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BALANCING ORGANIZATIONAL STABILITY AND CHANGE: A PRACTICE PERSPECTIVE ON ROUTINE INTERDEPENDENCE

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Jan Willem Hoekzema

geboren in Bonn

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Erstbetreuer: Prof. Dr. Daniel Geiger

Zweitbetreuer: Prof. Dr. Sebastian Späth

Vorsitzender: Prof. Dr. Rick Vogel

Erstgutachter: Prof. Dr. Daniel Geiger

Zweitgutachter: Prof. Dr. Timo Busch

Drittgutachter: Prof. Dr. Dominik Vogel

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First Dissertation Paper

Bridging the Gap between Ecologies and Clusters: Towards an Integrative Framework on Routine Interdependence (Jan Hoekzema)

Status:

Revise and Resubmit at: European Management Review (VHB-JOURQUAL3: B)

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Second Dissertation Paper

Exploring Routine Interdependence: Fluid Boundaries and Adaptive Patterning (Jan Hoekzema/Daniel Geiger)

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Third Dissertation Paper

Granularity Matters! Towards a Methodological Framework on Routine Studies (Jan Hoekzema/Waldemar Kremser/Daniel Geiger)

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Synopsis

Introduction

Organizational routines[1] are fundamental mechanisms by which organizations accomplish the majority of their work (Cyert and March, 1963; March and Simon, 1958; Nelson and Winter, 1982; Thompson, 1967). Traditionally, routines were conceptualized as habitual patterns of collective actions (Gersick and Hackman, 1990; Stene, 1940) or information-processing programs (March and Simon, 1958) that foster efficiency, reliability, and organizational stability (Hannan and Freeman, 1984; Nelson and Winter, 1982). Recently, this perspective was challenged through the emergence of the routine dynamics school of thought. Here, scholars have uncovered the ever-changing nature of routines and illuminated that these internal dynamics contribute to both stability and change in organizations (Feldman and Pentland, 2003; Feldman, 2000; Pentland and Feldman, 2005; Rerup and Feldman, 2011).

The notion that routines are practices with internal dynamics has long geared the scholarly focus towards *single* routines. Organizations, however, consist of *multiplicities* of routines that inter-dependent in more or less complex interrelationships (Kremser and Schreyögg, 2016; Sele and Grand, 2016; Spee et al., 2016). Reaching back to the fundamental principle of division of labor, organizations divide complex organizational tasks into *multiple* specialized routines that - when integrated sufficiently - each contribute a partial result to the accomplishment of the overall task (Kremser and Schreyögg, 2016; Lawrence and Lorsch, 1967; Smith, 1776). Organizational outcomes are therefore mainly generated by the concerted effort of multiple, interrelated routines (Kremser and Schreyögg, 2016). Triggered by this fundamental insight, the scholarly focus has recently extended from the internal dynamics of *single* routines towards the ways *multiple* routines interact, intersect, and be interdependent (Feldman et al., 2016; Kremser et al., 2019). By adapting this exciting new perspective scholars are able to explore in detail how

[1] From this point on, I will refer to organizational routines simply as routines

organizational tasks are accomplished and how organizational dynamics, such as stability, change, and innovation are generated and balanced (Feldman et al., 2016; Kremser and Schreyögg, 2016; Sele and Grand, 2016; Spee et al., 2016).

Routine interdependence research has diverged into two schools of thought: routine ecologies and routine clusters. The former stream of research describes the coordination processes at the interfaces between interrelated routines as dynamic balancing acts that generate the potential for emergent change and innovative outcomes (Birnholtz et al., 2007; Sele and Grand, 2016; Spee et al., 2016). The latter stream of research, however, somewhat contradicts this perspective by emphasizing that coordinating interdependent routines is achieved via the programming of interfaces between routines. As re-configuring these programmed interfaces becomes increasingly difficult, interdependent routines contribute to path-dependence and organizational stability (Kremser and Schreyögg, 2016). Current research thus hovers around two extremes that either link interdependent routines to generativity, flexibility and organizational change (Birnholtz et al., 2007; Sele and Grand, 2016; Spee et al., 2016) or conceptualize them as limiting to organizational dynamics and change (Kremser and Schreyögg, 2016). This lack of agreement between both schools of thought marks the starting point of my research endeavor.

