of safety rules and their translation into routines. Distinguishing between procedures described in rules and work processes actually carried out seems to get forgotten too often, even in high-risk industries. The approach taken in this thesis heavily emphasizes this difference and can thus act as a call to managers and decision makers in such organizations to do so as well. The conceptualization of the relationship between rules and routines furthermore provides practitioners with a terminology and a better understanding of both rules as organizational control and rule violations. Regarding control, especially paper 2 vividly highlights the limitedness of (safety) rules as a means for organizational control and the need for rule makers to account for the rule followers' perspective in order to actually influence routines. My findings also suggests that it is useful for practitioners to understand rule violations as misalignments between rule and routine. As studies on rule violations have shown, most violators have a perfectly good reason for their transgressions (e.g., Dekker, 2005; Lawton, 1998). It is therefore important to understand these reasons and how

they form the resulting deviating organizational routines. Only then can meaningfully be decided if it was in fact a “bad practice”, or instead a case of “bad rule”.

Indeed, one of the measures taken by SBB after receiving my research report was to start cataloguing and scrutinizing small-scale rule violations (such as the ones identified during my research). Safety managers at SBB figured that most of these types of violations were actually well-known, albeit not really being paid attention to. Formal acknowledgement of these issues was seen as a first step towards a deeper analysis and the sorting out of “bad practices” and “bad rules”.

A further implication for rule makers in high-risk organizations that can be drawn from this thesis is the importance of actors interpretations of rules in general – their way of sensemaking of rules. The cases discussed in paper 2 showed how these interpretations of rules (e.g., as supportive, or instead as irrelevant) crucially influenced virtuous or vicious circles of rules and rule change. In case of (inevitable) rule violations, if actors are largely indifferent towards rules, they are less likely to take initiative to strive for better rules. Such rule violations may thus go undetected and routines may get decoupled strongly from rules. Safety managers should therefore pay close attention to rule followers attitudes towards and their way of sensemaking of rules.

The most useful practical advice offers paper 3. The four measures of rules management discussed (managing the restrictiveness of rules; participation in rule creation and adaptation; education and training about rules; and considering alternatives to rules) can and should be directly implemented in any high-risk organization (if it is not already the case). The paper also provides examples and background information on how and why these measures work to mitigate some of the inevitable difficulties associated with rules as a means for achieving safety.

5.4. Future Research

Future research on the relationship between rules and routines could aim to extend the breadth of the results by studying different rules and routines in different fields of work and different industries. The way of sensemaking of rules seems to have a

substantial influence on the rule-routine relationship. Therefore, research on rules and their application in other work areas and industries would augment our current understanding of this factor. For example, it would be interesting to find out what other unique ways of sensemaking of rules are prevalent in other professional communities – or whether there are other fields of work were rule followers interpret rules as positively as the signalers studied for this thesis did.

In particular, future research should focus on how the way of sensemaking of rules can be influenced. The role of education and training about rules and its influence on the interpretation of rules is discussed in paper 3, but the exact workings of this are yet unclear. As noted in the paper, the concept of psychological ownership (e.g., Pierce, Kostova, & Dirks, 2001) could provide a useful approach to this question. A feeling of ownership seems to be needed in order for rule followers to take up initiative for adapting faulty rules to their needs. A worthwhile research question could focus on how psychological ownership of rules could be increased in order to break out of vicious circles of rule violations.

A theoretical issue brought up tangentially in this thesis, but yet to be resolved, is how the routine in principle (as a specific informal norm about how to carry out a task) relates to other informal forces, notably culture, in organizations. The literature on organizational routines to date provides little insights into how cultural norms and routines influence each other. The findings of this thesis provide a small starting point for this question, if one sees the different ways of sensemaking of rules as a cultural phenomenon (i.e., as distinct “rules cultures”). How these two concepts are related is especially relevant to high-risk organizations, where both rules and (safety) culture are known to be crucial factors for safe operations.

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PART II:

SCIENTIFIC PAPERS

Scientific Paper 1

How to Shape Behavior in Organizations: From Rules to Routines and Back

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Rules are meant to control behavior in organizations and elsewhere. From this perspective, rule following is seen as a virtue and rule violation as a vice. However, recent discussion around the concept of organizational routines has in fundamental ways questioned the adequacy and even existence of mindless, strict routines as the outcome of rule-following. How, then, can rules be used to control routines in organizations at all? We argue that in order to better understand the interaction between rules and routines in organizations, three roles need to be considered: rule maker, rule supervisor and rule follower. Six propositions are developed regarding those roles, the necessary characteristics of rules and routines, and their relationship. Research and practical implications are discussed.

Keywords: organizational routines, rules, organizational control, roles or role behavior

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1. Introduction

Rules are ubiquitous in organizations and beyond. Discussions about the postbureaucratic organization notwithstanding (e.g., Raelin, 2011; Styhre, 2008), they are still widely used as instruments of power, coordination, restraint and guidance – in short, as a lever for controlling behavior in organizations both from within and without. Fundamental questions concern the right kind and amount of rules: How can a trade-off be achieved between prescribing behavior and leaving scope of action? On a system level, this question represents the challenge of balancing standardization and flexibility (e.g., Grote, 2009; Orton & Weick, 1990; Thompson, 1967; Weick, 1976). For managers within an organization, a balance between formal and informal control has to be found (Cardinal, Sitkin, & Long, 2004, 2010). For external actors (e.g, regulatory agencies on a state level), this question can take the form of choosing among different regulatory regimes (Majumdar & Marcus, 2001; May, 2007). Ignoring these fundamental organizational challenges can either bring forth phenomena such as “red tape” and inertia (Pandey & Scott, 2002; van der Steen, 2009), or lead to inefficency and even organizational failure.

In organization theory, rules are discussed as one of several coordination mechanisms and contingencies are proposed for when rules are most appropriate for managing task interdependencies (Okhuysen & Bechky, 2009; Van de Ven, Delbecq, & Koenig, 1976). In most basic terms, rules achieve coordinated behavior through creating a mutual understanding of task requirements, shared expectations, and predictability of work processes. However, when external and internal uncertainties in work processes are high, rules are considered insufficient and need to be complemented by more adaptable forms of coordination, such as direct, personal communication (e.g., Grote, Weichbrodt, Günter, Zala-Mezö, & Künzle, 2009). A separate, though related, research stream has focused on rules as a means for formal organizational control (Cardinal, et al., 2004; Edwards, 1979; Ouchi, 1979, 1980). Formal control is contrasted with informal control through values and norms and configurations for the right balancing between formal and informal control are suggested (Cardinal, et al., 2010). While there is much research

on assumed contingencies of using rules as mechanisms for coordination and/or control (e.g., Juillerat, 2010; Naveh, 2007; Okhuysen & Bechky, 2009; Van de Ven, et al., 1976; Weibel, 2010), the immediate processes through which rules shape behavior are usually not studied.

Instead, the direct effects of rules on behavior are often addressed in the psychological and human factors literatures, not seldom with a special interest in safe performance in high-risk teams or organizations (Battmann & Klumb, 1993; Reason, 1990). Mostly, the appropriateness of rules as a coordination and control mechanism is taken for granted in this literature and the focus is on the antecedents and consequences of rule-following versus rule-breaking (e.g, Bruns, 2009; Lawton, 1998; McDonald, Waring, Harrison, Walshe, & Boaden, 2005; Phipps, et al., 2008; Reason, Parker, & Lawton, 1998). More recently, though, a discussion has been initiated on what constitutes good rules and when rule violation may even be the desired behavior (Dekker, 2003; Desai, 2010; Hale & Borys, 2012; Woods & Shattuck, 2000).

This debate anchors on concerns regarding insufficiently adaptive behavior in the face of unexpected events – which echoes a similar debate in the organizational literature on the benefits and dangers of uniform behavior patterns sometimes termed organizational routines (Becker, 2004; Cohen & Bacdayan, 1994; Feldman & Pentland, 2003; Parmigiani & Howard-Grenville, 2011) or also habitual routines (Gersick & Hackman, 1990). In this literature, the origin of routines, be it through rules or other organizational mechanisms, is mostly disregarded. Instead, the discussion centers on the question of whether routines are bound to be mindless repetitions of the same behaviors or whether they have an inherent potential for adaptation and change (Cohen, 2007; Feldman, 2000; Feldman & Pentland, 2003; Hannan & Freeman, 1984; Howard-Grenville, 2005; Pentland & Rueter, 1994; Weiss & Ilgen, 1985).

In this paper, we will draw on these three literatures (rules in organizational coordination and control; rules in human factors and safety; and organizational routines) in order to more fully investigate the interaction between rules and behavioral routines. While there have been some attempts at grasping the interplay

between rules and routines in fields like accounting (Burns & Scapens, 2000), maintenance work (Reynaud, 2005), or safety (Bruns, 2009; Grote, et al., 2009), a general understanding of how rules can (and cannot) influence collective action in the form of organizational routines is still lacking. In this article, we therefore present a model explaining how rules and routines in organizations can and should interact in order to bring about adequate individual, team and organizational performance in view of continuously balancing stability and flexibility demands (Farjoun, 2010; Grote, 2009). We argue that three roles need to be distinguished - rule maker, rule follower, and rule supervisor - to better understand the multiple relationships between rules and routines. Six propositions on these relationships will be suggested and research and practical implications of these propositions discussed.

2. Organizational routines and their connection to rules

In our understanding of the rule-routine interaction we follow the work by Feldman and Pentland who define rules as formal, written artifacts (cf. Pentland & Feldman, 2005), while routines are defined as "repetitive, recognizable patterns of interdependent actions, carried out by multiple actors" (Feldman & Pentland, 2003, p. 95). Much of the earlier work on organizational routines (e.g., Hannan & Freeman, 1984; Weiss & Ilgen, 1985) emphasized the stability and predictability of routines, and thus saw them as essentially controllable. Difficulties in controlling routines, according to this view, arise when routines are *too stable*: the downside of stability in routines being rigidness and inertia.

Feldman and Pentland (Feldman, 2000; Feldman & Pentland, 2003; Pentland & Feldman, 2005, 2008a) – radically and successfully – challenged this view, proposing that organizational routines can be a source of continuous change. They base their argument on the idea that routines embody a duality of principle and practice. The *routine in principle* is the common understanding or the articulated pattern of a routine. It serves as a normative goal for action and provides a reasoning for what one is doing. As a simple label for a complex action pattern, e.g. "the hiring routine", it can be used as a commonly understood reference. However,

the routine in principle should not be thought of in the singular: among different organizational actors, there may be different understandings of what exactly a specific routine comprises – which is often precisely the reason for introducing formal and unambiguous rules and procedures. Nevertheless, the routine in principle operates as an informal control mechanism – given enough overlap in their understanding of a routine among each individual involved in executing it,. Routines in principle can therefore also be understood as *unwritten rules*, which exist alongside written rules, possibly complementing them or serving as a substitute when there are no written rules, but possibly also contradicting written rules. The *routine in practice* is the behavioral execution of a routine in principle at a specific time and place. In this process, the abstract principle of the routine is adapted to the specific circumstances of a concrete situation. This process also constitutes a source for change within the routine, since small adaptations and interpretations have to be made, potentially changing the pattern as a whole. Routines are thus emerging phenomena: They are not rigid, mindless behavior, but in contrast they constitute an “effortful” and “ongoing accomplishment” (Feldman, 2000, p. 613).

Together with Pentland and Feldman (2008a), we argue that routines are not fully controllable, but can be influenced in a variety of ways, rules being one of them. From this understanding also follows that rules and routines are never fully aligned: Firstly, rules are by their very nature abstract and incomplete; the “void at the heart of the rule” (Bourdieu, 2005, p. 160) has to be filled by interpreting the rule and applying it to the circumstances at hand (Reynaud, 2005). Secondly, the resulting routines are not entirely fixed and stable, but rather incorporate the possibility for variation and change. Nevertheless, rules are meant to establish behavioral routines. In order to achieve an understanding of this apparent dilemma, we argue that several roles are to be distinguished whom we will discuss next.

3. Relevant roles in shaping the rule-routine interaction

We decided to focus on and formulate propositions around organizational roles (e.g., rule *maker* or rule *follower*) building on Katz and Kahn’s (1978) work on the

social psychology of organizations. They framed organizations as systems of roles, norms, and values, while roles are defined as "represent[ing] prescribed or standardized forms of activity" (p. 45). Furthermore, role behavior is described as the "recurring actions of an individual, appropriately interrelated with the repetitive activities of others" (p. 189). These definitions show much similarity to that of organizational routines as repetitive, recognizable patterns of interdependent actions, carried out by multiple actors. Indeed, Dionysiou and Tsoukas (2012) argued that role taking is the individual's part of the execution of organizational (i.e., collective) routines. Because of this proximity of the roles and routines concepts, we chose to build our proposition around the organizational roles specified in the following.

In the rule-routine interaction, three roles, or abstract stakeholders are involved: First there must be someone who creates the rule, a *rule maker*. Secondly, there must be someone whose behavior is to be controlled by the rule, the *rule follower* – who is supposed to follow the rule but may not always do so. A third role, the *rule supervisor*, is defined by being in charge of monitoring adherence to the rule. Together with this role usually comes the power to issue sanctions in cases of rule-breaking, or at least the responsibility and power to report those cases to another authority. These roles may be carried out by the same or by different people who may reside within the same or different organizations. When a self-managing team defines rules for themselves, the team members will act as rule makers, rule followers and rule supervisors. When top management sets standards for all company employees, they act as rule makers and, in as much as the standards apply to themselves, also rule followers. Rule supervision, in this example, may primarily be middle managers' task. Often rules are made by actors and institutions outside of the organization which is to follow the rules, such as regulatory agencies. Supervision of rules may be carried out by these same actors and institutions, for instance in the form of inspections, but supervision may also be delegated to the organization itself and then be carried out by internal rule supervisors.

Rule-making implies an inherent power asymmetry between rule makers and rule followers (e.g., Clegg, Courpasson, & Philips, 2006; Mintzberg, 1983; Morgan,

2006). However, rule supervisors are influential, too: By way of determining whether a certain behavior is within the boundaries of the rule or not, and thus whether or not sanctions are applied, rule supervisors not only enforce rules, but also shape the corresponding routines (Pires, 2011). Rule makers' and rule supervisors' influence on behavioral routines not withstanding, it is the rule followers who establish and shape behavioral routines. They do this by transforming the text of the rule into collective behavior. Established routines "contribute to managing the incompleteness of rules" (Reynaud, 2005, p. 853). Whether or not rules and routines are conducive to individual, team, and organizational performance goals depends on how the relationships between rule makers, rule followers, and rule supervisors are enacted. This is explored in the following, resulting in the formulation of six propositions.

4. Propositions on the rule-routine interaction

An overall view of the rule-routine interaction, the three roles, and the propositions exploring the various relationships is provided in Figure 1 on the next page. The various elements of Figure 1 will be described and explained in the following sections.

4.1. Rule-making: What constitutes a good rule?

Rules are meant to shape and control behavior. They constitute the informational prerequisite to a functioning bureaucracy (Cardinal, et al., 2010; Ouchi, 1980) and can thus help enable efficient and successful coordination of individual actors (Okhuysen & Bechky, 2009). But rules as forms of control also have drawbacks, such as preventing creativity, innovation and individual decision-making when it is necessary (e.g., Dekker, 2003; Rousseau, 1978; Woods & Shattuck, 2000). In order to address these disadvantages, organizations react either by reducing the overall amount and density of rules or by implementing more rules to counteract the shortcomings of the existing rules. Classic bureaucratization theory (e.g., Weber, 1978) argues that formalization has a self-promoting tendency to create more rules,

but Schulz (1998) found that rules do not infinitely "breed" more rules – instead, the production of new rules slows down as more rules are already in place. However, while these results rebut the idea of inevitable regulatory overload, the question remains as to how organizational rule makers can find the right amount of rules (and the right degree of freedom for rule followers, consequentially).

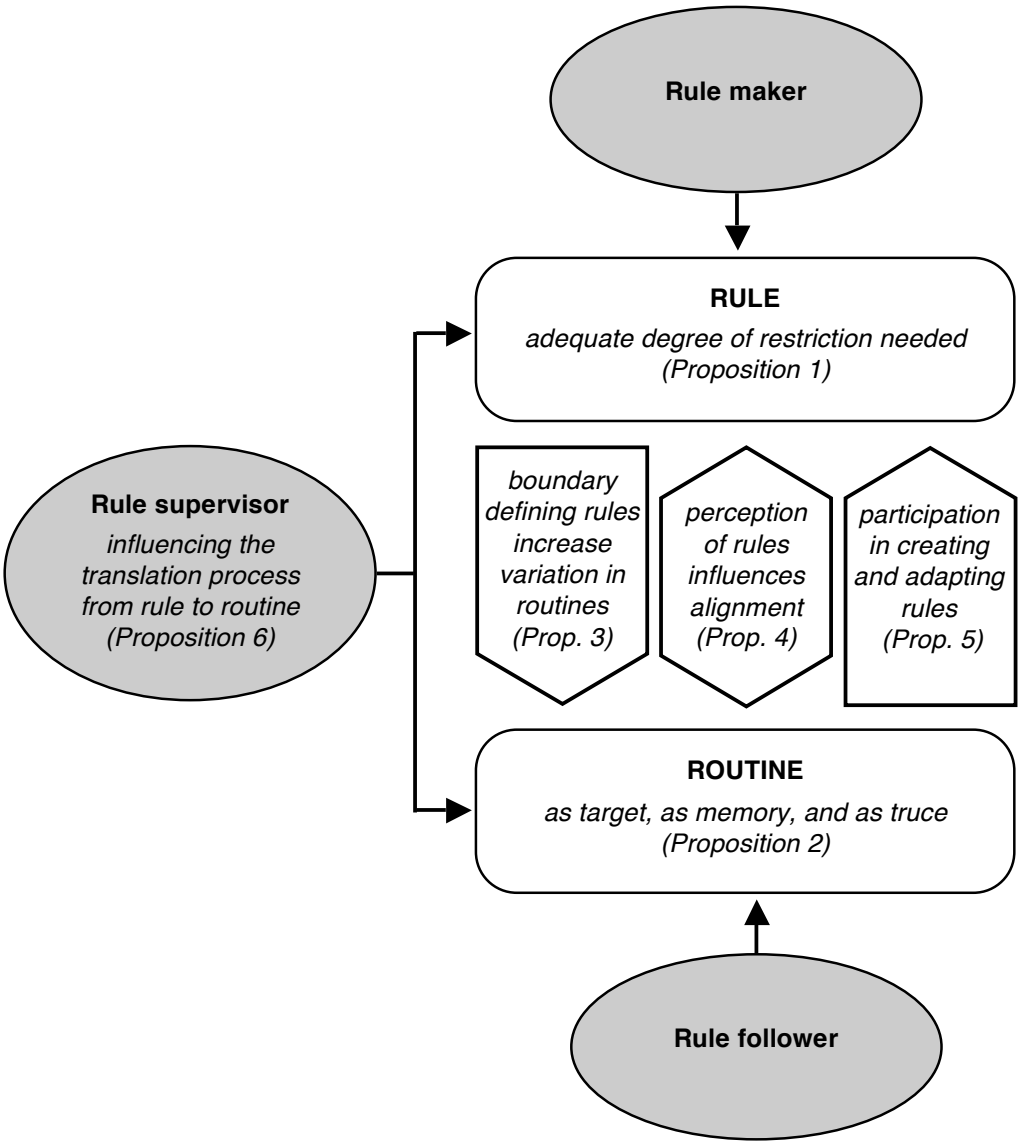

Figure 1: Rules, routines, and relevant roles in organizations

Tackling this challenge over time typically leads to phases of lower and higher levels of formalization in organizations (Cardinal, et al., 2004) – just as on a larger level, western societies seem to go through ups and downs of bureaucratic organization

(Olsen, 2008). Grote (2004, 2009) frames this dilemma in terms of the *management of uncertainty*, for which she distinguishes two general approaches: Uncertainty can either be minimized through central planning and standardization (thereby reducing operative degrees of freedom), or be coped with locally, which requires flexibility by maximizing operative degrees of freedom. She suggests that loose coupling (Orton & Weick, 1990; Weick, 1976) can serve as a principle of balancing standardization and flexibility. For rule makers who aim to control behavior in organizations from outside, such as regulators, the same issue arises and has been framed as finding the right choice among different *regulatory regimes* (Hopkins & Hale, 2002; May, 2007).

Whether by rule makers from inside or outside of organizations, rules are usually designed with a desired routine in mind: Ideally, the most efficient way of how to execute a task, i.e., a specific routine in principle, is translated into a written rule and then communicated to the rule followers. If the initial routine in principle, the idea behind the rule, gets across, they are able to execute the respective routine. In reality, of course, rules and routines do not align so easily (Bruns, 2009; Kieser, 2008; Pentland & Feldman, 2008a). Reasons for misalignment can be manifold, but one issue is often the necessary variation in routines that cannot be captured in the rule. The main recommendation regarding rule design is therefore to leave sufficient leeway for local decision-making. However, depending on rule followers' competence level, the degree of task interdependencies, and the quantity and quality of uncertainties to be handled, tighter rules may be more useful in order to provide sufficient guidance (Grote, et al., 2009). Hale and Swuste (1998) proposed several categories of rules which differ in terms of the restriction they impose. They distinguish rules with respect to the level of action regulation they aim at: Rules can define actions on a very concrete and detailed level (*action rules*); they can serve as search aids by specifying the means needed to come to a decision about the right course of action (*process rules*); or they can just define a goal to be achieved, leaving it up to the individual how to accomplish it (*goal rules*). While goal rules offer the most decision latitude and impose the least restrictions, they at the same time offer little guidance and support. In contrast, action rules are high in both aspects – they support individuals by guiding their action very narrowly, but do this at the cost

of being highly restricting. Hale and Swuste therefore emphasize the balancing function of process rules as a possible compromise between the two extremes. In organizational practice rules tend to always be designed with high levels of restriction, as only those tight rules are considered “proper” rules (Grote, et al., 2009; Hale & Borys, 2012).

We bring together the various perspectives on what constitutes good rules in view of adequately controlling behavior in organizations in the following proposition:

> *Proposition 1. When rule makers design rules with an explicit consideration of the level of restriction to impose, rules will be translated into matching routines more easily.*

4.2. Establishing routines: What constitutes a good routine?

In the work by Feldman and Pentland the inherent nature of routines is discussed, but little is said about how the routines are embedded in broader organizational processes. Beyond describing how efficient routines develop (e.g., Pentland, Feldman, Becker, & Liu, 2012; Pentland, Hærem, & Hillison, 2011) no help is given in determining what constitutes a good routine. Here, Nelson and Winter's (1982) outline of the three functions of routines in organizations is instrumental. They argue that routines can serve as *target* for control, replication and imitation; as *organizational memory*; and as an expression of *truce in intra-organizational conflict*. Depending on organizational conditions, these functions are more or less important for establishing routines that support individual, team, and organizational performance.

Routines as repetitive, recognizable behavior patterns are visible expressions of a shared understanding of correct behavior. Newcomers can be told to follow these routines just as much as they can be told to follow certain rules. Routines are more concrete, though, and may therefore better serve as targets – given that the routines sufficiently align with whatever rules are in place. Especially when no or few rules are in place, the memory function of routines becomes important. When organizational knowledge is not codified in rules, routines are the main storage of

knowledge (Argote & Darr, 2000). Drawing on psychological theories of the memory of skills, Cohen and Bacdayan (1994) proclaimed that routines are stored as *distributed procedural memories*. The function of routines as an expression of truce becomes particularly apparent in case of conflicting goals to be met by the same routine. The truce entails the acceptable range in carrying out a routine, possibly accompanied by accepting small-scale violations of rules the routine is to conform with. One classic conflict is that between quality and efficiency, exemplified in Bensman and Gerver's (1963) analysis of tap use (a tool to "re-drill" holes) in airplane construction: This was "the most serious crime of workmanship conceivable in the plant" (Bensman & Gerver, 1963, p. 590), as this practice bears significant risks for the stability of the airplane's structure. Yet, it happened frequently and even was (unofficially) requested by foremen in order to meet deadlines. The inherent organizational conflict between quality (in this case, stability of the air planes produced – hence the banning of the tap) and productivity (in this case, preventing production delays by occasionally using the tap) was "solved" by the establishment of a routine which entailed some degree of rule violations, but also informal measures to maintain moderation.

Building on the different functions of routines we conceptualize good routines in the following proposition.

> *Proposition 2. Routines support individual, team, and organizational performance if, in view of organizational contingencies, the appropriate function (target, memory, or truce) is served.*

4.3. Rule-following: The duality of support and constraint

Following rules is a way of reducing complexity and simplifying decision-making. In this way, individuals can benefit from organizational knowledge that is codified in rules (Burr, 1998; Kieser, 2008). Rules can thus provide guidance and support for the task one is faced with (e.g., especially for new or very complex tasks). However, rules are also restrictive and one is rarely in the position to choose freely whether or not to follow the rules. Because of their nature as instruments of organizational control (cf Cardinal, et al., 2010; Ouchi, 1979), rules are usually combined with

sanctions for violations. Hence, from the rule follower's point of view, rules have both a *supporting aspect* – by reducing complexity and offering guidance – and a *constraining aspect* – by reducing freedom of action. These two aspects are interconnected: In fact, it is precisely the constraining nature of rules that turns them into instruments of support (Ortmann, 2010; Stinchcombe, 2001). In road traffic, for instance, having to stop at a red light may be considered a nuisance, but at the same time, it is precisely this restriction that enables us to get from A to B without getting into an accident. Nevertheless, from a rule follower's point of view, the constraining aspect may be more pronounced and a reason for resistance and rule violation. Both constraint and support directly influence rule follower's behavior, and thus the enactment of routines: Via the supporting function, rules structure routines, for instance by determining a certain sequence of actions. But the more structure is provided, the less freedom of action remains for developing and changing routines. Rasmussen (1997, p. 191) has argued that "rather than striving to control behavior by fighting deviations from a particular pre-planned path, the focus should be on the control of behavior by making the boundaries explicit and known and by giving opportunities to develop coping skills at boundaries." In this way, rules can be set up in order to clarify boundaries within which routines can vary and change, without leading to a rule violation. This can be achieved, for instance, by using goal and process rules from Hale and Swuste's (1998) rule classification mentioned above.

Depending on the level of detail a rule contains, it covers more ore less of the behavior of the corresponding routine. If, for example, a rule just states a goal that is to be achieved, or prohibits a single certain action, the corresponding routine will be influenced less by that rule than by a rule that prescribes the process in detail. Such a *boundary defining rule*, leaving leeway for the rule followers in the concrete actions to be chosen, can thus lead to more variation in the connected routine while at the same time still assuring alignment between rule and routine. Depending on the circumstances, variability in routines can either be a desirable or an adverse effect: When creativity or innovation is desired, or when rule followers are faced with high uncertainty and frequent unforeseeable situations, a few boundary defining rules can prevent the "red tape" phenomenon and leave rule followers enough

leeway – while at the same time ensuring the minimal standards of the process or production outcomes. On the flip side, more detailed rules will can lead to less variable routines and a tighter coupling between rules and routines, which is usually desired for high-risk tasks with low uncertainty, or for tasks requiring a high degree of coordination (Grote, et al., 2009). At the same time, however, the likelihood of misalignments between rules and routines is also increased due to the small range of permissible behavior. A final important point on boundary defining rules is that leeway offered by them does not automatically lead to a high level of variation in routines: A high level of professional norms and values shared by rule followers can supplement the restriction otherwise imposed by formal rules. Applied to the issue of concrete rules and routines, this means that the "gap" left open by loose boundaries can be "filled" by sufficiently overlapping and detailed routines in principle held by rule followers.

These considerations lead to the following proposition:

> *Proposition 3: Boundary defining rules allow for more variability in the corresponding routines. However, whether such variability occurs or not is dependent on the routines in principle actors hold.*

Independent of the properties of rules themselves, the duality of support and constraint can be a question of how rules in general are *perceived*. The perception of rules depends on characteristics of the rule followers: both individually (e.g., an individual with a habit of questioning authority may have a hard time even with rules that are perceived as supportive by others) and on a collective level, based, for instance, on the values and norms in different occupational communities (cf. Van Maanen & Barley, 1984). In the field of health care, McDonald et al. (2005) showed how the same rules in operating theatres of one hospital were interpreted very differently by people with different professional backgrounds: Doctors tended to play down the importance of written rules, emphasizing the non-routine nature of events in medical care. They believed that experienced doctors can provide the best care using their tacit knowledge. For nurses, on the other hand, following the rules was an important part of their professional ethic. Working by the rule was

regarded as a key element in providing safe and high-quality patient care. The same rules can therefore be seen as primarily restricting by one group of rule followers, and as primarily supportive by another. Additionally, the perception of rules is influenced by the overall bureaucratic scheme in place. Adler and Borys' (1996) concept of an *enabling bureaucracy* stresses the supporting function of rules. In the case of "red tape", that is, ineffective and excessive bureaucratic regulation, rules are perceived purely as constraints that slow down work processes (Pandey & Scott, 2002).

This leads to the following proposition:

> *Proposition 4: When rule followers perceive rules as more supporting than constraining, the likelihood of alignment between rules and routines increases.*

4.4. Reversing the process: When routines shape rules

So far, we have been mostly concerned with the alignments of rules and routines seen as behavior matching a pre-existing rule (based on the understanding of rules as a top-down means for controlling behavior). However, routines may also serve as a source for codifying behavior into new rules (bottom-up). When those who already practice the routine in question take an active role in the process of rule-making, their established patterns of action (routine in practice) as well as their ideas about and concepts of the routine (routines in principle) can help creating better rules. If, for example, an organization wants to get certified in accordance with the ISO 9001 standard for quality management, documented (written) procedures have to be created for quality-critical processes. When the routines that are already established are deemed fit and are thus put into writing to become the required documented procedures, this can be regarded as a case of routines influencing rules. As rule followers can bring in their "expert" knowledge about the routines to be regulated, the ensuing rules will be better suited to the circumstances (cf. Adler & Borys, 1996). Furthermore, Weibel (2007) argued that participation in rule creation supports individuals' need for autonomy and thus leads to greater value

internalization – which in turn further increases alignment between rules and routines.

A further kind of bottom-up process that increases rule-routine alignment is empowering rule followers in adapting ill-suited rules to meet their needs. Frequent deviations may be a sign for a misalignment between rules and routines and constitute a learning opportunity for the organization (Desai, 2010). This essentially means taking rule-violations as a possible instance of “bad rules”, rather than “bad behavior”. Bourrier (1998) analyzed maintenance work in four nuclear power plants. She found in her comparative case study that the workers' compliance with rules was higher when they had influence over adapting the rules system. Changing conditions in the plant lead to workers being “forced” to work against the rules in order to do the right thing when these rules were not adapted quickly. Two of her cases she therefore identified as *self-correcting organizations*: For these, it is typical that procedures can be very easily modified by the people who have to work by them, thus reducing the necessity of rule violations. However, self-correction as a form of organizational learning does not happen automatically. Rather, rules have an inherent drive to keep their validity because of sanctions attached to them: Treating rule deviations as “bad behavior” is the default way of dealing with them. Violations (even well-intended ones) are usually hidden practices, thus actually helping to keep the rules in place. Because of this, effectively involving rule followers in adapting existing rules and giving them opportunity to voice concerns over “bad rules” are necessary for improving rule-routine alignment.

From this the following proposition can be derived:

> *Proposition 5: Participation by rule followers in rule creation and adaptation increases alignment between rules and routines.*

4.5. Shaping routines through rule supervision

By our assessment of the literature, rule supervision as an organizational role is heavily understudied. There are a few publications in fields like regulation or labor studies which highlight the role of regulatory inspectors – i.e., external rule

supervisors (e.g., Piore & Schrank, 2008; Pires, 2011). These authors emphasize the importance of regulatory discretion and relationship building between inspectors and the organizations they are to monitor. However, these studies mainly focus on firm level outcomes and are therefore of limited value to our endeavor of developing propositions about the behavioral side of organizational routines.

Supervision of rules implies observing routines and comparing them with what is prescribed in the rules. Rule supervisors are mainly concerned with the routine in practice: people's actual, observable, also often measurable, behavior. The routine in principle, i.e., the general idea of the routine in people's minds, may play a role, for example, when employees are required to take a test about their knowledge of the rules in place. Rule supervisors can furthermore monitor artifacts, for example protocols or completed checklists that are used as a representation for what people actually did.

Hopkins (2011) analyzed the visit by top management at the Deepwater Horizon oil rig, about seven hours before the disastrous explosion in 2010. Although not the single purpose of this visit, safety inspection was part of it. As such, the group of executives acted as rule supervisors. Hopkins showed that, while they were interested in adherence to rules concerning personal safety (i.e., workplace hazards, or the safety of the employees), they ignored all aspects of process safety (i.e., the safety of the production process; see also Grote, 2012). This choice of focus lead to the tragic irony of the rule supervisors checking safety details like the inspection dates on climbing harnesses – but completely overlooking the larger problems going on on the oil rig, and thereby any warning signs for the blowout. In our terms, this can be seen as a case of supervising the wrong rules (and routines).

Despite such an example of failed rule supervision, the role of rule supervisor entails a great deal of power: the power of ultimately deciding whether or not a particular behavior is in compliance with the rules. In some cases, this power can be used to such an extend as to subvert the original intention behind the rule (e.g., Helin, Jensen, Sandström, & Clegg, 2011). Martin et al. (2012) point out that rule violations can be either contested or permitted by those in charge of enforcement: They can opt to “turn a blind eye”, thus deciding to quietly accept certain behavior that would

normally be considered a violation. In this way, rule supervisors have a great influence on the common understanding of what *exactly* it means to follow the rules and are thus shaping both routines in principle and routines in practice. It is therefore very important for rule makers to work closely together with rule supervisors if they want to use rules as a means for organizational control.

As stated before, knowledge about the precise role of rule supervisors is scarce. Nevertheless, the aforementioned considerations lead us to the following, albeit broad, proposition:

> *Proposition 6: Because of their power to decide whether specific behavior is within the boundaries of the rules or not, rule supervisors have significant influence on the translation process from rules to routines.*

5. Discussion and conclusion

Our goals in this article have been to develop a model explaining the interaction between formal rules and organizational routines by drawing on three independent literatures (rules as organizational coordination and control; rules in human factors and safety; and organizational routines). Bringing together these literatures in the six propositions provides a extensive understanding of how rules and routines interact in organizations – which so far has been lacking in organizational research.

The main challenge concerning rules as a form of control in organizations can be seen from two sides: The overall organizational goal can be viewed as achieving a balance between standardization and flexibility (Grote, 2009), or the formal and informal (Cardinal, et al., 2010), while from the point of view of the individual, rules need to provide the right level of both support and restriction. Because routines are emergent phenomena, incorporating a certain degree of variation and change, finding a continuous balance in these conflicting goals is needed. For this, participation of all stakeholders in rule creation and adaptation is crucial.

This means that organizational roles regarding rules need to be understood in a different way than simple top down control. This concerns the basic assumptions about and expectations from actors assuming the three different roles. Rule makers need to carefully consider the degree of restriction and account for the supportive side of rules (cf. Adler & Borys, 1996). But because no rules system is ever perfect, rule makers need to include both rule supervisors and rule followers in their endeavors: Rule supervisors are needed for adequately communicating the intention behind the rules; they are furthermore responsible for deciding what exactly counts as rule following and as rule violation (see Helin, et al., 2011). Rule followers can provide crucial information about outdated or otherwise inadequate rules (cf. Bourrier, 1998). In this way, rule makers, rule supervisors and rule followers all should strive for achieving a common understanding about how a rule should be followed – i.e., the same routine in principle.

5.1. Research implications

Our propositions should of course be tested empirically. This could be done by comparative case studies, either between different organizations; between different parts of one organization; or between different routines within one organization. For example, the effects of participation in rule creation could be analyzed by contrasting an organization which has established means and procedures for this with a similar one that does not. And studying different departments (or different professional cultures) within an organization should bring about results on the differences in rule perception and routines. Organizational ethnography could provide insights regarding our propositions about the effect of boundary defining rules and about the influence of rule supervisors. All of these endeavors, however, face the challenges inherent in studying routines. While rules as artifacts can be analyzed fairly easily, routines are often more difficult to research. Pentland and Feldman (2008b) have discussed issues in empirical studies of routines: In short, one can focus on the routine in practice (e.g., by participant observation), or on the routine in principle (e.g., by means of surveys or interviews), or on artifacts as products or by-products of routines (e.g., by analyzing log files).

Future research on the subject matter should also investigate further factors that potentially shape the interaction between rules as artifacts and routines as patterns of behavior: For example, the role that organizational culture plays in this is so far understood only very little. It is also reasonable to assume that training and education about rules have an impact on how they are carried out – thus shaping routines. Finally, a more detailed look at the rules itself can prove fruitful: More fine-grained categorization systems of rules can be used to better answer the question of what type of rule is best suited for a certain routine.

5.2. Practical implications

Our propositions do not only advance the academic debate about rules and routines. They can also support organizational actors in achieving and maintaining a balance between formal and informal measures of control by preventing "overzealous re-balancing efforts" (Cardinal, et al., 2004, p. 425) and instead foster incremental change. Issuing rules in order to shape organizational routines in a top-down fashion may seem tempting for rule makers – and in some cases it may function well. But all rules have to be "translated" into concrete action in the form of organizational routines, and because this translation process allows for variation, the outcome is not entirely predictable. Furthermore, violations of rules are not always a bad thing: They can be seen as opportunities for improving the rule system. But for this to take place, rule followers must be able to participate in the process. Rule supervisors therefore face the challenge of identifying not only rule violations but also faulty rules. Separating the roles of rule maker and rule supervisor can help prevent over-regulation, when rule supervisors not only focus on rule followers' behavior, but also remain critical of the rules themselves.

5.3. Conclusion

When trying to achieve control in organizations by means of rules, one has to accept the fact that organizational routines are only partially controllable. However this limitedness of rules as organizational control should not lead to creating ever more rules. Instead, differentiating between different roles in the rule-routine

interaction process and re-defining those roles in light of participation, explicit consideration of the restrictiveness of rules, and the constant aim for a shared routine in principle among all organizational actors, can help achieve a balance between standardization and flexibility – ultimately leading to better alignment between rules and routines.

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Scientific Paper 2:

When the formal and the informal do not align: Exploring the rule-routine relationship in three fields of work in the railroads

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How do formal rules function as measures for controlling organizational routines? While research on organizational routines has been thriving in the last decade, a clear understanding on how they can be steered and controlled is still lacking. Drawing on literature on rule violations and organizational control, we view rule violations as misalignments between formal rules as artifacts and organizational routines as collective patterns of action. In order to understand how organizational routines can or cannot be controlled, we studied rules and routines in three fields of work within a railroad company (shunting, signaling, and construction and maintenance) focusing in particular on four cases of contested rules (i.e., rules that are often bent or broken). By mapping out these rules and routines in detail, we show how actors' routine in principle (i.e., the shared understanding about how exactly the rules should be followed) can diverge from envisioned processes. The routine in principle, we furthermore demonstrate, is therefore the key to managing routines through rules. Additionally, we found how different ways of sensemaking of rules can lead to vicious or virtuous circles of rule violations and rule change. The paper contributes to literatures on organizational routines and organizational control by suggesting an integral understanding of rule-routine interactions. Practical implications for formal rules as measures for organizational control are also discussed.

Keywords:
organizational routines, rules, rule violations, organizational control, field study

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1. Introduction

Formal, written rules are an essential aspect of many organizations, as they are used as a means for achieving organizational control (Cardinal, Sitkin, & Long, 2004; Ouchi, 1980). More precisely, they are usually meant to create and shape organizational behavior in the form of organizational routines (Feldman & Pentland, 2003; Pentland & Feldman, 2005). Through prescribing processes by means of formal rules, it is hoped to streamline human action and interaction, reduce errors, and achieve alignment with regard to overall organizational goals (Cyert & March, 1963; Thompson, 1967). In particular, organizations in high-risk domains – aviation, power generation, medicine, or the railroads – depend heavily on standardized processes in the form of rules and regulations for safety and quality control. Following or not following a rule in such organizations can be a matter of life and death. However, in addition to formal rules, many other forces shape individuals' behavior as well. For example, shared norms and beliefs as part of organizational culture function as informal forms of organizational control (Cardinal, et al., 2004; Schein, 1992), and play a vital role in assuring high reliability (Weick, 1987). Organizational routines, defined as "repetitive, recognizable patterns of interdependent actions, carried out by multiple actors" (Feldman & Pentland, 2003, p. 95), are themselves another important force that influence individual and collective behavior in organizations. Because of their inherent processual nature as patterns of action (Becker, 2004; Cohen & Bacdayan, 1994; Pentland & Rueter, 1994; Schulz, 2008), and their overall importance to organizational performance (Cyert & March, 1963; Nelson & Winter, 1982), routines are especially interesting with regard to organizational control.

Research on organizational routines has been thriving during the last two decades (Becker, 2004; Parmigiani & Howard-Grenville, 2011). Innovative conceptualizations have captured routines as interwoven with technology (D'Adderio, 2008; Labatut, Aggeri, & Girard, 2012), flexible (Howard-Grenville, 2005), and a source for both stability and change (Feldman, 2000; Feldman & Pentland, 2003; Pentland, Hærem, & Hillison, 2011; Rerup & Feldman, 2011). Overall, the concept has become an

important and promising approach to understanding how organizations function. However, it is still not clear exactly how routines can or cannot be designed, controlled or otherwise influenced by management (Lazaric & Denis, 2005; Pentland & Feldman, 2008a). In this paper, we want to specifically focus on and develop the understanding of the relationship between formal rules and organizational routines. We use the term "rule" to refer exclusively to formal and written rules (e.g., procedures, regulations, checklists or other documentation of processes), which can thus also be seen as artifacts (Pentland & Feldman, 2005). Routines may or may not be coupled with formal rules, but for rules to function as a measure of organizational control, there must be an organizational routine connected to it. We furthermore build on Feldman and Pentland's (2003) conceptualization of routines as incorporating both an ostensive and a performative aspect, or *principle* and *practice*. According to Feldman and Pentland, a routine exists both in principle (the ostensive aspect, or the general idea or shared representation of how it typically is carried out) and in practice (the performative aspect, or the execution of a routine in a specific situation). Both aspects necessitate each other and give rise to the possibility of variation and change (Feldman, 2000; Parmigiani & Howard-Grenville, 2011). As routines in principle are not just neutral descriptions of routines, but rather work as guidance and referral, they are a form of informal control (cf. Cardinal, Sitkin, & Long, 2010). Given this understanding, and taking into account the extensive literature on informal organizations (e.g. Meyer & Rowan, 1977), it becomes clear that the influence of rules on routines is limited, and that rule violations (viewed as rule-routine-misalignments) need to be understood as naturally occurring phenomena. Although well worth aiming for, expecting perfect alignment, all the time, between a written rule, actors' shared understanding of it (routine in principle) and their actions (routine in practice), is a mistake.