This cumulative dissertation contains three papers that make important conceptual, empirical, and methodological contributions to the literature on interdependent routines, routine dynamics, as well as the broader field of process studies. The first dissertation paper introduces a conceptual model that synergizes insights from the routine ecologies and the routine clusters school of thought. Thereby, it develops an integrative framework which unveils that coordinating interdependent routines is an ongoing process of addressing different degrees of interdependence with specific modes of coordination. Building on these insights, the framework further illuminates that these different modes of coordinating interdependent routines play a key role in the process of balancing organizational stability and change. Hence, the first

dissertation paper contributes to an improved conceptual understanding of the coordination processes among interdependent routines and their role for organizational dynamics. The second dissertation paper challenges the prevailing assumptions in current research that interdependent routines have distinct boundaries and coordination thus occurs at their clearly identifiable interfaces. The paper empirically shows that routine boundaries blur, shift, and potentially even dissolve over time and coordination is thus not achieved at the interfaces between routines, but rather between actions within the respective routines that are dynamically adapted to each other. As a result, the paper generates important insights into the dynamics of routine boundaries and the coordination processes among interdependent routines. The third dissertation paper introduces the concept of granularity into routine studies. By conducting an extensive literature review the paper unveils that routine dynamics scholars unconsciously apply diverging levels of granularity in their empirical work. The paper reveals that side-stepping the concept of granularity significantly aggravates the comparability of studies since different levels of granularity foreground very different coordination problems. To address this issue, the paper develops a methodological framework that enables researchers to establish the appropriate level of granularity in their empirical study.

This synopsis serves as an introductory chapter to the three dissertation papers. It is structured as follows: First, I review the literature on single and interdependent routines. Thereby, I provide an overview of the relevant fields of research and lay the ground for the research questions. Subsequently, I outline the major shortcomings that this dissertation aims to address within the scope of its research agenda. Afterwards, I provide detailed insights into the research setting, as well as the methodological approach of this work. Finally, I briefly summarize the three dissertation papers and reflect on their synergies, contributions, as well as the potential questions for further research.

Theoretical Framework

This chapter outlines the evolution of the scholarly debate on organizational routines. It begins with a comprehensive review of research on *single* routines. Here, I differentiate between the traditional perspective on single routines and more recent research on routine dynamics. Following this section, I introduce the evolving stream of recent research on *multiple*, interdependent routines. By delineating the main schools of thought in this field - routine ecologies and routine clusters - and distilling the respective research gaps, I develop the research agenda of this dissertation.

Single Routines: From Stability towards Flexibility

Traditionally, routines were conceptualized as stable mechanisms that reduce cognitive complexity and improve organizational efficiency (Cohen and Bacdayan, 1994; Cohen et al., 1996; Cyert and March, 1963; March and Simon, 1958; Simon, 1947). Routines were hereby also seen as potential sources of inertia, inflexibility, competency traps and thus organizational stability (Hannan and Freeman, 1984; March, 1991; Weiss and Ilgen, 1985). This perspective shifted with the emergence of the routine dynamics (Feldman and Pentland, 2003) school of thought. Following this perspective, routines endogenously change and their internal dynamics contribute to both organizational stability and change (Feldman and Pentland, 2003; Feldman, 2000; Pentland and Feldman, 2005; Rerup and Feldman, 2011). In the following, I outline the development of both streams of literature and distill their key insights.

Traditional Perspective

Early work by Stene (1940) defined routines as patterns of interaction that facilitate coordinated organizational activity. A few years later, Simon (1947) came up with the notions of boundedly rational individuals and organizations as rational systems where resolving conflicts and efficient coordination are essential. In this vein, he identified routines as important mechanisms to conserve time and attention in decision-making processes (Simon, 1947). Following this line