Misalignment between rules and routines can actually be a good thing: Numerous scholars have studied the positive side of rule violations (e.g. Dahling, Chau, Mayer, & Gregory, 2012; Morrison, 2006; Olin & Wickenberg, 2001; Warren, 2003). When rules are no longer appropriate because circumstances have changed, deviating from them can be in the organization's best interest (Desai, 2010). Rule violations can also mean taking a shortcut in the organization's interest, for example, in order

to meet production goals (Bensman & Gerver, 1963) or simply trying to help out co-workers or customers (Morrison, 2006). Hence, rule violations happen for more reasons than just ignorance or bad intentions, and they can be an important information to rule-makers that their rules need adjustment.

However, giving up the idea of perfect alignment between formal rules and organizational routines certainly does not mean that there is no connection between them. In fact, rules without routines would be just abstract, meaningless text, for “it is through routines that rules operate” (Reynaud, 2005, p. 866). Nevertheless, the precise nature of the relationship between rules and routines is still only partially understood. As Heimer (2008, p. 45) argued: “rules ... do in fact have some effect, but it is neither exactly the instrumental effect their writers intended nor the symbolic or political effect that we might expect if rules were fully decoupled from practice.” Following from this, the questions we answer in this article are: How do rules work as instruments for controlling routines, given that routines themselves constitute a form of (informal) control? More generally, how can the relationship between rules and routines be described conceptually with regard to organizational control?

In order to shed light on the issues raised above, we decided to research rules and routines in the field. We turned to a traditionally highly regulated organization: the railroad. In trying to better understand the relationship between rules and routines, we focused on the limits of rules as measures for organizational control. As our reasoning was that this relationship becomes most clear when routines drift off from rules, we therefore specifically studied small-scale and everyday rule violations. Additionally, we interviewed railroad employees on their understanding and handling of rules in order to understand the underlying processes of sensemaking. We made these investigations in three distinct fields of work within the railroad: shunting (movement of rail cars in stations or shunting yards); construction and maintenance (building and repairing tracks, electric lines etc.); and signaling (train traffic control). We found that routines drift off from rules when actors need to integrate competing reasonings (i.e., goals or norms other than the rationale behind the formal rule). These competing reasonings become apparent in actors’ routine in

principle (their shared idea of how to execute a routine) and its difference from the rule-maker's routine in principle that guided the creation of the rule. Different ways of sensemaking of rules can furthermore lead to vicious or virtuous cycles of rule violations and rule change. Our results contribute to the routines literature (e.g. Becker, 2004; Feldman & Pentland, 2003; Nelson & Winter, 1982; Parmigiani & Howard-Grenville, 2011; Pentland & Feldman, 2005) and to concepts of organizational control (Cardinal, et al., 2004, 2010; Ouchi, 1979, 1980), and at the same time provide organizational practitioners (in particular, rule-makers) with support for better rules management.

2. Theoretical Background

2.1. Rule violations and organizational control

Rules are a necessity for large organizations (March & Simon, 1958; Thompson, 1967; Van de Ven, Delbecq, & Koenig, 1976), and for high-risk systems in particular (Hollnagel, Woods, & Leveson, 2006; Hopkins, 2011). Such rules may prescribe human action down to the smallest detail, or allow for great discretion by only giving a broad goal to achieve (Hale & Swuste, 1998). Nonetheless, it is a well-known fact that violations of rules do occur. Brunsson and Jacobsson noted that "extensive research on individuals and organizations has shown that there may be substantial differences between presentation and practice, between formal structures and actual operations [...]. This is a phenomenon which standardizers seldom appear to notice, or at least seldom discuss seriously in public." (Brunsson & Jacobsson, 2000, p. 130). In other words, formal rules and behavioral routines are naturally not always in perfect alignment. Although to some degree organizations can achieve alignment through command and control, or surveillance and sanctioning, this top-down form of control obviously has limits.

Not only is it a question of costly resources to monitor all employees at all times; sometimes, rule violations may actually be beneficial to the organization. Although some rule violations certainly occur because of ignorance, negligence, or even

harmful intent, other violations, however, can be considered "necessary" to ensure productivity and efficiency. Organizational and management literature has been somewhat divided on how rule violations are perceived (Warren, 2003). While many researchers have focused on the harmful side of deviance (e.g. Burby, May, & Paterson, 1998; MacLean & Behnam, 2010; Phipps, et al., 2008; Robinson & Bennett, 1995; Tyler & Blader, 2005), some have studied how rule violations can be beneficial to coworkers, customers, or other organizational stakeholders (Bensman & Gerver, 1963; Dahling, et al., 2012; Morrison, 2006) or how rules being broken can be an indicator for necessary change (Desai, 2010). Others have taken a somewhat neutral stance (e.g. Bruns, 2009; Iszatt-White, 2007; McLean Parks, Li, & Gallagher, 2010; Reason, Parker, & Lawton, 1998; Warren, 2003) and highlighted both possible beneficial and detrimental aspects of rule violations.

Based on the management science tradition, Cardinal, Sitkin and Long (2010, pp. 56-57) defined organizational control as "any process whereby managers direct attention, motivate, and encourage organizational members to act in ways desirable to achieving the organization's objectives." They furthermore distinguished between formal (e.g., written rules or directives) and informal control mechanisms (e.g., values, norms or beliefs), which can target inputs, behaviors and outputs of organizational processes. Formal rules are thus measures of formal control, mostly targeted at behaviors of individuals. The somewhat dubious "necessity" of rule violations discussed above then forms the core limitation to organizational control by means of formal rules. Thus, Cardinal and colleagues have rightfully argued that a balance must be found between formal and informal forms of control (2004, 2010). In medical facilities, Katz-Navon, Naveh, and Stern (2005) accordingly found a curvilinear relationship between the perceived amount of formal procedures and treatment errors. A well-known symptom of an imbalance towards too much formal control is the phenomenon called *red tape* (Pandey & Scott, 2002), which has been described as comprising "impressions on the part of managers that formalization (in the form of burdensome rules and procedures) is detrimental to the organization" (Pandey & Kingsley, 2000, p. 782). On a more abstract level, Grote (2004, 2009) has framed the dilemma in terms of the management of uncertainty: organizations need to find a balance between reducing uncertainties through central planning and

standardization and providing local actors with flexibility and other opportunities for coping with uncertainties.

But how can organizations achieve and retain this balance in practice? Terms like "red tape" may help identify excessive bureaucracy, but they do not provide much support for avoiding it in the first place. It is unlikely that red tape is created intentionally – or, as Waldo (1946, p. 399) phrased it: "one man's red tape is another man's system." The degree of control that rules supposedly provide may be alluring to rule-makers (Cropanzano & Byrne, 2001). Rule systems can make perfect sense on paper, but not so when faced with practical demands. Because rule violations, even "necessary" ones, are usually hidden practices, the defects of the rule system may not come to light. What should rule-makers then do in order to achieve and retain the right degree of formal control? We argue that in order to achieve such a balance, it is helpful to conceptualize the question in terms of the relationship between rules as artifacts and routines as patterns of action.

2.2. Rules and organizational routines

The understanding of rules as artifacts connected to organizational routines has been developed most prominently by Feldman and Pentland (Feldman & Pentland, 2003; Pentland & Feldman, 2005, 2008a). Their conceptualization of organizational routines accounts for both an ostensive aspect (*routine in principle*) and a performative aspect (*routine in practice*) of organizational routines. The former is the abstract idea actors have about a routine — how it typically is carried out in their view. Feldman and Pentland emphasized that the routine in principle should not be conceptualized in the singular (Pentland & Feldman, 2005, p. 797), as there may be multiple and differing ideas and representations about a single routine. The routine in practice pertains to the execution of a routine in a specific situation at a specific time. According to Feldman and Pentland, the principle of a routine needs to be carried out in practice in order for a routine to actually exist. The routine in principle works as guidance and reference and thus has a normative function. The process of repeatedly applying the principle to situations at hand, and thus "performing" a routine, is, on the one hand, necessary to keep a routine "alive", but on the other

hand it also constitutes a potential for change. Because the abstract principle must be applied to concrete (and possibly changing) situations, these micro-adaptations in practice constitute an opportunity for changing the principle and thus the whole routine. This continuous cycle of routine enactment allows for endogenous change of routines.

Feldman and Pentland further expanded their conceptualization by integrating artifacts (Pentland & Feldman, 2005, 2008a). Organizational artifacts relevant to routines can be, for example, infrastructure, furniture, apparel, technology, software and formal rules. Artifacts are also considered a key component of organizational culture, which can convey organizational values (Schein, 1992). However, an artifact by itself does not contain a single, coherent meaning, as meaning is created in a process of collective sensemaking (Rafaeli & Vilnai-Yavetz, 2004; Weick, 1995). Pentland, Hærem, and Hillison (2010) showed how the same artifact (in their case, accounting software) leads to significantly different organizational routines in different organizations.

Regarding rules, Reynaud (2005, p. 866) studied the connection between rules and routines in a French Metro Workshop and concluded that rules are “arrangements awaiting interpretation”, while routines are “rules already interpreted.” This means that we must take into account the meanings people ascribe to rules. How they are made sense of affects the connected routines. But as there can be different cultures within the same organization, there can also be different meanings for rules. Many authors have highlighted the inter-group differences in organizational culture (e.g. Bechky, 2003; Van Maanen & Barley, 1984) but only some have so far studied differences specifically in the perception of rules (e.g. Bax, Steijn, & De Witte, 1998; McDonald, Waring, Harrison, Walshe, & Boaden, 2005).

Sensemaking of artifacts can occur on three different dimensions: aesthetic, instrumental, and symbolic (Rafaeli & Vilnai-Yavetz, 2004; Vilnai-Yavetz & Rafaeli, 2006). *Aesthetics* relate to our sensory reaction to an artifact and concern the question whether or not we find an artifact visually (or audibly, etc.) appealing. *Instrumentality* is about the usefulness of an artifact, or more precisely, “whether or how artifacts support or hamper desired activities” (Rafaeli & Vilnai-Yavetz, 2004, p.

673). A lot of research in the human factors tradition is concerned with the question of instrumentality of artifacts (e.g. Howell, 1994; Nielsen, 1994). Lastly, *symbolism* "regards the associations elicited by an artifact" (Rafaeli & Vilnai-Yavetz, 2004, p. 673). Through the symbolic dimension, artifacts can carry a rich body of meanings and messages (Hatch, 2006; Schein, 1992).

When applying the three dimensions of artifact interpretation to rules, the instrumental dimension is probably the most important. Rules are usually created, taught, used, and referred to in such a way as to steer human action. The degree of detail with which they cover a routine can vary (Hale & Swuste, 1998). A checklist (e.g., for washing one's hands in a hospital's operating room) would be an example of a rule that is instrumental for a single specific routine. Other rules can be of general guidance, giving only a broad goal to achieve. They can apply to many different routines and are less instrumental. However, instrumentality is also subjective and can be assessed differently by different organizational members. For example, rules mandating the use of personal protection equipment like helmets or goggles may be judged useful by safety officers, but may be seen as an unnecessary hindrance by workers. Rules furthermore have a symbolic dimension. They can, for example, stand for oppression, for mindless bureaucracy, or instead for support and helpful guidance (cf. McDonald, et al., 2005). But when actors view rules as irrelevant and inconsequential, they have no symbolic meaning at all. Lastly, only a few possibilities for the aesthetic interpretation of rules are conceivable, if – as we suggest – the rule text is viewed as the relevant artifact (rather than, for example, an actual rule book). Although it might be possible to have sensory reactions like "beautiful" or "ugly" to rule text, rules presumably work much more strongly as instruments and symbols. Following Heimer (2008), we therefore decided to focus only on the instrumental and the symbolic interpretation of rules for the purposes of this study.

For managers, artifacts, such as rules, are often much more easily changeable than routines. When actors' interpretations and their routines are not taken into account it can be a cause for organizational conflict (Burns & Scapens, 2000; Pentland & Feldman, 2008a; Rafaeli & Vilnai-Yavetz, 2004). Hence, as artifacts are dependent

on sensemaking and interpretation, their ability to steer organizational routines is limited. In this paper, we will show that it is precisely the routine in principle which is the key to managing the limitedness of organizational rules: Behind every written rule, there is a routine in principle envisioned by the rule-maker, a particular way of doing things that is supposed to become the regular way of doing things. As Feldman and Pentland (2003, p. 110) wrote, "To the extent that individuals internalize the managerial version of the ostensive aspect of the routine [i.e., routine in principle], overt monitoring and enforcement may be unnecessary." As rules are abstract by nature, only a fraction of this envisioned routine in principle can be encoded in a written rule. For routines to emerge, rule-followers need to come up with their own routine in principle (and in practice, of course), which may or may not be identical with the rule-maker's one, and which may differ between different organizational sub-groups. Furthermore, routines in principle are not neutral descriptions, but rather work as guidance and referral (Feldman & Pentland, 2003). Therefore, they are in part normative, and as such a form of informal control (cf. Brown & Lewis, 2011). Ideally, the rule-maker's routine in principle, the written text of the rule, the rule-followers' understanding of it (their routine in principle), and their actions (routine in practice) should somehow be in alignment. When there is misalignment between these aspects, organizational control is diminished. Rule-makers can try to get rule-followers "back in line" by supervising their routines and sanctioning deviations. But, as pointed out above, firstly this form of top-down surveillance and control is resource intensive, and secondly it may mean missing opportunities for improvements if the rule-followers have good reasons for their diverging routines. The question is then how to distinguish between "bad routines" (i.e., rule violations because of negligence or ignorance) and "bad rules" (i.e., necessary rule violations because of ill-suited rules).

2.3. Research motivation

As numerous studies on rule violations in organizations have shown, we must accept that alignment between rules and routines as described above is an ideal that firstly is not trivial to accomplish and secondly may mean missing opportunities for necessary change. Developing our understanding of the relationship between

formal rules and the actual organizational routines is therefore crucial for developing organizational control theory. Current literature acknowledges that rules, although they can contain descriptions of them, are separate from routines (Desai, 2010; Kieser, 2008; Pentland & Feldman, 2005) and that rules must be interpreted in a process of sensemaking in order to become routines (Reynaud, 2005). But we do not yet really understand the workings between the formal layer of rules and regulation and the informal layer of rule-followers' interpretation and their routines. How do the forces behind formal rules as control mechanisms interact with other forms of (informal) control, namely organizational routines? Furthermore, differences in sensemaking and ascribing meaning within an organization (e.g. among different professional groups) have to be accounted for. Our core interest for the field study was therefore to analyze how routines are tied to rules, how rule violations can be explained in terms of a rule-routine relationship, and how rules are made sense of differently by different professional groups.

3. Methods

3.1. The setting

Stretched over large geographical areas, railroad organizations have traditionally relied heavily on formal rules as a means for coordination (Chandler & Salsbury, 1965). Although today, more direct forms of communication and coordination are available, they are still highly regulated (Grote, Weichbrodt, Günter, Zala-Mezö, & Künzle, 2009; Hale & Heijer, 2006), if not over-regulated, as some have argued (Amalberti, 2001). For our case study, we thus selected three fields of work within a European railroad company. Including different fields of work enables us to widen the scope of possible routines to study. Based on results of a prior study (Grote, et al., 2009), we chose the fields of shunting, construction and maintenance, and signaling. The rules we studied were all safety rules, identified as such by field informants. This choice was made because, for safety rules, the issues around rules as organizational control are especially pinnacled: In extreme cases, following or not following rules can be a matter of life and death, both for employees and for

passengers. When concerned with safety rules, it is important to distinguish between process and personal safety (Grote, 2012; Hopkins, 2009): *Process safety* is the safe achievement of the primary work task (e.g., safe transportation of passengers, or curing patients in a hospital). Breaches of process safety may or may not pose a risk to organizational employees. In contrast, *personal safety* concerns the health and safety of human operators executing the primary task. For example, wearing a helmet on a construction site can protect the worker, but is otherwise unrelated to the goals of construction work. Process and personal safety can be intertwined: For instance, pilots or train drivers put their own life just as much as passengers' lives at risk, and wearing latex gloves protects both medical staff and patients. In the following, we describe the three fields of work in more detail.

Shunting entails the task of taking apart and assembling trains. Many tasks involve manual labor, such as the coupling and decoupling of rail cars, and much of it is routine work. Shunters almost always work outside and they often work at night (e.g. assembling and preparing trains for the next morning). Shunting is an inherently dangerous activity (Elms, 2001; Lawton, 1998): Workers have to deal with both personal safety (e.g., risk of getting caught between rail cars or getting run over by trains) and process safety (e.g., when accompanying trains or simply correctly connecting and checking a train's brakes).

At the railroad company studied, both construction of new and maintenance of existing infrastructure are done by the same department. Work is organized in teams of different sizes and most teams work with a designated lookout, whose job is to forewarn about approaching trains and who also has some oversight over safety. Although he or she is not allowed to do other work, the lookout is typically regarded as a member of the team. Most workers in construction and maintenance are male, but some women work as lookouts. The vast majority of tasks has to be carried out at night, when rail lines are closed. For construction and maintenance workers, almost every work site is unique, so there is less routine work than in shunting. Risks are omnipresent in this type of work: For example, trains are passing by work sites at high speeds, and high voltage lines have to be dealt with.

Risks concern both personal and process safety, often interconnected. Sanne (2008) studied railway maintenance in Sweden and found that risk-taking is an inherent part of the job in order to make things work.

Signaling work is quite different from shunting and construction and maintenance. Signalers, sometimes also called dispatchers or controllers, manage the ongoing train traffic within a station or a specified geographical area. A large part of this task is automated: Trains on schedule are normally assigned a track and given the right signals automatically. Signalers have to monitor this activity and step in in cases of delays or unscheduled trains. Their job also entails closing off a track for shunting maneuvers or maintenance work. Signalers' two main activities are operating the train control system via PC terminal and communicating (with each other, with other control centers, with train drivers and with personnel on the tracks). They usually deal with interconnected personal and process safety (e.g., train traffic around construction sites, which poses risks to track workers, passengers, and the whole system), but they are not involved in the risks themselves.

3.2. Data collection and analysis

Researching routines means studying both cognition (routine in principle) and behavior (routine in practice). Sometimes it is easier to talk about routines and sometimes they are more accessible through observation (Pentland & Feldman, 2008b). We therefore used a mix of semi-structured interviews and observation in a manner typical for field studies (Eisenhardt, 1989; Locke, 2011; Yin, 2003). Observation was non-participant, insofar as the researcher (the first author of this paper) did not assume any other roles in the field (but did "participate" by going through a basic safety training, wearing safety gear on the site, accompanying workers and talking with them about what has happened, etc.). For the interviews, a guideline was used, covering the following topics: the types of rules relevant for the interviewees; their perspective on the function and meaning of rules for their daily work; and their experience regarding conflict around rules and supervision and sanctioning of rule-related behavior.

Twenty field visits and 33 individual interviews were carried out. Interview partners were employed at different organizational levels (department chiefs, team leaders, regular workers). In shunting, three team leaders, one person responsible for quality control, and seven shunters took part; in construction and maintenance, three department chiefs or deputies, five team leaders or foremen, and four workers participated; and in signaling, two station managers and eight signalers were interviewed. Interviews were carried out in German. They lasted between 20 and 100 minutes, with a mean of 38 minutes, and were all recorded and later transcribed. Quotes selected for this paper were later translated into English.

Throughout the course of the study, interview data was used to identify cases of contested rules. Participants were explicitly asked to identify difficult or conflicting rules, i.e., rules that are difficult or impossible to adhere to. Together with contacts in leading positions in each of the three fields of work, arrangements were made to be able to observe these cases in daily organizational life. During each of the field visits, the first author of this paper accompanied a team of workers for half a day up to a complete shift: Five half-days each in shunting and signaling, and two half-days and four complete night shifts in construction and maintenance were spent observing employees at their everyday work, focusing especially on the execution of safety rules. Short and informal interviewing took place whenever possible, mostly in order to understand the nature of the work and the safety issues of a particular work process. Extensive field notes were taken. The researcher always introduced himself as “from the university doing a study on safety rules, and in no way there to report them to their supervisors.” Participants (both during interviews and observation) were thus always assured anonymity, although not in writing. The whole approach to the field study was in accordance with the railroad company’s management, who hoped to obtain novel insights from such an independent, external research project. The company did not pay for the study. In exchange for granting access, results were reported to a standing safety committee at the highest level of the organization after data collection and analysis were finished. For this report, all results were anonymized so that no specific individual could be identified. Although results could have been traced back to the team or department level, the rail company was not interested in doing that. They knew that some rules

were not being followed all the time – they wanted to understand why and what to do about it on an organizational level.

This "non-persecutive" approach was an important principle for both researchers and railroad managers throughout the project, which is why we estimate the influence of the researcher's presence on the railroad employee's behavior (especially concerning following rules) as insignificant. As an indication of this, numerous small-scale rule violations could be observed, which the workers in many cases did not even comment on. One team leader in maintenance work even stated, after the researcher emphasized that he is not there to report them: "That wouldn't matter. It is like it is."

During the course of the field study, four cases of contested rules were selected for a detailed analysis. For each of the cases, the formal rule, the routines in principle (both from a rule-maker's and the rule-followers' point of view) and the routine in practice were identified. Documents containing the formal rules were obtained either from publicly available regulation or from field contacts. The intentions behind the rules (i.e., the rule-maker's routine in principle) were derived from interviews and field conversations with department managers, team leaders and foremen. In the same manner, workers' perspective and interpretation of the rules were identified in the interview and observational data, applying communicative validation (Kvale & Brinkmann, 2008; Stracke, 2009). The routine in practice became visible during observations, backed up by informal inquiries (e.g., whether workers' present way of doing things was typical or unusual). During analysis, all of these five aspects were then contrasted with each other. In this way, different reasonings which were in conflict with the procedure described in the written rule (and envisioned by the rule-maker) could be identified and mapped out in their relation to the rule and routine.

In a second step, all interview data was later examined, using a form of Qualitative Content Analysis (Mayring, 2005), in order to understand actors' sensemaking of rules. Four categories concerning actors' perception of rules and rule-related practices were used, namely the function of rules (i.e., their purpose and intention), the meaning of rules (in what way do they make sense to actors), the supervision of

rules (e.g. through surveillance and sanctioning, or peer supervision), and conflict around rules (e.g. rules vs. productivity). All interview transcripts were searched and coded for instances from all four categories. The resulting codes were then further condensed towards the two selected dimensions of artifact interpretation, instrumentality and symbolism (Rafaeli & Vilnai-Yavetz, 2004). For example, most codes relating to actors' perception of the function of rules and to the meaning of rules could be linked to instrumentality and symbolism, respectively, while instances of conflict around rules could provide insights regarding both dimensions of artifact interpretation. The end result of this process was the formulation of a single, aggregate description of sensemaking of rules for each field of work and each dimension. Interview citations representing these descriptions were then selected in order to highlight the identified different ways of sensemaking.

4. Findings

4.1. Competing safety priorities: The case of the coupling sequence

We encountered the first case of a contested rule in the field of shunting. When asked about rules which are sometimes difficult to follow, several shunters mentioned the coupling sequence, which involves the very common task of manually coupling two rail cars with a buffer-and-link coupler: A heavy metal link on one car is to be lifted and placed over the hook on the other car. Furthermore, pneumatic tubes and electrical cables for brakes and lights have to be connected. When two cars are to be coupled, the formal rule specifically requires workers to first attach the mechanic coupling, then the pneumatic connections, and then any electrical connections. For uncoupling, the sequence is prescribed in reverse. The reasoning behind this sequence (the rule-maker's routine in principle) is not explained in the rules, but team leaders in the shunting division explained that the aim is to make rail cars running loose as unlikely as possible by always connecting them with the most reliable link first. Accordingly, an exception in the official rules states that deviation from the prescribed sequence is permitted only if both cars are secured using other means (e.g., both cars are backed up by a locomotive).

During field visits, shunters could be observed deviating from this sequence quite regularly (without taking the required precaution against runaway trains), and they were frank in reporting on their actions:

> Shunter #6: “According to the prescribed sequence, I have to hook up the metal coupling first and the pneumatic tubes afterwards. But this means I have to bend down underneath the coupling in order to connect the tubes. And I have to do that twice, once going in and once going out. And I am fairly tall, you know, so that’s not very good for my body. So whenever the cars are standing absolutely still, I apply some common sense and connect the tubes first, and then the coupling.”

> Shunter #3: “When you have to uncouple a car, the coupling should be the last thing you disconnect. But the problem then is, you have to go down underneath it and that’s not very good for your health, you understand? So most people don’t care about the rule, although everybody knows it. [...] But they do it [work against the rules] because of their health and safety, because it’s simply damaging your back.”

Doing the procedure in the prescribed way is a strain on the back, so it is quite common to change the sequence and first connect whichever is farthest away from them and then work their way back towards the starting point. This way, they can operate each connection at a comfortable level and while standing.

A team leader also explained his view on this issue:

> Interviewer: “Are there rules that are broken often or maybe not adhered to all the time?”
> Shunter #11: “Yes, there are. Like the example of the coupling sequence I told you about earlier: People just connect the tubes first – even I do it sometimes, I admit it. It’s just easier.”
> Interviewer: “So that doesn’t get sanctioned every time?”
> Shunter #11: “No, we don’t put much emphasis on that. Because at some point, you have to start using common sense, I tell myself.”

In this example, the routine in principle guiding the rule-maker was this: To bring down the risk of rail cars running loose to an absolute minimum, cars should always be coupled in the most reliable way first (prioritizing process safety). Shunters, however, have a different reasoning: While runaway cars are of course a concern for them, they are also worried about the strain which their work is putting on their

bodies. Therefore, they often "apply some common sense" and (after a rough estimate of the actual risk of cars running loose) prioritize their personal safety and well-being. Altering the sequence of the coupling procedure reduces the risk for acute and chronic back problems. Thus, their routine in principle weighs in personal safety as a *competing reasoning* and is thereby differing from the rule-maker's routine in principle for how the routine should be carried out. Since shunters are not supervised all the time with regard to this issue and even team leaders apparently share their reasoning, a different routine (in principle and in practice) could develop. Figure 2 shows the formation of the shunters' routine out of two reasonings: the procedure as described in the rule (based on the rule-maker's routine in principle) and their demand for personal health and safety.

Trying to understand shunters' underlying processes of sensemaking of rules can shed more light on this case of misalignment between rules and routines. In our interviews, we found that many shunters regarded rules as rather unhelpful. Some acknowledged that rules exist for their own protection, but for many, rules were also an instrument for management to protect themselves:

> Shunter #3: "The rules are, I think, for protection. For personnel as well as for the company. To prevent accidents, that's the main reason for rules."

> Shunter #2: "I don't think that more rules mean safer working out there. They may safeguard the company by suggesting: We have a rule for it so we are covered. But I wonder whether people can still comprehend all those rules."

Statements indicating that rules are seen as helpful or as guidance for daily work were scarce in shunters' interview data. We conclude therefore, that on the instrumental dimension rules are interpreted as providing personal protection, but whether or not they actually achieve this goal is contested. To many shunters, rules mainly function as protection for the company, when rules are used to manage organizational accountability requirements.

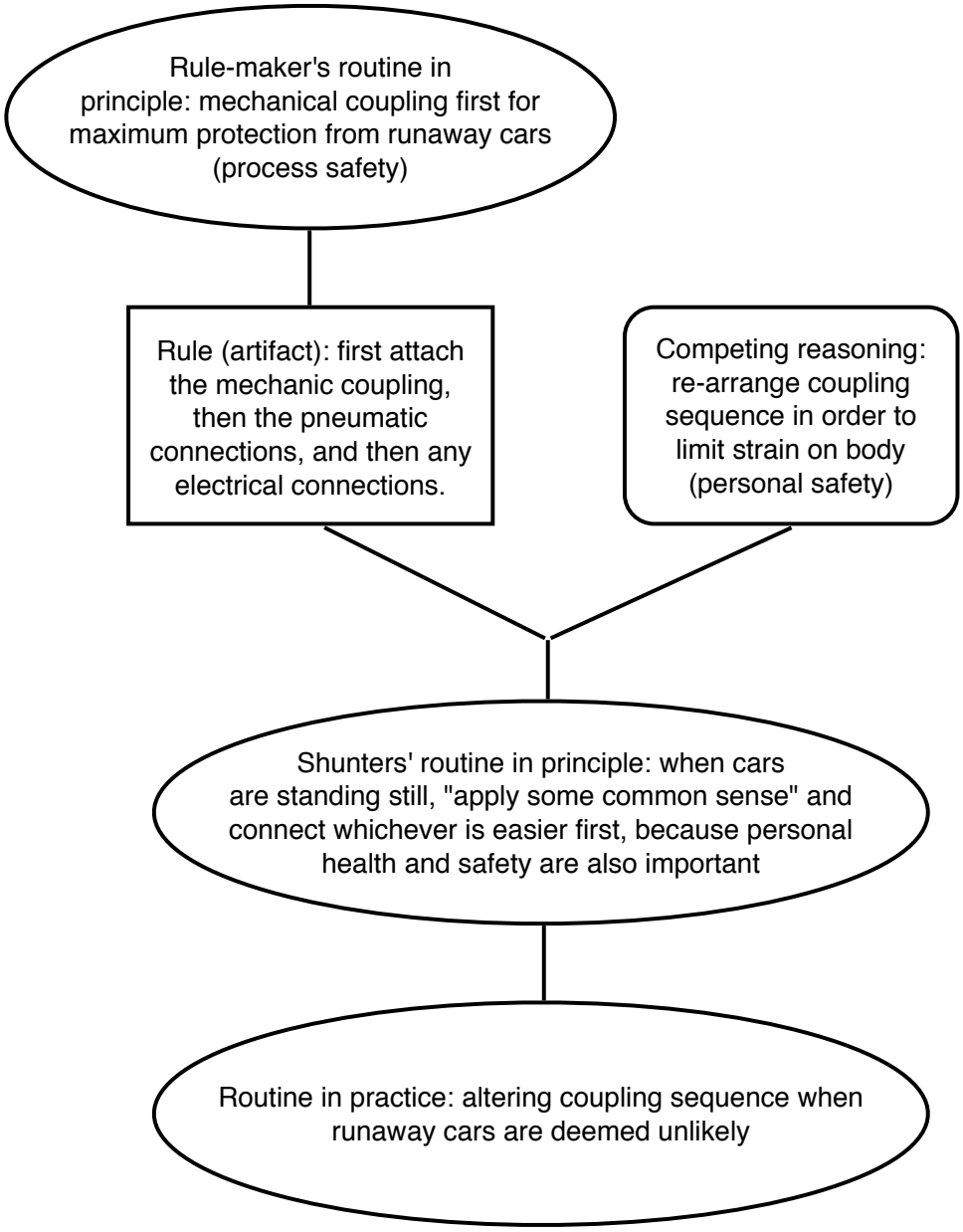

Figure 2: The case of the coupling sequence

Regarding the symbolic dimension, our data showed that for shunters, rules are associated with a detached hierarchy and bureaucracy. Rules are furthermore somewhat in opposition to “common sense”:

> Shunter #6: “I need to have some common sense, in order to know what is dangerous and what I therefore absolutely shouldn’t do, and to know

> when I can [safely] use good judgment. But then there are the formal rules and the lawyers, they've never worked out here. And there are many who say: It's the rule, so do it precisely like this. But actually working at the front line, I just try to do my work as good as possible, while at the same time being aware of safety."

Compatibly with this detachment, rules generally seemed to be treated with a little bit of indifference. For example, shunters stated that they do watch out for each other's safety and rule-related behavior, but they would not report rule violations of others to supervisors.

> Shunter #4: "Everybody knows the rules anyway, so maybe you just point it out to them and say: Hey, that was a close call, watch out next time! But I wouldn't run to the office right away [to tell the supervisor]."

Another statement sums up this reduced importance of rules:

> Shunter #5: "Whether or not rules are being followed – well, I think it's everybody's own life. I always say rules are a matter of debate. Some of them may be cumbersome, but they are necessary. But whether or not they are being followed – well that's everyone's own concern."

To sum up, for shunters, there is an obvious divide between rules and their application. Overall, rules seem to be of limited relevance, as adherence to them is "everyone's own concern".

4.2. Rule compliance versus production: The case of "greeting" passing trains

In track maintenance and construction work, a central challenge for safety is how to safely get work done while tracks near the work site – or even the very track to be worked on – are in use. A number of rules are written to manage this issue. Teams normally have a designated lookout, whose only job is to watch and warn. Several different acoustic warning signs are defined for alerting workers when a train is passing by. When the lookout gives a warning signal, every worker is required to "immediately stop any work on the relevant track and clear it" (all quotations are from official rules by the railroad organization or the state regulator) When personnel have cleared the relevant track, they "should stay alert and face the approaching train in order to spot objects on the passing train that could endanger them (open

doors, loose covers, shifted cargo load, etc.).” For every construction site, there is a designated safe zone. This can be somewhere on the side of the tracks, or on a track which has been closed for traffic. Clearing the track after a warning sign then usually means moving into the safe zone. If their present track is closed off for traffic, workers can stay where they are, but nevertheless are expected to interrupt their work and face the oncoming train. Although not found in official rules, it is furthermore customary to “greet” (raising a hand) the train driver passing by.

Trains passing by a work site is a normal occurrence. During every field visit in construction and maintenance, the routine relating to this rule could be observed. It was very obvious that this rule is not being followed down to every detail all the time. When tracks are heavily in use, strictly following the rule could mean interrupting one’s work as often as every ten minutes. Although a lot of construction work is accomplished at night, there are hours where there is still a lot of traffic (e.g. between 11.30 pm and 1.00 am). A typical instance of workers not completely adhering to the “stop work and greet” rule is described as follows:

> From field notes: “I accompany a team of track workers during a night shift. Their job is to replace a piece of the track. We start out around 11 pm. The workers do preparatory work on the designated track, and leave the track every time the lookout warns about an approaching train. At around half past midnight, the track that is to be replaced is closed off and the workers immediately start cutting the old rails. The lookout signals trains approaching on the neighboring tracks by using his horn. This happens about every 10 to 15 minutes. The workers are required to interrupt whatever they are doing, and “greet” the train driver, but this is not done all the time by all of them. Instead, they keep on working. They seem eager to get their jobs done, weary of the constant interruptions. The lookout sometimes reminds them, but not every time.”

During interviews, construction workers talked a lot about their problems with adhering to all rules all the time and at the same time getting their work done in time. For instance, one worker said:

> Construction worker #3: “In my opinion, these rules, if we would adhere to them strictly by the book, we could do close to nothing. Our hands would be tied. So, with the work we do, there is always some common

sense necessary: you have to balance the risk, is it too high, or is it possible?"

The case of the procedure for passing trains can be described in terms of the rule-routine-relationship as shown in Figure 3.

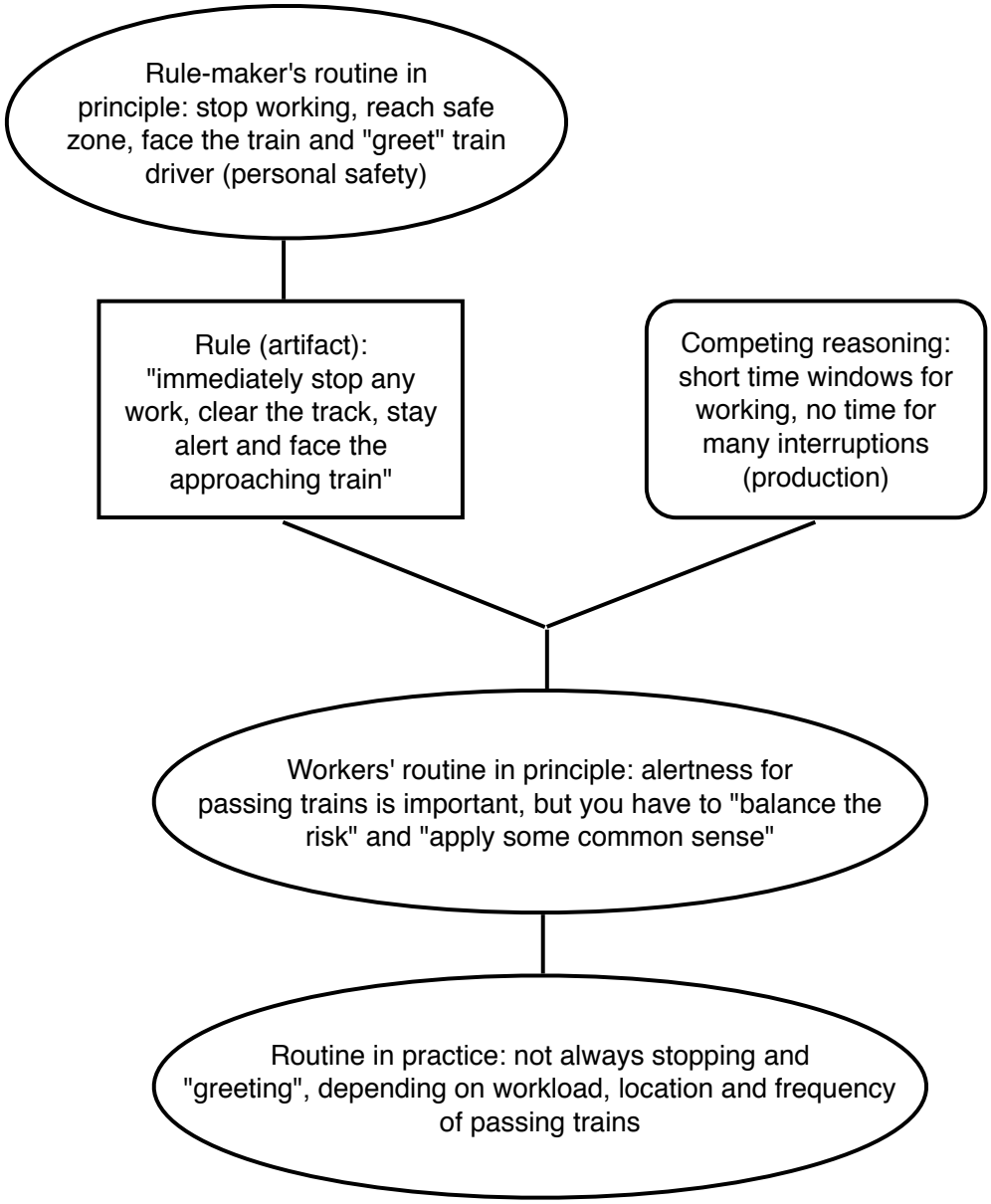

Figure 3: The case of the "greeting passing trains" rule

The rule-maker's routine in principle is essentially guided by increasing personal safety. As working on or near tracks in use holds numerous risks, workers are

supposed to deliberately interrupt their work and focus their attention on the passing train. While construction workers would not argue that this procedure provides the most safety for them, they are, however, faced with balancing personal safety with production requirements. Timeframes for work on the tracks are always limited, and time pressure is high. In their routine (in principle and in practice), construction workers weigh in this competing reasoning and (similar to the shunters in the previous case) apply "common sense" and "balance the risk".

Looking further into construction workers' sensemaking of rules, we found that they view rules first and foremost as important for their own protection. But they also stressed the point that rules are a means of safeguarding for the company and of delegating responsibility downwards. This was even acknowledged by staff with a managerial function:

> Construction worker #9 (department head): "The rules are supposed to protect the people. But when I make so many of them that I can't possibly know all of them anymore, then he [the worker] is no longer protected, now he is the fool."

We concluded that for construction workers, on the instrumental dimension of rule interpretation rules first of all bring personal safety (despite all the conflicts around them). But rules have just as much a safeguarding function for the company at large.

With regard to the symbolic dimension, construction workers were pointing out that there are too many rules to adhere to all of them. Rules therefore probably have a negative symbolic meaning, associated with bureaucracy and red tape. Furthermore, what stood out in interviews was the conflict between rule compliance and production requirements, as seen in the case of "greeting" passing trains: Getting the job done means bending or even breaking the rules now and then. Or, as one worker put it:

> Construction worker #2 (foreman): "But I know, if I go strictly by the rules, maybe I won't be able to get it done in the morning [finishing the job and clearing the track]. You're showing business interest then, but virtually, with one foot you're in prison. But you do it for the company."

Sensemaking of rules, it seems, is therefore a highly contested process for construction workers. While on the one hand, rules in general and their necessity were sometimes questioned, on the other hand workers expressed their aversion towards breaking rules in order to get the job done. Rules, then, probably also stand for conflict and stress.

4.3. Rule compliance versus production: The case of the blockage checklist

During interviews in the field of signaling, it was difficult to find cases for contested rules. Signalers held very positive attitudes towards rules. They generally felt that rules satisfied their needs. Almost all of them emphasized the necessity of rules for structuring and guiding individual as well as collective action. For them, rules ensure coordination and a uniform approach to their tasks:

> Signaler #4: “You’ve got it [the rules] in the blood, you know? If the steps of our work tasks wouldn’t be prescribed, then there would be even more different opinions about it and that would jeopardize safety. It wouldn’t work.”

We were eventually pointed towards one single case of a “difficult rule”: the procedure for blocking and clearing a specified section of the tracks in order to ensure that no regular train can pass over it for a given period of time. This task can be necessary for shunting maneuvers (blocking a track means stopping the regular train traffic from using it while shunting trains are permitted) or for maintenance work to be done on the tracks. Setting a blockage is done via the PC terminal. Signalers can use the mouse or keyboard commands to select the required track section and block it, making it unusable for regular train traffic. The task of blocking a track section entails communication between the signaler and the person requesting (and using) the blockage. Thus, at the core of the task is the challenge of setting the blockage on the right track at the right time and informing other personnel on the tracks of it. For this, a checklist is to be used which often has the respective track section or sections (often several sections in a row or parallel to each other are to be blocked) pre-printed on it. Several steps in the process have to be checked off in the document. Among them are informing neighboring stations, marking the respective track(s) on the large panorama wall (a schematic

representation of the station) with a small magnetic sign, as well as ultimately removing the blocking and making it usable for regular traffic. In addition to the checklist, there is detailed regulation about how all checklists are to be handled: It is particularly required that the checklists have to be used before (or during) performing the critical task (filling it out after the fact is not allowed) and that checklists are ”principally to be handled in the given sequence, from step 1 to the final step in order”. The routine in principle behind this rule is obvious: Signalers are to work with the checklist and not to deviate from the given sequence in order to prevent any mistake and not jeopardize safety. This routine in principle is thus concerned with both process and personal safety.

During field observations, it became clear that signalers do not use the checklist strictly like it was prescribed, especially during periods of high workload, when multiple requests for blockages are to be handled in a short amount of time. If traffic allowed it, many signalers actually set the blockage in the system some time before it was due and before they confirmed it to the requesting track personnel. Checking off the boxes on the checklist was then done when they communicated with the track personnel: the checklist was not used for the actual task of setting the blockage in the computer system, but for structuring communication. Another deviation observed was putting up the small magnetic sign on the large panorama wall before the actual task of blocking the track section. The magnetic signs indicating a closed track were regularly put up at the beginning of a signaler’s shift, when the respective track sections were still in use. It was thus used as an indicator of a future blockage, in order to get a general overview of what would have to be managed during the shift. These practices meant that the checklist was not used exactly as prescribed, as it was not handled in the given sequence, sometimes filled out afterwards, and not (only) used for supporting the actual task of setting the blockage.

During interviews, some signalers admitted to these small deviations and justified them with a lack of flexibility during peak times.

> Signaler #6: “If I would go strictly by the rules, it would be safe, but it would be slow. So I apply sort of a mix that is quicker than the rules

> would allow it, but where the safety is still ensured, from my point of view. But I know I am in a grey zone, I violate the rules."

Others, however, stressed the importance of working strictly by the rule, even during periods of high workload:

> Signaler #4: "We have to take our time with these checklists, it is a priority, even when it means that someone has to sit there and wait for five, ten minutes. We have approval for that."

In sum, the issue of the blockage checklist can be described as follows: When many requests for blockages are to be handled during a short amount of time, treating all of them strictly as prescribed by the rules would mean considerable waiting time for track personnel – a typical conflict between rule compliance and production. This leads to some signalers leaning more towards the competing reasoning of working more swiftly under time pressure: They decide to work "quicker than the rules would allow it" and adapt the sequence of the work process to account for the high workload.

From this, we can map out the following relationships between the rule and the routine, as displayed in Figure 4.

Two things were particularly interesting about this case: Firstly, it was very hard to identify such a case of a contested rule in signaling in the first place, because signalers in general held very positive beliefs about rules. Interestingly, some wished to have clear and strict rules particularly for disturbances and breakdowns:

> Signaler #5: "When there are disturbances, they have to be handled always the same. And in this way it makes sense that the rules are like operating guidelines for these disturbances. If someone would do it one way, and someone else another way... [pause] I don't think there is room for interpretation, especially concerning disturbances."

In line with their general appreciation of rules as instruments of uniformity, signalers also emphasized the role of peer control. When asked about how adherence to rules is enforced, many of them said that they watch and supervise each other. The following quote suggests that this form of peer control is not so much about

snitching on colleagues, but rather about a positive team spirit, because safety is believed to be a collective responsibility:

> Signaler #9: “When this [someone working against the rules] is happening and I see it, I will point it out to the person. Because it’s not fair letting someone walk into a trap, in my mind. [...] But if you see something like this, you just tell the person – it’s a matter of helping each other out.”

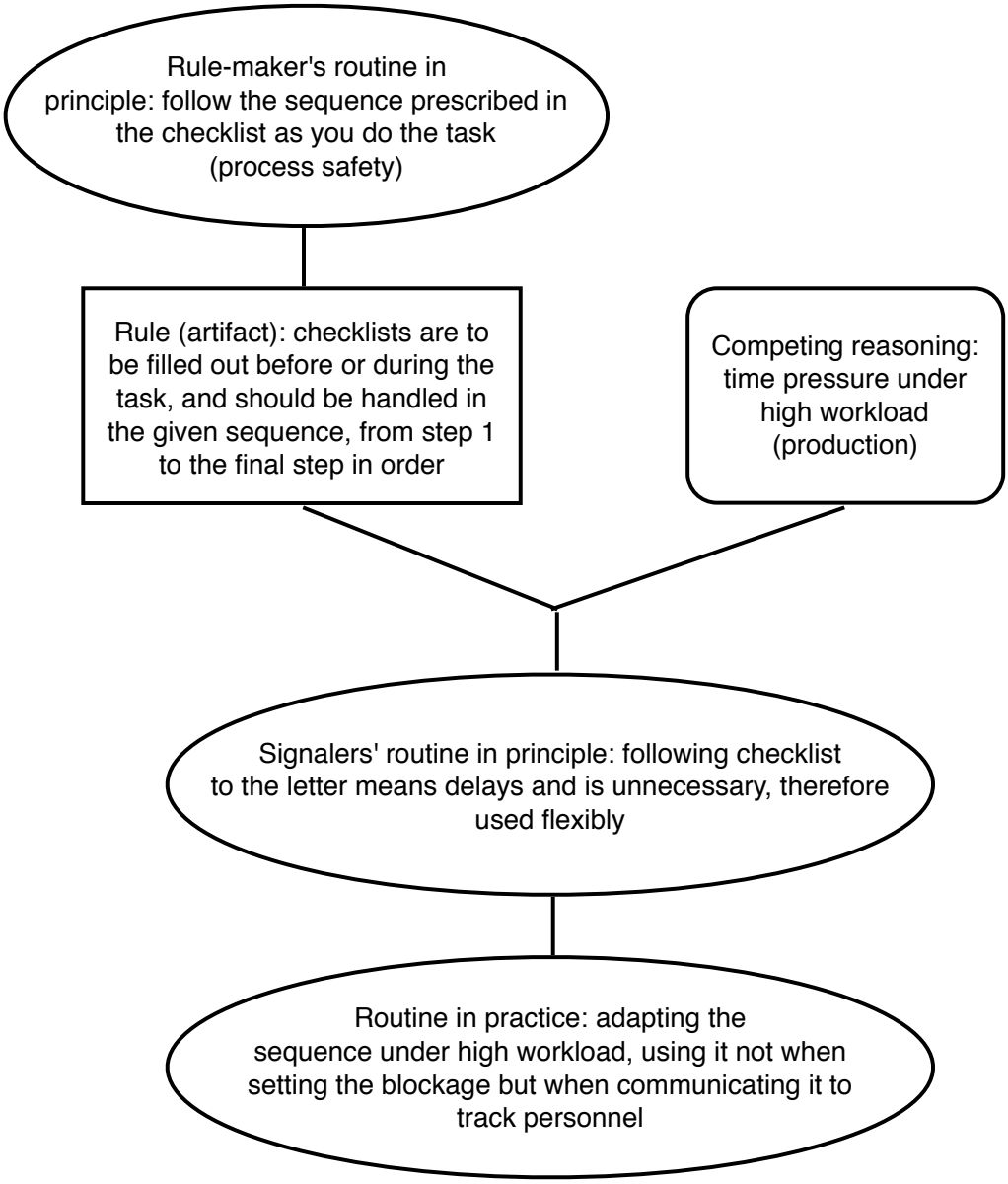

Figure 4: The case of the blockage checklist

What can we interpret from this about the instrumental dimension of signalers' sensemaking of rules? For them, rules ensure working in a safe and uniform way. Faced with complex tasks in a high-risk system, rules that ensure a uniform and coordinated approach to problems are necessary for signalers. Therefore, rules are guidelines for practice, both individually and collectively. Regarding the symbolic dimension of signalers' sensemaking of rules, we concluded that to them, rules mean help and support. But it can furthermore be hypothesized that rules provide a sense of community: Signalers stated their dislike for too many different opinions about how to handle a task and explained how, in their view, rules are necessary for a uniform approach. To them, rules thus strengthen teamwork and bring them closer together.

The second interesting aspect of this case was that, due to complaints by signalers, management was already very aware of the problem and it was soon to be solved: During our field visits, preparations where already underway for a replacement document for the blockage checklist. About a month after our observations took place, the new version of "protocol and instruction sheet" was introduced: Using the shortened "protocol", signalers now only need to write down date and time, the track sections to be blocked and their initials. All necessary steps that had to be checked off previously are now just listed for reference on an "instruction sheet", which is to be placed on the desk. As this new process accounts for the need to be quick during high workload and still work more precisely within the rules, it was no surprise that it was received positively by signalers.

4.4. Rule compliance and group norms: The case of the "no work" rule for lookouts

While accompanying maintenance workers who specifically deal with overhead electrical lines, a fourth distinct phenomenon of contested rules could be identified, although it is not as easily tied to a single rule. Maintenance personnel responsible for the overhead electrical lines enjoy a somewhat special role among construction and maintenance workers. They have the most formal education and training, and they almost exclusively work at night. They are audited less than their colleagues

working on the ground and generally enjoy a little more autonomy. During field observation and interviews, a distinct morale and demeanor could be noted: Overhead line workers presented themselves as more competent and more self-assertive than their colleagues working on the ground. This attitude became especially evident with regard to safety. As a groundwork team leader bluntly stated:

> Construction worker #2: "A regular worker is absolutely not educated as well as a foreman. And so that he doesn't get into dangerous situations, we have all these rules – so that even the dumbest of them all is safe."

In contrast, the accompanied overhead workers openly expressed their disapproval of many safety rules. They were united in their claim that there are far too many rules and that a lot of them are useless:

> Construction worker #13: "We have too many rules and that doesn't make it safer, rather it makes it less safe. Whether you work safely or not is often simply not visible."

To them, rules are a way for management to protect themselves. An example discussed was the rule that a harness is to be worn during all climbing activities – a requirement which, according to the overhead line workers, simply was not possible to meet in practice:

> Construction worker #11: "The harness would protect you, sure, but my feeling is rather that this rule is there so that others can shove off the responsibility."

When asked what else then creates safety (if not rules), they named personality aspects of self-awareness or self-assurance like "always knowing where you are and where there is current on the lines". One team leader told a story about a co-worker who had a serious accident and concluded:

> Construction worker #14: "He was the nervous type, he was not meant to work on the tracks."

In this way, overhead line personnel displayed a self-assertive attitude, claiming that they do not really need safety rules in order to work in a safe manner. Instead, they

rely on their experience and personality traits like awareness and calmness. This attitude towards rules also worked as a shared norm: If a colleague would have required perfect rule adherence at all times, he or she would have been seen as clueless (if not outright crazy) and insistence would have probably lead to an argument.

This group norm could be seen at work at numerous small instances, e.g., when workers did not use the harness when climbing in high altitudes. Another example was the “no work” rule for lookouts, for whom, very clearly, “with exception of using the communication equipment and operating the warning system, all other work is forbidden.” During one field visit, there was a period of time late in the night (around 2.30 to 4.30 a.m.) where there were no other trains on the tracks. The team of overhead operators were busy checking and replacing parts on the overhead lines, standing on the roof of a rail maintenance car. The lookout was standing by the side of the rail car, not watching the tracks. She knew that at that time of the night, no trains were to be normally expected, and indeed, no trains drove by. The team on the roof occasionally asked her if she could hand them tools or equipment, which she willingly did. Seeming calm and confident, she was disobeying the “no work” rule and rather helping out her teammates. Similar instances of lookouts helping out during times of no traffic could be observed at different occasions.

This case can be described in terms of the rule-routine-relationship as follows (see Figure 5): Rule makers want to clearly define the role of the lookout as purely there for safety. All of his or her routines should concern safety, not the primary work task. The written rule is quite clear about this, but lookouts themselves apparently have a slightly different understanding. While most of the time (and especially during train traffic) they stick to their role as strictly responsible for safety, they do not strictly follow that rule at times when they are sure that no trains are coming. The competing reasoning in this case is the shared norm in overhead electrical line work which puts less relevance on safety rules and more relevance on one’s own alertness and confidence. Combining these different reasonings, lookouts thus create their own understanding (routine in principle), which allows some form of work (giving colleagues a hand) during times of no train traffic.

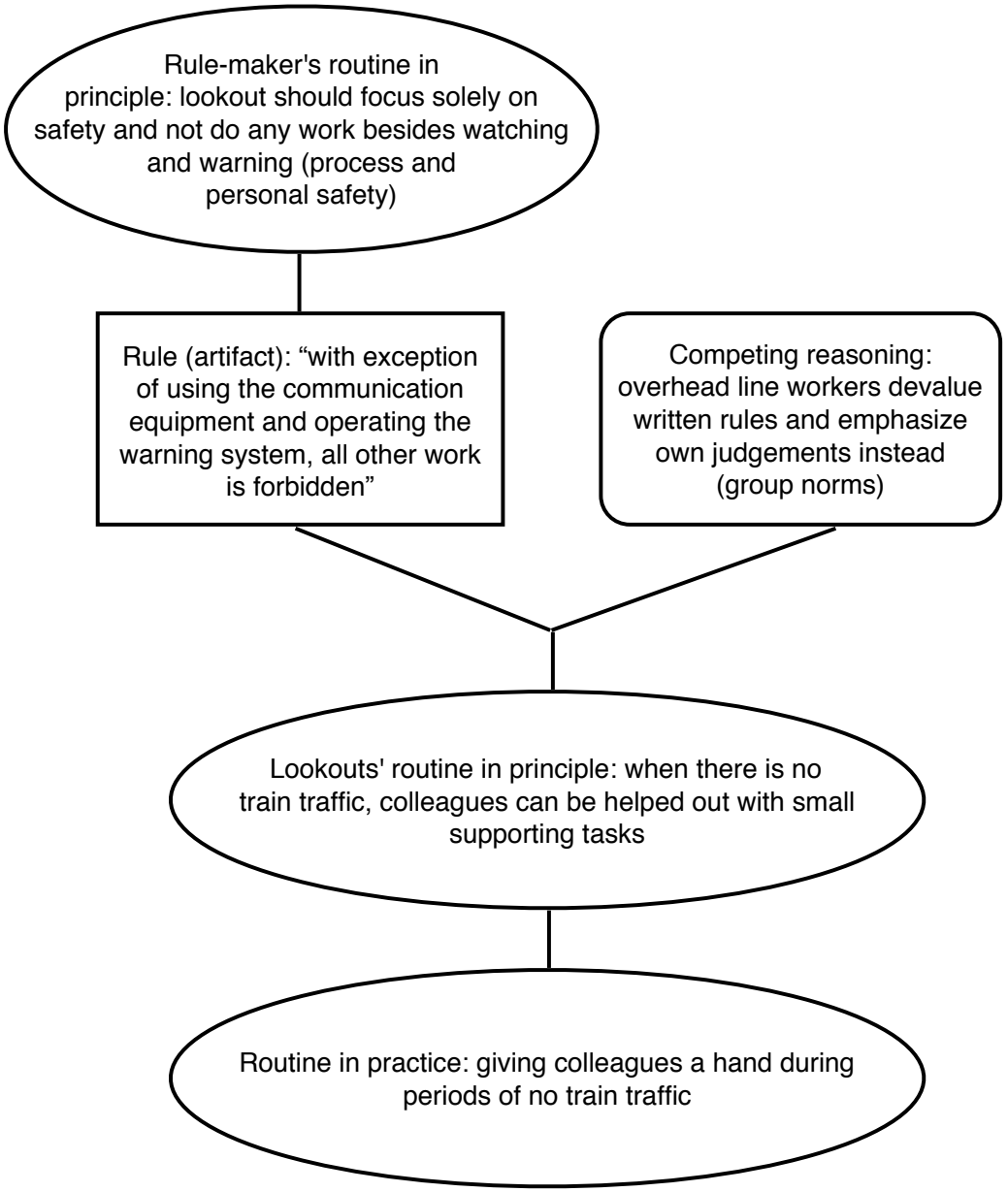

Figure 5: The case of the "no work" rules for lookouts

Our previous assessment of construction workers' rule interpretation on the instrumental and the symbolic dimension seems to be even pinnacled for overhead line workers in particular. To them, rules are useful mostly for management and the company at large (instrumental dimension). In order to work in a safe and coordinated way, factors other than rules are much more relevant. Thus, rules either have a negative symbolic meaning or only little meaning at all.

5. Discussion

5.1. Competing reasonings as a source for rule-routine misalignment

We set out to explore the relationship between formal rules and organizational routines in three work environments, and furthermore scrutinize the differences in sensemaking of rules. We first discuss the findings regarding rule-routine-relationship and later turn to the issue of different ways of sensemaking of rules.

Rule violations can be explained by diverging routines in principle. When rule-makers' and rule-followers' understanding of the rule-related routine is not in alignment, that is, when they employ different principles about the routine in question, rule violations ensue. Rule-followers may hold differing routines in principle because following a rule in practice means balancing it with other demands and goals (e.g. productivity), or, in our terms, *competing reasonings*. These reasonings can pertain to goals or norms on the individual, group or organizational level. In other words, when rule-followers are faced with further demands beyond just following rules (which is almost always the case), these competing reasonings can lead them to set different priorities and thus develop a diverging routine. In our cases, we found that compliance with safety regulation was in competition with a different type of safety (competing reasoning at the individual level), with production goals (organizational level), or with group norms (group level):

- Shunters are faced with prioritizing either personal or process safety when deciding in which order to connect the couplings between two rail cars. This finding is similar to what Bruns (2009) discovered about scientists' use of safety guidelines, only that in her case, scientists prioritized process safety (avoiding contamination of experiments) over personal safety (avoiding contamination of themselves).

- Construction workers and signalers both have to manage the dilemma of rule compliance versus production. In short, they face the question of either adhering to all safety rules down to the last detail or keeping up with the work as planned to avoid delays. While previous researchers have been

concerned with the tension between production and *safety* (e.g. McGonagle & Kath, 2010; McLain & Jarrell, 2007), our finding specifically concerns the difficulties in managing production requirements and *rule-following*. In both our cases, rule infringements, because they were so small-scale, did not necessarily mean jeopardizing safety. Yet a tension nonetheless existed.

- Lastly, lookouts in overhead line maintenance work have to decide whether or not to strictly follow the rule of not taking part in the work – even in order to help out their co-workers and to keep up a good work relationship. This can be regarded as a case of *role conflict*, or, an "incompatibility between expectations of a single role" as described by Örtqvist and Wincent (2006, p. 399), which has been theoretically linked to rule bending and breaking (McLean Parks, et al., 2010).

An interesting observation was that in three of our four cases, rule-followers talked about "applying some common sense", when justifying their rule violations. *Common sense* seems to serve as a (necessary) opposite to strictly following rules. This could be used as an indicator for diverging routines in principle. If, as we have done in our four cases, rule violations are viewed as differences between rule-maker's and rule-follower's routine in principle, much can be gained with regard to understanding how rules work in organizations. Indeed, our findings highlight the routine in principle as the key to controlling routines through rules. In other words, it is actors' understanding of the rule in context that makes the difference between following or not following a rule. Even in highly regulated environments, actors are not solely dealing with requirements stemming from written rules – rather, multiple organizational goals and norms have to be managed and prioritized. Our approach of untangling the competing reasonings and differing routines in principle makes it possible to encompass both written rules and other goals and norms as this integration is being accomplished by actors in their everyday work. Diverging routines in principle explain rule violations in a simple, yet extensive way.

This perspective makes clear that controlling behavior (i.e., the routine in practice) in organizations by means of formal rules can only be accomplished through actors' routine in principle. This constitutes an important clarification and expansion of

previous research on the rule-routine relationship (Burns & Scapens, 2000; Grote, et al., 2009; Pentland & Feldman, 2005; Reynaud, 2005). Pentland and Feldman (2005), for example, proposed a number of conditions that possibly influence divergence between artifacts and performances (e.g., the specificity of rules or the ability to observe or monitor performances). With our findings, we can expand their conceptualization and show that it is actors' routine in principle that connects the formal rule and the performance of the routine: More specificity in rules leads to less divergence in the performances of the routines only if actors hold a similarly specific routine in principle (as shown in the example of the coupling sequence); and monitoring performances will only lead permanently to higher alignment if actors have a congruent understanding of the rule and the intentions behind it (as would be the case for the "greeting passing trains" rule, where more monitoring and sanctioning would most likely only lead do "superficial" rule-following, because the underlying conflict with production pressures would not change).

5.2. Different ways of sensemaking of rules

Our second major finding concerns sensemaking of rules in general. Analyzing interview statements about rules showed how sensemaking of rules both on the instrumental and the symbolic dimension of rules and can be generally positive or negative. Signalers' sensemaking of rules stands out in particular: On the instrumental dimension, they view them as support for their tasks and necessary for ensuring a uniform approach. Symbolically, rules stand for support and possibly community-building. For signalers, then, rules are not only useful tools for their tasks, they furthermore are seen as a necessary underlying structure for their co-operation. In stark contrast, both shunters and construction workers view rules as instrumental mainly for the company's safety. They are seen as a prerequisite, not necessarily for their own work tasks, but rather for management to protect themselves from legal conflicts. Not surprisingly, both construction workers and shunters symbolize rules with hierarchy and bureaucracy. Groundwork construction workers (more than shunters and overhead line workers) stated they try to comply with all the rules and thus experience a constant struggle between rule compliance and production. To them, rules also stand for conflict. Some of the shunters, on the

other hand, have turned to indifference and caring less about the rules; rules thus have only a minor symbolic meaning. And for overhead line workers, rules play a minor role in achieving safety; they rely more on personality traits like alertness and self-assurance.

While previous studies have found differences in sensemaking with regard to *safety* (e.g. Clarke, 1999; Fonne & Myhre, 1996; Gherardi, Nicolini, & Odella, 1998; Rasmussen & Kroon Lundell, 2012), there has only been little research on differences in sensemaking of safety *rules* (or other rules, for that matter). One study resembles our findings: In a hospital setting, McDonald et al. (2005) found that doctors and nurses differ in their appreciation of formal rules. While for nurses, rules provide guidance and are a necessary and helpful part of their work ethic, doctors mostly see rules as only important or useful for beginners, emphasizing instead the non-routine nature of their work. Their results can be interpreted in such a way that for doctors, rules have little to no symbolic meaning and are instrumental mostly for beginners. For nurses, on the other hand, rules symbolize safety and professionalism and are crucial for error-free work.

Our results can thus be seen in light of well-grounded knowledge on occupational communities (Van Maanen & Barley, 1984) and their power to shape shared understanding and collective action (e.g. Bechky, 2003; Fonne & Myhre, 1996). Rules as artifacts need to be interpreted in a process of sensemaking, and, as Rafaeli and Vilnai-Yavetz (2004, p. 682) noted: “Sense making can lead to multiple views regarding symbolism, instrumentality, and aesthetics ... .” These different ways of sensemaking of rules between different occupational communities need to be accounted for with regard to organizational control. Issuing identical rules for different occupational communities within one organization could be problematic if their sensemaking of rules is very different. In our findings, for example, the differences between signalers’ and construction workers’ ways of sensemaking of rules could be especially problematic because of their high level of cooperation: Reliable and exact coordination (which is at least in part based on rules) between members of these two groups is necessary, for instance, when requesting the closing off of tracks or informing about trains passing by. Different assessments of

the relevance of rules for these tasks could diminish organizational control and jeopardize safety. However, such differences should not be addressed by issuing even more rules, because they will still be seen as less relevant by such organizational communities. Instead, the limits of rules as organizational control should be acknowledged and informal forms of control (e.g., addressing norms and beliefs and strengthening shared understanding through training and leadership) should instead be considered (cf. Cardinal, et al., 2004, 2010). Because the difference is at the informal level of sensemaking, it should be addressed at that level.

5.3. Vicious and virtuous circles of rules and routines

Bringing together our two major empirical findings, we found that conflicting routines in principles and the sensemaking of rules (in particular, positive or negative beliefs about rules) are related. Together they can form vicious or virtuous circles of rules, sensemaking of rules, and initiative to change.

For construction workers and shunters, following rules is often in conflict with other goals. Our cases in these areas show that some of the rules are not calibrated well to the actual work tasks. Given these problems in the rules system, it is not surprising that construction workers' and shunters' sensemaking of rules is rather negative: Although important for personal safety, they are viewed as signs of bureaucracy and red tape. Workers view rules as being made to safeguard the company; they are made by management for management. This type of sensemaking, in particular viewing rules as bureaucratic and less relevant, does not lead workers to take initiative to make the appropriate changes in the rules system. Rather than attempting to fix the rule system where it does not meet their needs, workers in such cases ultimately decouple their practices from the rules, hoping to remain undetected. Shunters and overhead line workers, in particular, showed a tendency to build a community, while not outright against rules, but decidedly detached from them. Hence, a vicious circle becomes apparent, in which ill-suited rules lead to negative sensemaking of rules, which lead to detachment and less

initiative to change rules and make them better, which is in turn a reason why the rules stay as they are.

In contrast, in signaling, a different relationship between rules, sensemaking, and initiative to change could be identified. Rules seem to be well adjusted to the actual routines. It was difficult to find misalignment between rules and routines at all. It is therefore not surprising that signalers' sensemaking of rules is generally positive; viewing them as essential parts of their work environment, even to the point of saying that they build a community through rules. Signalers are convinced that good rules are necessary for getting the job done. This way of sensemaking, at least in part, explains why they actively seek to adjust rules when they do become difficult to follow. This was the case with the checklist for track blockages, where complaints about the tediousness were heard by supervisors and ultimately led to a change in the formal rules. In signaling, good rules lead to positive sensemaking of rules and this in turn leads to quick improvements in the rule system when necessary, which of course makes the rule system even better and thus re-enforcing the circle.

These vicious or virtuous circles of rules and rule change should be viewed in the larger context of organizational stability and change. Newer literature on routines has shown how they can be a source for both stability and change (Adler, Goldoftas, & Levine, 1999; Essén, 2008; Feldman, 2000; Feldman & Pentland, 2003; Pentland, Feldman, Becker, & Liu, 2012). Changing routines are possible because of the necessary implementation and adaptation of the routine in principle in everyday organizational practice. Our study builds on this understanding by addressing the question of how changes in routines can change artifacts such as formal rules. Our findings demonstrate that such change is dependent on actors' sensemaking of rules. Whether or not continuous misalignment between rule and practice (based on diverging routines in principle) leads to adaptations in the rules, depends on the way in which rules are made sense of symbolically and instrumentally. If, for a particular set of organizational actors, rules in general have little symbolic meaning and are not really instrumentally helpful, misalignment is simply not seen as a problem and hence, initiative to change the formal rules is low. If, however, actors' sensemaking

of rules means assigning them a high symbolic value and seeing them as supportive in achieving one's task, rule changes because of diverging routines in principles are much more likely.

5.4. Practical implications

Our findings underline the fact that rules systems (whether in high-risk or in "regular" organizations) must be looked at critically with regard to their relationship to the actual organizational practice in the form of routines. Several implications for practitioners (rule-makers, managers) can be derived: When dealing with rule violations, taking actors' routine in principle (that is, their priority settings, interpretations, and trade-offs with competing reasonings) into account offers managers a choice to either try to change the routine, or the rule: First, the desired routine in principle can be strengthened by training, tighter supervision and education (see also Pentland & Feldman, 2008a). These measures should normally be preferred over even more detailed formal rules, especially in organizations which are already highly formalized. Rather than trying to translate the targeted routine in principle into even more detailed rules, it should be acknowledged that formal rules are always incomplete (Reynaud, 2005) and the inevitable "void at the heart of rules" (Bourdieu, 2005, p. 160) should rather be "filled" with informal forms of control (e.g., influencing actors' routine in principle by strengthening norms, exercising direct leadership etc.). Competing reasonings should be discussed with workers and a clear, concrete priority should be communicated. In our cases, this could be a promising approach for the cases of the coupling sequence and the "no work" rule for lookouts. The second option rule-makers always should consider equally is to adjust the rules to accommodate worker's priority settings in practice. If assessing workers' reasons for rule violations by identifying their routine in principle shows that the rules are in fact next to impossible to follow, they should be changed accordingly. This was the case in signaling, and could also be a helpful approach to the "greeting passing trains" case, where the required constant interruptions seem to add only little to overall safety, and a rule less strict could be formulated. As these examples show, taking into account actors' routine in principle

is not only useful in high-risk environments – it should be applicable in any organization and help to avoid red tape.

Furthermore, rule-makers and managers should be very aware of rule-followers' sensemaking of rules, that is the meanings they ascribe to rules in general. Because the necessity for rule change is often first and foremost visible to front line workers, their interpretations of rules in general significantly influence the organization's ability to adapt. Indifference or other negative ways of sensemaking of rules can lead to the decoupling of practices and thus diminishes organizational control.

5.5. Limitations

As with all such research endeavors, our study also has limitations. Although we made all efforts to do so, like all researchers employing observational methods we cannot fully rule out the researcher's influence on the subjects of study. Furthermore, the virtuous circle of well-suited rules among signalers could be explained by other factors: For example, signalers' positive attitude towards rules may be due to overall different personality traits, as meticulousness and orientation towards details are values which play a major role in signalers' selection and their lengthy training process. It is also possible that signalers' overall higher level of status plays a role, as this makes them more likely to practice speak-up behavior (cf. Edmondson, 2003) and request rule changes. Lastly, we purposefully studied only rules that are related to safety. The relationships we described between rules and routines may pan out differently in fields of work with less risk, where following or not following a rule is not always about someone's health and safety.

6. Conclusion

We set out to study the relationship between rules and routines and how the former can work as organizational control. Our findings show that rules function as organizational control mechanisms through actors' routine in principle, which integrates competing reasonings, that is, other goals or norms next to what is prescribed by rules. Rule violations can thus be theorized as driven by diverging

routines in principle. How these are dealt with depends on how actors make sense of rules, both as instruments and as symbols. If sensemaking is rather negative (e.g., rules are ascribed little symbolic meaning and/or little use as instruments for one's task), rule violations are more likely to be tolerated and competing reasonings are more likely to be emphasized. However, if actors make positive sense of rules (e.g. by seeing them as positive symbols as well as instrumentally helpful), rule violations are less likely to be tolerated and rule-followers are more likely to demand better rules that reduce competing reasonings, thus leading to overall higher rule-routine alignment and more effective organizational control.

On a societal level, the issue of translating rules into behavior has been described as the gap between the law in the books and the law in action (e.g. Ewick & Silbey, 1998; Huising & Silbey, 2011). Democratic societies have a separation between the legislative branch, where rules are made, and the judicial branch, where the practical meaning of the written law can be determined in courts of law. In a court, the interpretation of a law, or what it actually means to follow it, is accomplished through debate and negotiation. Since most organizations are not democratic, they usually lack such institutionalized practices for finding the meaning of their rules in a similar manner. Our approach to understanding the rule-routine relationship enables rule-makers and managers in organizations to address their gap between rules and routines: Rule-makers need to understand that the idea behind a rule (their routine in principle) cannot be fully translated into it and neither completely out of it by rule-followers. Instead, rule-followers create their own routine in principle which necessarily incorporates competing reasonings and can thus diverge from the original intention. In order to achieve better alignment and thus more effective organizational control, rule-makers need to engage in some form of discourse with rule-followers – analogous to what happens in courts of law – to grasp their routine in principle, as well as the underlying process of sensemaking of rules. This discourse, on the one hand, means communicating the original intention behind the rule more strongly, but on the other hand also means treating rule violations as opportunities for improving the rules themselves.

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Scientific Paper 3:

Safety Rules as Instruments for Organizational Control, Coordination and Knowledge: Implications for Rules Management

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Recent research in the field of safety science on the limitedness of rules as a measure to achieve safety has coincided with new research in organization science on rules and routines, and their mutual relationship in particular. The present article is an attempt to uncover what the former can learn from the latter. It outlines three functions of rules in organizations (as a means for organizational control, as coordination mechanism, and as codified organizational knowledge) and applies these to safety rules in high-risk industries. Four common challenges of safety rules, as well as four typical measures of good rules management are illustrated by discussing examples from safety research. These challenges and typical measures of rules management are furthermore examined in terms of the three functions of rules in organizations. The article demonstrates how safety science, by taking a broader perspective, can benefit from organization theory.

Keywords:
safety rules, rules management, organizational control, coordination, organizational knowledge

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1. Introduction

Safety rules are an indispensable part of safety management in high-risk systems. Whether in the form of rule books, checklists, or procedures, safety rules are abundant in industries like power generation, aviation, transportation, medicine, and other high-risk industries. Through prescribing human action and interaction (with other individuals as well as with machines), it is hoped to reduce errors and eliminate risks. Rules are thus usually designed and implemented by experts, based on risk and task analysis, intended to influence and control human behavior. This use of safety rules is ultimately rooted in Scientific Management and the idea of rationalization (Taylor, 1911). A core idea behind the design of safety rules is thus the assumption that work tasks are designable and controllable in a top-down fashion and that organizational control should therefore be used to identify and eliminate safety risks (Berman, Ackroyd, Mills, & Davies, 2007; Grote, 2009; Hale & Borys, 2012a; McCarthy, Wright, Monk, & Watts, 1998).

However, there has also been a growing concern in the field of safety science that such an approach to safety may be flawed and that rules in the actual organizational context do not work in such a simplistic way (Amalberti, 2001; Dekker, 2003; Grote, Weichbrodt, Günter, Zala-Mezö, & Künzle, 2009; Iszatt-White, 2007; Lawton, 1998; Rasmussen, 1997; Reason, Parker, & Lawton, 1998; Weichbrodt & Grote, 2008; Woods & Shattuck, 2000). Most recently, Hale and Borys (2012a) presented an extensive review of the literature on the management of safety rules. They contrasted two paradigms of how rules are perceived, used, and managed. Model 1 is characterized by a top-down approach, based on rationality and control, where rules are made by experts and seen as necessary and binding. Accordingly, violations are seen as “bad practice” and are therefore to be sanctioned. In contrast, model 2 recognizes the impossibility of a perfect rules system. Rule violations are seen as inevitable, and should be dealt with by treating local operators as experts in improving the rules. In short, “model 1 sees the solutions in modifying reality to match the rules, while model 2 advocates changing the rules and their definition fundamentally to match reality” (Hale & Borys, 2012a,

p. 8). In a companion paper (Hale & Borys, 2012b), the authors then make valuable suggestions for rules management in order to essentially move from model 1 to model 2. In other words, at the core of the issue thus lies the difficulty of differentiating between violations that truly are *bad practice* and violations that instead are the result of *bad rules*.

This difficulty is pinnacled in high-risk systems, where it can represent a matter of life and death. However, insofar as all organizations are rule-based systems, very similar questions arise in virtually all industries or public administrations. The question of how to deal with the gap between written procedures and actual practices is not only relevant to high-risk organizations. Indeed, there is a substantial body of literature in organizational and management theory dealing with issues akin to the ones outlined above (e.g., Cardinal, Sitkin, & Long, 2004; Desai, 2010; Olin & Wickenberg, 2001; Ortmann, 2010; Reynaud, 2005; Silbey, Huising, & Coslovsky, 2009; Tyler & Blader, 2005). This gives reason to the assumption that there are fundamental issues about the functions of rules in organizations (e.g., how to prevent excessive bureaucracy, or how to deal with the inherent abstractness of rules), from which conclusions can also be drawn for the case of safety rules. Research endeavors crossing organization science and safety science have been called for by safety researchers in order to broaden the understanding of the role of humans in technologically complex systems – and ultimately also to increase safety in such systems (Bourrier, 2005).

In this paper, I therefore aim to bridge the two literatures: By discussing selected literature and examples from safety science, I re-examine common challenges of safety rules in high-risk systems, as well as measures intended to deal with these challenges. I apply theory about rules as organizational control, as a coordination mechanism, and as organizational knowledge to each of these issues of safety rules and rules management. By broadening the view and incorporating basic organizational theory, a more fundamental understanding of how rules work (and don't work) in high-risk organizations can be gained.

The paper is organized as follows: First, I briefly review the three functions of rules in organizations. I then discuss four typical challenges of safety rules in high-risk

industries and their effect on rules as control, coordination and knowledge. In the third part, I describe four "good practices" of rules management, showing how these practices work regarding organizational control, coordination and organizational knowledge. Additionally, I will explain how the challenges and good practices are related. The resulting juxtaposition of safety science with organizational theory provides safety researchers with a deeper understanding of the workings of rules in organizations, and helps rule-makers and safety managers in high-risk industries with useful guidance as to how typical challenges around rules can be dealt with.

Throughout the paper, I will use the term "rule" to refer to any written, formal rule or procedure in an organization. "Safety rule" refers to any such rule that regards personal or process safety (Grote, 2012). Distinct from this are informal or so-called "unwritten" rules, which are instead part of organizational routines (Pentland & Feldman, 2005; Weichbrodt & Grote, 2010; as outlined below).

2. Rules as instruments for organizational control, coordination and knowledge

Formal rules in organizational theory are usually seen as a means for organizational control, as a mechanism for coordination, and furthermore as a form of codified organizational knowledge. These conceptualizations are generally based on a behaviorist approach to organizations (e.g., Cyert & March, 1963; March & Simon, 1958), often using the concept of organizational routines as a key element (Feldman & Pentland, 2003; Nelson & Winter, 1982). Organizational routines are defined as "repetitive, recognizable patterns of interdependent actions, carried out by multiple actors" (Feldman & Pentland, 2003, p. 95). Although routines are "repetitive patterns", they are by no means mindless repetitions (Cohen, 2007; Essén, 2008; Parmigiani & Howard-Grenville, 2011). In the recent literature on organizational routines, they are seen as effortful accomplishments and even as a potential source for change (Feldman, 2000; Feldman & Pentland, 2003). Based on this understanding, routines are differentiated from rules, which are seen as formal,

written artifacts (Pentland & Feldman, 2005). This has enabled researchers to study the relationship between the two (Becker, 2005; Bruns, 2009; Burns & Scapens, 2000; D'Adderio, 2008; Grote, et al., 2009; Kieser, 2008; Reynaud, 2005; Weichbrodt & Grote, 2010). In this article I will build on these ideas. In the following, I will describe the three functions of rules as control, coordination and organizational knowledge.

Rule-making is one form of exercising power and control in organizations (Clegg, Courpasson, & Philips, 2006; Gouldner, 1954; Mintzberg, 1983). Rules function as mechanisms of control through their two-sided nature of restriction (by reducing freedom of action) and support (by providing solutions for known problems) for rule followers (Farjoun, 2010; Ortmann, 2010; Weichbrodt & Grote, 2010; Zhou, 1997). Rules as organizational control are often associated with bureaucracy, which constitutes a general scheme of control distinguished from others, such as markets and clans (Cardinal, Sitkin, & Long, 2010; Ouchi, 1979, 1980). Characteristic of bureaucracies is their reliance on formal rules and aversion towards informal control mechanisms, such as traditions or other social norms. However, most organizations employ a blend of different forms of control. Cardinal, Sitkin and Long (2004) showed in a decade long case study of a moving company how organizations can shift between phases of low and high formalization, trying to find the right balance. Grote (2004, 2009) describes this balance in terms of the management of uncertainty, for which she distinguishes two general approaches: Uncertainty can either be minimized through rules, central planning and standardization (thereby reducing operative degrees of freedom), or be dealt with locally, which requires flexibility by maximizing operative degrees of freedom. In general terms, the approach of minimizing uncertainty means organizational control through restrictive, detailed rules and surveillance, whereas the approach of coping with uncertainty means generating less rules, or rules which are less restrictive and offer decision latitude (see below).

Rules are also a form of coordination. Coordination mechanisms in organizations can be defined as “the organizational arrangements that allow individuals to realize a collective performance” (Okhuysen & Bechky, 2009, p. 472). Rules are one type of

coordination mechanism, whereas others are, for example, technologically defined processes, personal leadership, or mutual adjustment via reciprocal team interaction (Thompson, 1967; Van de Ven, Delbecq, & Koenig, 1976). Rules provide accountability and predictability by defining responsibilities for tasks, and help in achieving a common understanding by developing agreement between organizational actors (Okhuysen & Bechky, 2009). Interestingly, both following rules as well as collectively breaking rules can serve coordination: In a field study in a medical trauma center, Faraj and Xiao (2006) identified reliance on protocol as one among several coordination practices. They also found that, under certain unusual circumstances, collective protocol breaking was used as one of several ways to respond to time-critical or novel events.

Rules can furthermore serve as repositories of organizational knowledge (Kieser, 2008; Levitt & March, 1988; March, Schulz, & Zhou, 2000). Organizations can learn by developing routines for solutions to recurring problems, and then codifying these routines into formal rules for later retrieval (Beck & Kieser, 2003). Instead of developing a new solution each time a problem occurs, organizational actors can apply the rule and thus draw from organizational knowledge. Formal rules can also be used to teach newcomers, and furthermore to replicate the underlying routines, for example, to a new factory of an expanding organization (Argote & Darr, 2000; Winter & Szulansky, 2001). A key point regarding rules as codified organizational knowledge is, however, that rules are naturally abstract and incomplete (Bourdieu, 2005; Ortmann, 2010). Tacit knowledge is knowledge that is tied to movement skills, intuition, or implicit heuristics (Nonaka, 1994; Nonaka, von Krogh, & Voelpel, 2006). Such knowledge cannot be stored in formal rules, but is instead reliant on the continuing application of rules in the form of organizational routines (Lazaric, 2000; Reynaud, 2005). Nonaka and von Krogh (2009) theorized tacit and explicit knowledge along a continuum. Formal rules would then be positioned as strongly explicit. Viewing rules as explicit knowledge and as learned and codified problem solutions means that rule violations can be seen as opportunities for organizational learning: If environments change, the established rules may no longer represent the best solution to a specific problem and actors may start to actively search for a better way – which, however, can mean breaking rules (Desai, 2010). Rule violations

are then indicators that the codified knowledge is obsolete and needs to be replaced.

3. Four common challenges with safety rules

All three of these functions of rules in organizations apply to safety rules in high-risk systems as well. In the following, I will outline four typical challenges of safety rules based on safety science literature (e.g., Battmann & Klumb, 1993; Dekker, 2003; Grote, et al., 2009; Hale & Borys, 2012a; Hopkins, 2011; Lawton, 1998) and describe them in terms of their effect on organizational control, on coordination and on organizational knowledge.

3.1. The allurement of writing rules

Safety rules are created and issued by people (or organizational authorities) who are responsible for safety in an organization. This typically means reducing the chance for human or machine error – and one way of reducing human error is to exercise organizational control and prescribe certain behavior by means of safety rules. Safety rules are of course only one type of resource for people responsible for safety (others being, for example, training and technology). But the issuing of rules can be very tempting. In their responsibility for regulating safety, organizations can essentially make two mistakes: they can either be excessively strict or inappropriately lenient. It is not hard to imagine that most rule-makers try harder to avoid the latter one, since safety ultimately is a matter of life and death. In essence – while scrutiny and strictness are certainly necessary – there exists a certain allurement of writing rules to tackle issues of safety.

This allurement is sometimes further increased by the drive of finding a quick solution to a complex problem. Especially after accidents and incidents, there can be public pressure on managers and others in charge of safety to take action immediately – with creating a new rule being an easy and fast measure to take (Mascini, 2005). The notion that accidents represent a “hole” in the rules system that needs “fixing”, is still very prevalent. Morris et al. (1999) showed that decision

makers are more prone to attribute accidents to human error rather than technological failure when they are asked to generate an "if only ... the accident would not have happened" conjecture of accident prevention.

Since high-risk organizations do not operate independent from society and instead are themselves subjected to a system of laws and regulations, pressure to write rules furthermore comes from outside the organization. If an accident occurred, and there was a rule in place that should have prevented it, the rule violator usually is to blame. But if there was no rule in place, at least part of the blame may be assigned to the rule maker. This was the case with the 2006 accident on the "Transrapid" testing track in Northern Germany. The maglev train crashed into a maintenance vehicle still parked on the tracks, killing 23 and severely injuring ten people. During the trial, the judges identified the signaler as the main culprit for not having closed off the track while the maintenance vehicle occupied it. However, two operations managers were additionally sentenced to a € 20,000 fine for not having regulated the process adequately (Regional Court of Osnabrück, 2008). In other words: rule makers were prosecuted for insufficient rules.

An extreme form of the allurement of writing rules is the so-called "cover-your-ass" (CYA) attitude (Ackoff, 2006; Bardach & Kagan, 1982), when safety rules are made by managers with the intention of avoiding even the most remote possibility of taking blame themselves. CYA rule-making is not just about trying to be on the safe side (which is the core responsibility of rule makers), but rather about wanting to be on the safe side *every time*, in every instance, however small the issue may be.

The allurement of writing rules represents an imbalance towards formal control mechanisms (cf. Cardinal, et al., 2004). In organization theory, this has also been captured in the idea of ever-increasing bureaucratization, commonly based on Max Weber's ideas (e.g., 1978). Classic bureaucratization theory argues that formalization has a self-promoting tendency to create more rules. Schulz (1998), however, found that rules do not infinitely "breed" more rules – instead, the production of new rules slows down as more rules are already in place. In any case, too many and too detailed rules are a problem for organizations because they can slow down organizational processes, thus ultimately decreasing organizational

control. Too many rules incrementally developed may not make up a good system. Such an inefficient system of rules has also been termed “red tape” and is defined as excessive formalization in the form of burdensome rules and procedures (Pandey & Kingsley, 2000; Pandey & Scott, 2002). For organizational rule makers, “red tape” means creating a false sense of control. The same phenomenon applied to safety rules in high-risk industries could ultimately mean creating a false sense of safety. For instance, Amalberti (2001) argued that in ultra-safe systems – those which already collect and analyze data on accidents, quasi-accidents, incidents and quasi-incidents – the additional “treatment” of these incidents does not lead to more safety.

Too many rules can also hinder coordination. When, as in the case of “red tape”, the rules system becomes too strict, it only offers little guidance and support for rule-followers. The likelihood of contradictions among rules and other cases of inapplicability increases. Too much restriction furthermore means that actors are less free to choose the appropriate coordination mechanism themselves. Depending on organizational and situational contingencies, more direct forms of coordination like mutual adjustment may be appropriate (Grote, et al., 2009; Van de Ven, et al., 1976). Especially in non-routine situations, where strong but also flexible guidance is needed, strict procedures may actually hinder safe coordinated operation (Dekker, 2003; Woods & Shattuck, 2000).

Regarding rules as a form of organizational knowledge, the allurement of writing rules can lead to high levels of formalized knowledge – at the cost of informal, tacit knowledge. In seafaring, for example, Knudsen (2009, p. 295) contrasted the proliferation of formal procedures with the traditional idea of seamanship, which she defined as “a blend of professional knowledge, professional pride, and experience-based common sense”. She showed that seamen’s reluctance towards the formalization of practices – even though intended to increase their safety – is due to their fear that experience and practical knowledge may get less valued and even lost. Because tacit knowledge cannot be codified easily, increasing formalization of safety-critical processes may actually lead to a loss of organizational knowledge.

3.2. Differences in the symbolic meaning of rules

Safety rules can be seen as organizational artifacts that require interpretation and "translation" into behavioral routines. Artifacts, including rules, can be interpreted both as instruments and as symbols (Heimer, 2008; Rafaeli & Vilnai-Yavetz, 2004; Vilnai-Yavetz & Rafaeli, 2006). Instrumentality is about the usefulness of an artifact, or more precisely: "whether or how artifacts support or hamper desired activities" (Rafaeli & Vilnai-Yavetz, 2004, p. 673). In the case of safety rules, the instrumental dimension is probably the most important one: rules are generally seen as instructions on how to perform a task in a safe manner. However, the instrumentality of rules, i.e., their usefulness for safety, can be assessed differently by different organizational members. For example, rules mandating the use of personal protection equipment like helmets or goggles may be judged instrumental to safety by rule makers, but may be seen as a hindrance by the addressees of such rules. Even larger discrepancies in the meaning ascribed to rules can occur regarding their symbolic meaning. The symbolic dimension of artifact interpretation "regards the associations elicited by an artifact" (Rafaeli & Vilnai-Yavetz, 2004, p. 673). Through the symbolic dimension, artifacts can carry a rich body of meanings and messages (Hatch, 2006; Schein, 1992). In the case of rules, they can, for example, stand for support and helpful guidance, or instead for excessive orderliness or even oppression. The existence of safety rules can mean *safety* to some, while it can mean *risk* to others. When actors view rules as irrelevant and ignore them, it can be regarded as rules having no symbolic meaning at all. A positive interpretation of rules, e.g., when they symbolize precision, support and usefulness, is related to the concept of psychological ownership (Pierce, Kostova, & Dirks, 2001; Pierce, Rubenfeld, & Morgan, 1991), which has been defined as "the feeling of possessiveness and of being psychologically tied to an object" (Pierce, et al., 2001, p. 299). People can feel ownership towards both material and immaterial objects in organizations. Ownership can be regarded as an extension of the self and is generally pleasurable.

The process of artifact interpretation, both instrumentally and symbolically, is prone to a number of influences – one of which is the norms and values held by

organizational actors belonging to different professions. That different professional groups ascribe different meaning to artifacts, including formal rules, is not surprising, considering the power of occupational communities on shaping shared understanding and collective action (Van Maanen & Barley, 1984). Authors have long stressed the importance of taking into account the inter-group differences in safety culture in general (Clarke, 1999; Fonne & Myhre, 1996; Gherardi, Nicolini, & Odella, 1998; Malloy, et al., 2009; Rasmussen & Kroon Lundell, 2012; Silbey, 2009) – but studies on inter-group differences in beliefs about safety rules in particular are scarce. McDonald et al. (2005) showed how the same rules can have very different meanings to different professional groups. In their study, doctors and nurses were interviewed about their perception of the relevance and meaning of safety procedures. Doctors tended to play down the relevance of written rules, emphasizing the non-routine nature of events and the importance of experience and tacit knowledge in medical care. For nurses, on the other hand, following the rules was an important part of their professional ethic. Working according to the rules, for them, was a key element in providing safe and high-quality patient care. These results can be interpreted in such a way, that for doctors, rules have little to no symbolic meaning and are instrumental mostly for beginners. For nurses, on the other hand, rules symbolize safety and professionalism and are crucial for error-free work. In a railroad company, Weichbrodt and Grote (2008, 2012) found different symbolic interpretations of formal rules among signalers, shunters, and workers in construction and maintenance: Signalers generally saw rules as helpful and essential to the successful accomplishment of their tasks. Some even symbolized them as strengthening their collective identity. Shunters, in contrast, saw them as an instrument by which management wants to assert control and assign blame. Construction and maintenance workers, lastly, held mixed views on rules, seeing them as both instruments of control by management, but also helpful in increasing safety. Because for them, following rules often stood in conflict with production pressures, they symbolically associated them with conflict and stress.

These examples demonstrate some of the weakness of safety rules: Their effectiveness as organizational control, as coordination mechanism, and as codified organizational knowledge depends on how they are interpreted (both instrumentally

and symbolically) by organizational actors – specifically among different professional cultures within an organization. Regarding organizational control, different symbolic interpretations rules mean that managers as creators of rules can not be certain about their effect, since it is dependent on the professional norms and values different groups of rule followers ascribe to rules. In occupational communities that devalue the instrumentality of rules in general, or consistently attach negative symbolic associations to rules, it is clear that organizational control through rules is very limited. In order to strengthen the control function in these settings, managers can try to back up formal rules with strict supervision and sanctions. This, however, may only increase the negative views on rules held by these actors.

Different interpretations of rules can also become a problem for coordination – especially when the same rules apply to different professional groups ascribing different symbolic meaning to rules. One group's reliance on rules as important instruments for how to conduct a task may be in contrast to another group's emphasis of informal coordination mechanisms – as was apparently the case between nurses and doctors in McDonald's et al. (2005) study. Such differences may hinder efficient coordination between different professional groups with distinct occupational cultures.

Similar issues arise regarding the function of rules as codified organizational knowledge: Professional groups with negative views on formal rules are more likely to independently cultivate their own, non-codified knowledge (Knudsen, 2009). Especially when rules are regarded as irrelevant, they can become decoupled from actual routines and practices. In extreme cases, the procedures captured in the formal rules may be no more than words on paper, fully separated from the "real" organizational routines, and unbeknownst to other professional groups or to managers, who expect the formal rules to represent the actual routines.

3.3. The inevitability of rule violations

It is a recognized fact that safety rules are not always being followed (Bruns, 2009; Dekker, 2005; Iszatt-White, 2007; Phipps, et al., 2008). In Hale and Borys' (2012a)

review mentioned in the introduction of this paper, both safety rule paradigms recognize a certain inevitability of rule violations. Proponents of model 1 tend to attribute the causes for rule violations to the rule followers and their lack of discipline, conscientiousness or diligence. In model 2, causes are searched for additionally in the work context (for example, lack of knowledge, lack of correct tools, pressure to produce, etc.). Thus, in both models, rule violations are seen as natural phenomena – either due to the fact that people are not perfect, or that rules are not perfect. Accordingly, Lawton (1998, p. 94) concludes: "It is important to remember that violations occur because rules exist."

Rule violations often occur because of goal conflicts. Safety can concern two fundamentally different goals: *Personal safety* is defined as the worker's protection from harm, whereas *process safety* concerns the safe execution of a task (Grote, 2012; Hopkins, 2009). These two types of safety are not necessarily in alignment with each other. For example, hearing protection equipment may reduce workers' risk for hearing impairment (personal safety), while at the same time making it more difficult to detect important changes in machine noise indicating damaged parts (process safety). Operators may be tempted to violate rules prescribing ear protection in order to better identify what is going on with their machinery and not to miss signals of potential breakdowns. In railroad shunting, Weichbrodt and Grote (2008) identified a converse case (the procedure of coupling two cars together), where workers dealt with a goal conflict by frequently breaking rules regarding process safety in favor of their own personal safety.

A different and often occurring goal conflict is that between (any type of) safety and production, sometimes also called *work-safety tension* (e.g., McGonagle & Kath, 2010; McLain & Jarrell, 2007). From a behavioral economics standpoint, Battman and Klumb (1993) have long argued that rule violations can be explained by unclear or conflicting rules: "rule following can be described as a hierarchical top-down process, in which global and general rules decide about lower-level optimization. Often global rules ('production first') and local rules ('safety first') contradict each other" (p. 41). Goal conflicts are thus an expression of ambiguous organizational control. Such a goal conflict (in this case, between production and process safety)

has been illustrated vividly by Bensman and Gerver (1963), who in the 1950s analyzed the usage of the tap in airplane manufacturing. A tap is a tool to create a hole with a screw thread in metal parts, used in cases when the previously drilled holes are not in sufficient alignment. While using the tap bore significant risks for the stability of the airplane's structure and was thus deemed "the most serious crime of workmanship conceivable in the plant" (p. 590), applying it in exceptional (but regularly occurring) situations was commonplace. Following the rule and never using the tap would have meant delays in production, so it was no surprise that Bensman and Gerver discovered this common violation. Along with it, they found a set of informal norms in place regarding the usage of the tap: Workers would deliberately and regularly not use the tap whenever inspectors were near, and there were professional norms (enforced and upheld by foremen) that prevented the overuse of it. In retrospect, the case of the tap could be explained as a relatively simple case of ill-suited rules: productivity demands and safety demands simply where not in alignment. Either the rule needed some official exceptions or management had to accept slower production (or both). For all we know, however, it required two organizational researchers to uncover this misalignment. Because rule violations are usually hidden practices, the underlying goal conflicts are very difficult to discover.

Lawton (1998) studied the reasons for rule violations among shunters and found four different types of violations, two of them relating to goal conflicts: *Situational violations* are "provoked" by lack of the correct tools or understaffing. Workers usually regard these violations necessary. Secondly, *routine violations* constitute a shortcut that has become regular behavior. Lawton defines them as "high-frequency and low-risk violations", which "usually go unpunished, and often have benign effects". Especially routine violations are a problem because they can dilute the entire rules system. Because they are seemingly not very relevant and often improve productivity, workers as well as supervisors tend to accept the violations as inevitable. This can lead to a lack of clarity about for which rules it is accepted to break them and for which it is not. From the workers' point of view, a rightful question to ask is: Why should I follow *these* rules, if we all silently agreed that we don't always need to follow *those other* rules? This phenomenon, in its extreme

form, has been termed *practical drift* and is described as "a slow, steady uncoupling of local practice from written procedure" (Snook, 2002, p. 225) with Ortmann (2010, p. 210) adding: "Often, this process establishes a slightly or even completely different operating procedure that is well known by insiders though not by outsiders – outsiders in the sense of non-members of a rather narrow community of practice."

Obviously, routine violations (and practical drift in particular) constitute the biggest threat to rules as organizational control. If rule followers' practice deviates *routinely* more and more from written procedures over time, rules as a means of control become less and less effective.

Furthermore, the inevitability of rule violations also diminishes the coordination function of rules: Goal conflicts and resulting rule violations create ambiguity among organizational actors about how to accomplish a task. Increasing numbers of routine violations may dilute the entire rules system, making it difficult to rely on rules as coordination mechanisms at all.

Regarding organizational knowledge, frequent rule violations mean that newcomers need to learn two sets of knowledge – the one represented in the formal rules and the knowledge of the actual practices. Even worse, different organizational actors may "solve" goal conflicts differently, with some regularly following the rule and others not. If rule violations are indeed the norm (as for example, in Bensman and Gerver's case of tap usage), this means that the "wrong" organizational knowledge is stored in routines, and the gap between what is practiced and what is prescribed in rules widens.

3.4. Individual decision-making versus rule-following

Underneath all three challenges discussed so far – the allurement of writing rules; different symbolic interpretations of rules; and goal conflicts and the inevitability of violations – lies a central polarity: On the one hand, formal rules are necessary for large organizations to function, but on the other hand, individual initiative, which requires scope of action, is also necessary (cf. Grote, 2009). Zhou (1997) has

described this as two contrasting models of organizational decision making: choice versus rule-following.

For rule makers in high-risk organizations, this polarity takes the following shape: While safety rules are necessary, all rule makers would agree that workers' "common sense" is also necessary. Safety rules and common sense are of course not always in contrast to each other, but they *can be* – yet managers still have to demand both rule adherence and applying common sense from their workers. The same issue can be viewed from the rule followers' point of view, who are, theoretically speaking, faced with a double-bind situation. The two opposing messages are: "Safety is everyone's responsibility, so use your good judgment and decision-making capabilities" versus "for the sake of safety you ought to follow the rules, so *do not* use your own judgment." Whereas goal conflicts are about contradicting goals at the organizational level, this "dilemma" is about individual decision making versus rule following and goes back to the two-sidedness of rules as both restriction and support (Farjoun, 2010; Ortmann, 2010; Weichbrodt & Grote, 2010).

Although inherent in any safety rule, this tension becomes very visible in regulation regarding personal health and safety. In many work settings, for example, workers are required to wear a hard hat as part of personal protection equipment at all times – even when there is no danger from above or risk of bumping one's head. Workers are discouraged from actively using their judgment in identifying and dealing with risks regarding this aspect. Their risk assessment capabilities (a key aspect of taking responsibility for safety) are essentially declared unneeded, as they are only required to follow a simple rule. This is not to say that safety rules about hard hats or other personal protection equipment should be abolished. A rule is a simplification of a decision process, and as such it often makes sense because it reduces the need for risk assessments regarding when and where a hard hat is necessary. But simultaneously, a rule in place also deprives a worker from the opportunity to make a decision on his or her own (and take responsibility for it).

Illustrating this polarity, Sanne (2008) studied railroad maintenance work in Sweden and found that risk-taking is an inherent part of workers' activity. Although a number

of organizational or technological safety measures for reducing risk are implemented (and accepted by the workforce), in order "to 'make it work' in the allocated time, rules may be broken and risks taken". Similarly, Knudsen (2009) contrasted the traditional idea of seamanship with formal rules. Seamen's reluctance towards rules, as she showed, was in part due to their fear that responsibility and opportunities for individual decision making are taken away from them.

The polarity of individual decision making versus rule following poses a challenge to organizational control because organizations cannot function without one or the other. While rule following behavior is necessary for an organization to function, it clearly cannot operate on this alone. If, in the case of "work-to-rule", rule followers decide to act *exclusively* according to the rules and to withhold individual decision making, operations can be severely slowed down (Napier, 1972).

Regarding rules as a coordination mechanism, the double-bind situation of "follow the rules" versus "follow your own judgment" represents a fundamental challenge for organizational actors trying to coordinate themselves. Individuals sometimes need to carefully consider whether following the rules like everybody else really is the right thing to do.

Finally, the described polarity also depicts the limitedness of rules as organizational knowledge: Relying on past solutions codified in rules only works for known and repeatedly appearing situations. In unexpected events, quick and sound decision making is inevitable, particularly in high-risk organizations (Dekker, 2003; Woods & Shattuck, 2000).

The four challenges with safety rules with regard to their functions as control, coordination and knowledge are summarized in Table 2.

Table 2: Challenges for safety rules and their functions as control, coordination and knowledge

Challenge	…for rules as organizational control	…for rules as coordination mechanism	…for rules as organizational knowledge
Allurement of writing rules	• Imbalance towards formal control • Too many rules may lead to false sense of safety	• Possibility of contradictory rules • Difficulty to choose appropriate coordination mechanism, especially in non-routine situations	• Tacit knowledge may get lost
Differences in the symbolic interpretation of rules	• Effectiveness of rules as control depends on rule followers' interpretation	• Difficulty in rules-based coordination across communities	• Gap between codified and practical knowledge may increase
Inevitability of rule violations	• Loss of control, especially in cases of "practical drift"	• Diminished reliance on rules as coordination mechanism	• "Wrong knowledge" is stored in routines
Individual decision-making vs. rule-following	• Loss of control in cases of "work-to-rule"	• Double-bind can hinder coordination	• Individual decision-making necessary for creating new solutions

4. Four Measures of good rules management

In the second part of the paper, I will outline four important measures organizations can employ to face these challenges around rules. These measures are based on common themes in literature on the management of safety rules (Grote, 2012; Hale & Borys, 2012b; Hale & Swuste, 1998; Hale, Heijer, & Koornneef, 2003; Larsen & Hale, 2004; Leplat, 1998; Reason, et al., 1998). Each of these measures works, again, through the three functions of rules in organizations, the specifics of which are outlined below. The four measures are not linked one-on-one to the four challenges discussed before. Instead, most measures address several challenges at once. The relevance of each measure to the four challenges is described at the end of each section.

4.1. Managing the restrictiveness of rules

For many, the term “safety rule” invokes ideas of clarity and unambiguity and is thus often defined very strictly (e.g., as describing “the ONLY proper way to perform a work activity” (Ranney & Nelson, 2007, p. 1; emphasis in the original). The idea of a rule explicitly providing decision latitude is often met with skepticism and labeled as a “soft rule”. However, several authors in the field of safety science have highlighted the benefits of varying the degree of restriction in rules. Often building on Hale and Swuste’s (1998) work, authors have shown how different levels of scope of action are needed, depending on situational, personnel or task characteristics (Blakstad, Hovden, & Rosness, 2010; Borys, 2012; Grote, 2012; Grote, et al., 2009).

Hale and Swuste (1998, p. 165) defined safety rules as follows: “A safety rule is a defined state of a system or way of behaving in response to a predicted situation, established before the event and imposed upon those operating in the system […] as a way of improving safety or achieving a required level of safety.”. Their typology of safety rules distinguished rules at the level of action regulation: *Action rules* define the required behavior on a concrete and detailed level; *process rules* specify the means of how to come to a decision about the right course of action and thus can function as solution search rules; and *goal rules* only broadly define a desired goal or state of a system, leaving it up to the rule follower which actions to take in order to achieve it. Goal rules provide the least restriction for rule followers, but also offer only little support. Action rules are highly restrictive, but on the other hand also offer ample support (Weichbrodt & Grote, 2010).

Another often ignored possibility in rule design is that it could be desirable to frame rules in a non-binding way as advice or recommendation. While some exclude such rules from their definitions of safety rules altogether, I argue that such recommendatory rules can offer a balancing function in many cases. However, recommendatory rules can pose problems when an accident or incident happens: Because of their indefinite nature, assessing human error is more difficult. Rule makers might fear not adequately meeting their responsibility for safety when there is no single course of action deemed the correct one – thus shy away from issuing recommendations. As such, I argue that especially in less-critical processes they

might be useful in order to decrease the overall restriction workers experience and allow for variation in the tasks performed (Weichbrodt & Grote, 2010). In connection with informal, unwritten norms and work ethics, recommendatory rules could serve as a form of “best practice solution” made explicit and integrated within the safety culture. Another way to use recommendatory rules is to combine them with goal rules: In this case, achieving an unambiguous goal would be mandatory, but the documented way to achieve said goal is less restrictive and “only” a useful recommendation. Similar to process rules, such combinations would strike a balance by being both restrictive and supportive.

From an organizational perspective, the issue of finding the right degree of restriction can be dealt with by delegating increasing levels of restriction downwards in the organizational hierarchy. Rules made at the top level can be written less strict, covering only the minimally required safety level. Sub-divisions of the organization can then be authorized to issue stricter rules if their specific tasks or its context requires them. For example, a general rule could require workers to always have safety goggles with them and put them on only when needed. In work areas where risk of eye injuries is especially high, the respective managers could make the rule more restrictive and require workers to always wear them.

Blakstad et al. (2010) presented a case study of rules revision in the Norwegian railway system where action rules were supposed to be changed towards more outcome-oriented rules with greater latitude for decision-making (i.e., goal rules). However, the final results of the rules revision, involving a process termed “reverse invention” by the authors, showed a combination of goal and action rules. The case shows how a combination of top-down processes (aiming to introduce outcome-oriented rules) and bottom-up processes (inclusion of existing rules and knowledge, mainly action rules) can be a strategy in order to find the correct degree of restriction.

Generally speaking, the more uncertainty for a task is involved, the less restriction should be used (Grote, et al., 2009). If the degree of restriction is too high, actors might not be able to do the right thing in exceptional situations and are potentially forced to commit rule violations. Especially action rules greatly reduce actors’

responsibilities, aggravating the dilemma between individual decision-making and rule-following outlined above – whereas rules providing scope for action always leave a fair share of decision-making with the rule follower. Indeed, when dealing with occurrences of repeated (small-scale) violations, reconsidering the restrictiveness of the rules in question is a useful approach. Avoiding overly strict rules by carefully selecting the right degree of restriction will thus reduce "inevitable" violations. In this way, making rules less restrictive can actually *increase* organizational control: It may be better to have a rule that is less detailed and leaves some room for individual decision-making, but is accepted by rule followers because it fits the task – than having a rule that prescribes a task down to the last detail, but is detached from reality and not possible to adhere to in frequently occurring situations. An overly restrictive rule that gets ignored is less effective than a more lenient rule which is being followed.

Furthermore, better-suited rules whose restrictiveness is tailored to actors' task and context requirements are also beneficial to coordination: Rule followers can only rely on rules as a shared coordination mechanism when they are actually able to follow them (and can expect others to follow them, as well). Reducing the necessity of violations by actively managing the restrictiveness of rules is therefore beneficial to both organizational control and coordination. Bearing in mind and truly considering the option of varying the restrictiveness (whether by goal or process rules or by recommendatory rules) should furthermore mitigate some of the allurements of writing rules.

Regarding rules as a representation of organizational knowledge, it is equally important to have rules tailored well to rule followers' actual behavior. If rules are too restrictive and detailed, the corresponding organizational routines may therefore incorporate variations not covered in the rules. In such cases, relying on the formal rules as representations of people's actual behavior may lead to false conclusions and organizational knowledge may actually be lost. It is important to keep in mind that most knowledge cannot be fully codified in rules. Reducing the detailedness in written rules may therefore not really be a loss in many cases, as knowledge is to some degree always stored in rule followers' application of these rules in everyday

organizational life. Managing the restrictiveness of rules can also mean trying to grasp this practical knowledge and take it as a starting point to formulate new rules around it in a bottom-up process (a further measure of good rules management discussed next).

In summary, managing the restrictiveness of rules can mitigate some of the allurements of writing rules and reduce rule violations by giving appropriate leeway. Less restrictive rules can thus also help strike a balance between individual decision-making and rule-following.

4.2. Participation in rule creation and adaptation

Designing completely new rules on the basis of the organizational routines in place can be considered an extraordinary form of participation and is probably practiced only rarely. More common seem to be consultation procedures in cases of new rules or adaptations to existing rules: Before they become official, rules suggestions are sent out to relevant stakeholders within the organization for comments. Through this procedure, middle managers and team leaders familiar with local requirements and working conditions have the opportunity to voice concerns (but also to give positive feedback) about regulation to be implemented. Though often this is merely a form of consulting and not binding for the rule making authority, it nevertheless gives rule followers a real chance to point out flaws and foreseeable difficulties. Rule makers on the other hand have an opportunity to rule out heavy mistakes beforehand, and can expect better support for the implementation of their new rules.

Research on participation in rule creation has only recently begun, but has nevertheless brought about interesting findings: Although not testing participation in rule creation per se, Simard and Marchand (1997) found that a participatory management style in manufacturing plant workgroups is positively related to rule compliance. Bax et al. (1998) report on a survey of 143 employees of high-risk organizations (mostly in healthcare) with somewhat conflicting results: Workers perceived the legitimacy of formal rules as higher when enforcement was stricter and when they were consulted regularly by supervisors about the rules, but also

when they did *not* take part in the formulation of the rules. According to the authors, this finding could indicate the existence of a blame culture, where workers do not want to be held responsible for the rules, but consultations with management about the rules are needed for marking the boundaries of their responsibilities. Ranney and Nelson (2004; 2007) found evidence for participation in rules revision having positive effects on safety culture and incidents rates in the U.S. railroad industry: In one out of three railroad carriers analyzed, a statistically significant improvement in incident rates could be found after a participatory rules revision process. Interview data pointed towards further benefits of such a change process, such as a reduced number of safety rules, better-suited rules (and thus increased compliance), improvements in union-management relations, and increased psychological ownership of the workforce regarding safety rules and safety. This last finding points to the symbolic interpretation of rules. Participation in rules revision, its seems, shapes rule followers' perception of the relevance and meaning of rules. Taking part in the creation process of rules may lead to actors symbolizing rules in a more positive light.

Compelling findings regarding participation in rule changes also come from Bourrier (1996, 1998), who analyzed and compared maintenance work in four nuclear power plants. She found that in two of the plants different practices of swift rule adaptation where in place in order to make rule compliance easier when conditions have changed. In one plant, the engineers responsible for the formal procedures maintained a close relationship with the foremen and maintenance workers carrying them out. In another plant, the maintenance foremen themselves had the authority to change the procedures. However, in the two other plants, no such mechanisms for swift rule adaptation were in place, and thus bypassing rules in order to get the job done was the norm. This finding particularly highlights how participation can reduce "necessary" violations.

These studies provide a convincing starting point in terms of scientific evidence for the benefits of participation in rule creation and adaption. Participation thus leads to fewer goal conflicts and fewer violations as the overall "usability" of rules is increased. Similar to managing the restrictiveness of rules, this measures thus

improves both organizational control by means of rules and the functioning of rules as a coordination mechanism. In particular, cases of *practical drift* would become apparent and could be counter-balanced either by adapting rules or trying to change rule followers behavior (e.g. by education and training as outlined below). Additionally, participation can act as a measure to counter the allurement of writing rules in an organization, because it provides rule followers with an opportunity to voice their concerns in cases of too many rules already in place. Especially "cover-your-ass" rule-making would become visible and preventable – although such cases probably have some underlying issues of lacking mutual trust and a co-operative atmosphere between rule makers and rule followers and therefore may not be easily fixable.

If different professional groups within an organization have fundamentally different interpretations of rules, and all are sufficiently able to participate in the rule-making process, these differences should be noticed by rule makers and can be addressed appropriately. Furthermore, increasing psychological ownership of rules through participation should shift the symbolization of rules towards a more positive interpretation. Coordination across communities could thus be improved.

With regard to organizational knowledge, participation in the rule creation process can help align routines and rules in a bottom-up process. As described in Bourrier's (1998) case, participation can be seen as a process of turning "wrong routines" (i.e., routines incorporating disallowed but necessary violations) into "correct rules" (rules that cover the actual, adequate routines). When the actual routines (which have proven to be successful) are represented better in the formal rules, the rules system can work more efficiently as codified organizational knowledge.

Participation can thus be used to face three challenges: allurement of writing too many rules is countered by rule-followers, the symbolic interpretation of rules can be influenced in a positive way, and "inevitable" rule violations are reduced.

4.3. Education and training about rules

Obviously, in order to follow rules, one has to know about them. Given the vast numbers of rules and regulations in some high-risk industries, stemming from different sources, this is not a trivial issue. Education and training about rules can take many different forms. Even before entering an organization, actors' professional education already constitutes a background of (theoretical) knowledge about practices and possibly even basic formal rules. When workers enter the organization as new members, they are most amenable to organization-specific shared values and beliefs. As such, during initial training after entering an organization, workers are learning not only formal rules and procedures but also "breathe in" the informal norms and values of an organization – including the ones around how the rules are typically perceived and dealt with (Gherardi & Nicolini, 2002). Through additional training later on in an employee's career, explicit knowledge can be more or less easily changed, but changing tacit knowledge usually requires much more effort (Salas & Cannon-Bowers, 2001). For safety trainings, it has been found that the more participants are actively engaged, the more effective the training (Burke, et al., 2006). Rather than just ordering practices by means of issuing rules, managers should therefore actively engage with workers in order to explain and persuade (Conley, Singer, Edmondson, Berry, & Gawande, 2011). In this way, educating about rules and their reasons is key in bridging the gap between knowledge stored in formal rules and in organizational routines. Especially in aviation, crew resource training has become a standard in safety management (Helmreich, Merritt, & Wilhelm, 1999; Salas, Wilson, Burke, & Wightman, 2006). Through training, members of heterogeneous teams with different professional backgrounds can develop a better shared understanding, whereas homogenous teams can learn to counter complacency and challenge their assumptions (Grote, 2012).

Regarding rules as organizational control, education about them can first and foremost reduce violations. During safety trainings, well-known routine violations can be addressed and the reasoning behind the rules can be communicated. Such trainings are also an opportunity to discuss typical goal conflicts and, ideally, give

rule followers some assistance in how to deal with them. In such a way, training can be used to teach not only the formal rules, but also informal organizational norms and desired priorities.

Assistance in goal conflicts (and thereby reducing them) is also beneficial to coordination. Intensive interdisciplinary training can align different interpretations of rules among different professional groups – ideally enhancing coordination between them.

Lastly, training can be understood as a management tool to strengthen the "correct" organizational knowledge. Well-trained employees thus not only schooled in the formal rules and the ideas behind them, they are also better equipped to deal with unexpected situations, when new solutions need to be created out of existing individual and organizational knowledge. Training, understood as more than simple instruction on how to perform tasks, can then be a resource to workers for better rule-following as well as for better individual decision-making.

To sum up the effects of education and training, such measures can shape informal norms and symbolic interpretations of rules, they can provide assistance in goal conflicts and thus reduce the problem of necessary violations, and they can increase actors' ability for balancing individual decision-making and rule-following.

4.4. Considering alternative to rules

Another solution to overcome the challenges of safety rules is to simply not create them in the first place and instead consider alternatives. Two different forms of alternatives are discussed here: The first choice is to alter equipment or infrastructure design instead of writing rules in order to encourage or enforce safe behavior. The second is attempting to change norms and values regarding safety as a form of informal control.

Leplat (1998), building on Norman (1988), suggested system designers should check if ergonomic principles could be applied instead of safety rules. For example, the principle of affordance means that instruments or infrastructure can be designed as to afford, or "invite" the safest usage. Even more effective could be the

use of forcing functions, which "are a form of physical constraint: situations in which the actions are constrained so that failure at one stage prevents the next step from happening" (Norman, 1988, p. 132). An example would be safety mechanisms that prevent operators from opening a machine while it is running. Leplat (1998, p. 202) concludes: "For every rule, it is always good to ask: what should be done to eliminate the necessity for this rule?" Changing objects or infrastructure in order to eliminate the need for safety rules seems like a promising approach. But implementing principles like affordance or forcing functions into equipment and infrastructure only leads us back to the question of finding the right degree of restriction. Designing forcing functions, by its nature, is strongly restrictive. It actually means higher restriction than prescribing behavior through rules, as these usually can be more easily broken than forcing functions can be circumvented – which could turn out to be necessary in an unforeseen situation. Ultimately, the question of how to strike a balance between restriction and support is just as relevant in equipment design.

Theoretically, another alternative to formal rules could be *informality*. Researchers in the High Reliability Organizations (HRO) framework have long pointed out the importance of "soft factors" like culture for achieving safety (e.g., Bierly & Spender, 1995; Rochlin, 1999; Weick, 1987). The HRO literature, however, offers only little support for rule makers and others in charge of safety on how to tap into the social or cultural aspects of safety. In fact, there is considerable consensus that safety culture is not directly controllable or modifiable (Gherardi & Nicolini, 2002; Grote & Weichbrodt, 2013; Silbey, 2009). Nevertheless, culture seems to be such a strong force in organizations that it should not be neglected. Levers for influencing culture are – as outlined above – education and training, as well as leadership. When trying to influence employees' norms and values, informal hierarchies among them can be taken advantage of: By getting experienced and well-respected workers on one's side, these can act as role models and influence others. In any case, however, it is clear that changing culture is a difficult and long-term process, whereas rules, if implemented well, have a much more short-term effect.

Outside of organizations, an interesting example of replacing rules with alternatives can be found in traffic regulation in the form of *shared spaces* (e.g.` Hamilton-Baillie, 2008). Shared spaces are a combination of re-designing infrastructure and counting on informal forms of coordination. Through rebuilding streets and squares by removing curbs and markings and abolishing traffic signs and street lights, all public space is available to all stakeholders (cars, bicycles, pedestrians). Traffic is regulated not by rules that separate space into roads and pedestrian walkways, but instead by mutual communication and awareness. Re-designing infrastructure in this case notably does not include forcing functions, but rather the opposite: By removing clear boundaries and making all space available to everybody, uncertainty is increased, which is thought to prompt actors to act more cautious. The principle behind shared spaces can thus be described as “dangerous is more safe”. The idea has been implemented in a few cases in small towns across Europe with some success.

Considering alternatives to rules is an important measure of rules management in organizations, albeit not without its own difficulties. On the positive side, choosing alternatives to rules of course eliminates violations and goal conflicts around rules and all related challenges for organizational control and coordination. Even more, merely actively considering alternatives works against the allurement of writing rules and can thus increase organizational control by averting “red tape” and a false sense of safety. However, as outlined above, fundamental questions about the degree of restrictions still apply to equipment design, and organizational control through informal measures is often much more difficult to achieve, especially in large organizations (Walsh & Dewar, 1987).

Regarding coordination, it is not clear whether replacing rules with alternatives makes it easier for organizational actors to coordinate: On the one hand, the supporting function of rules (as guidelines and orientation) are lost. On the other hand, similar difficulties as in regard to organizational control appear. Re-designing equipment and implementing forcing functions can hinder coordination in exceptional situations. Relying on informal forms of coordination means that actors are not restricted on how to achieve coordinated action and instead can try to find

the best mechanism for coordination on their own. This process, however, requires sufficient training and resources (Grote, et al., 2009).

With regard to organizational knowledge, relying on alternatives to formal rules eliminates the gap between them and actual routines. Because it is unlikely that technological equipment can function as storage for organizational knowledge in the same way as rules do, practical knowledge stored in actors routines would be the only form of knowledge in such a case. While on the one hand, the loss of a codified version of organizational knowledge could pose problems, it could, on the other hand, strengthen the acceptance and importance of practical knowledge.

In summary, choosing alternatives to rules eliminates the problem of rule violations and can act as a countermeasure to the allurement of writing rules. While an important aspect of rules management, the impact of abolishing rules should be carefully considered.

The four measures of rules management discussed above and their implications for organizational control, coordination and organizational knowledge are summarized in Table 3.

5. Conclusion

In this article, I have linked research on safety rules and rules management with broader theory on rules in organizations. The result is a juxtaposition of challenges and measures regarding safety rules as means for organizational control, as coordination mechanism, and as codified organizational knowledge.

This article can serve as an example for the transfer of knowledge from one domain to another. Prior research has proposed similar issues regarding safety rules and ways of dealing with them (Dekker, 2003; Hale & Borys, 2012a, 2012b; Hale & Swuste, 1998; Hale, et al., 2003; Larsen & Hale, 2004; Leplat, 1998; Reason, et al., 1998). Putting these issues of safety in high-risk industries into a broader organizational context is a novel achievement of this article. The resulting framework can benefit both researchers and practitioners.

Table 3: Measures of good rules management and implications for the three functions of rules

Measure	Implications for organizational control	Implications for coordination	Implications for organizational knowledge
Managing the restrictiveness of rules	• Reduces violations by giving appropriate leeway (less restriction can mean more control)	• Increases rule followers' ability to rely on rules as coordination mechanism	• Formal rules can better represent actual routines
Participation in rule creation and adaptation	• Reduces violations and goal conflicts • Mitigates "practical drift" • Possibly counters allurement of writing rules	• Reducing necessary violations improves coordination • Different interpretations are noticed • Increases ownership of rules	• Can align rules and routines by turning "wrong knowledge" into "correct rules"
Education and training	• Reduces rule violations • Provides assistance in goal conflicts	• Helps to align different perceptions on rules • Provides assistance in goal conflicts	• Strengthens "correct" knowledge • Provides resources for better individual decision-making
Considering alternatives to rules: *Re-designing equipment*	• Eliminates violations and goal conflicts • Counters allurement of writing rules • Difficulty of finding the right degree of restriction still remains	• Actors could be hindered to coordinate in exceptional situations	• Eliminates gap between formal and practical knowledge • Equipment less useful for storing knowledge
Considering alternatives to rules: *Relying on culture and informal norms*	• Eliminates violations and goal conflicts • Counters allurement of writing rules • Control through informality is more difficult	• Although supporting function of rules is lost, actors may be able to better find adequate coordination mechanism	• Eliminates gap between formal and practical knowledge • Strengthens practical knowledge

For researchers in the domain of safety science, organization theory provides an important backdrop for all that goes on in high-risk industries. Problems and challenges for safety can be regarded as general problems which all organizations are facing. Vice versa, organizational researchers could apply their theories to high-risk organizations in order to test them and determine their range of applicability.

This article represents an attempt of the former – with the latter being an excellent opportunity for future research.

For practitioners (especially rule makers) in high-risk industries, the framework presented in this article serves as an orientation for taking into account the multiple and diverse functions of rules. Keeping in mind that rules are not just instruments of organizational control, but have to work as mechanisms for coordination and as codified organizational knowledge as well, will generate better rules. The four challenges outlined furthermore serve as a reminder that every rules system is in flux, given a large enough timeframe. External requirements, internal conditions, people, technology and probably every other aspect of an organization inevitably changes and a rules system needs to address this in order to function (March, et al., 2000; Schulz, 2003). The four solutions discussed can thus be seen as strategies for taking into account the multiple functions of rules as well as for dealing with this "impermanent institutionalization" (Schulz, 2003, p. 1077) that lies in the nature of every (safety) rule.

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