of thought, organizational designers establish routine programs when organizations are confronted with recurring (decision) problems (Cyert and March, 1963; March and Simon, 1958). Thereby, most of the major decision are made in advance and do not require any deliberate search (March and Simon, 1958). For every triggering event (such as a decision), the respective performance steps for program execution are pre-defined (Luhmann, 1971; Simon, 1978) to ensure that actors in organizations do not have to consistently re-interpret the respective problems (Walsh and Ungson, 1991). The repetitive performance of routine programs then leads to a strong internalization of the underlying performance specifications, which significantly reduce the search for new, alternative ways of reacting to a particular stimulus (Ashford and Fried, 1988; Gersick and Hackman, 1990). Thereby, routines positively influence organizational performance by increasing cognitive efficiency and reducing complexity (Cohen and Bacdayan, 1994; Cohen et al., 1996; March and Simon, 1958; Simon, 1947). Further, by developing stable patterns of collective actions, routines facilitate conflict resolution and efficient coordination (Cohen and Bacdayan, 1994; Cyert and March, 1963; Hannan and Freeman, 1984; March and Simon, 1958; Nelson and Winter, 1982). Hence, following the traditional perspective, routines promote standardization, reduced variability, and the avoidance of failure (March, 1991). Besides these positive effects, however, routines are also described as source of inertia (Hannan and Freeman, 1984), inflexibility (Weiss and Ilgen, 1985), deskilling (Leidner, 1993), mindlessness (Ashford and Fried, 1988), and competency traps (March, 1991). Thus, following the traditional perspective, routines are the opposite of flexibility and change, locking organizations into inflexible, unchanging patterns of action.

Irrespective of their positive or negative effects on organizations, routines are traditionally conceptualized as internally stable. In this vein, they are considered as crucially important but rather undifferentiated arrows that connect organizational inputs with outputs in the firm's economy (Feldman, 2016). As a result, traditional scholars pay relatively little attention to individual agency within these mechanisms and rather see routines as unchanging entities or

black boxes (Feldman, 2016; Parmigiani and Howard-Grenville, 2011; Salvato and Rerup, 2011). At this juncture, the routine dynamics school of thought emerged. Being rooted in organizational theory, this perspective emphasizes the internal processes of routines by focusing on their daily enactment and the respective consequences. Thereby, it opens the black box of routines (Parmigiani and Howard-Grenville, 2011).

Routine Dynamics

The study of routine dynamics elaborates on stability and change in routines, driven by their endogenous dynamics (Feldman, 2016). In this vein, routine dynamics research draws from broader practice theory that is based on the work of numerous social scientists (Bourdieu, 1977, 1990; Giddens, 1984) who describe how everyday practices are accomplished, reinforced, and changed (Feldman and Orlikowski, 2011; Geiger, 2009; Parmigiani and Howard-Grenville, 2011). Putting a specific emphasis on human actors and agency, such practice approaches consider people's everyday actions as consequential in "*producing the structural contours of social life"* (Feldman and Orlikowski, 2011: 1241). Hereby, they presume that "*phenomena exist in relation to each other, produced through a process of mutual constitution*" (Feldman and Orlikowski, 2011: 1242). Thus, following practice theory, structures are produced by human action, which is, however, enabled and constrained by these very structures (Giddens, 1984).

Applying these insights to the realm of routines, Feldman and Pentland (2003) base the ontology of routine dynamics on the notion that routines, just like other social phenomena, embody a duality of structure and agency (Bourdieu, 1977, 1990; Feldman and Pentland, 2003; Giddens, 1984). Therefore, they emphasize that routines consist of two related parts: the ostensive aspect, which represents the structure, and the performative aspect, which represents agency. The ostensive aspect is the abstract pattern that participants use to guide, refer to, and account for specific performances of a routine (Pentland and Feldman, 2005). It "*may be*

thought of as a narrative or script" (Pentland and Feldman, 2005: 796) and "*shapes the perception of what a routine is*" (Feldman and Pentland, 2003: 101). It therefore represents the routine in principle (Parmigiani and Howard-Grenville, 2011). The performative aspect consists of "*specific actions taken by specific people at specific times when they are engaged in what they think of as an organizational routine*" (Feldman and Pentland, 2003: 101). Whereas these practices are carried out against a background of expectations and rules, the course of action that is actually chosen is usually to some extend novel (Feldman and Pentland, 2003: 102). Even in work settings with very detailed descriptions of the sequence of steps in a procedure, participants introduce variations since routines may have to be adjusted to changing contexts. The performative aspect of routines is therefore inherently improvisational and the degree of divergence may vary considerably, from minor adjustments to dynamic changes and sometimes even near total re-invention (Feldman and Pentland, 2003). It therefore represents the routine in practice. Neither the ostensive nor the performative could prevail individually because each aspect is essential for the mutual constitution of a routine (Parmigiani and Howard-Grenville, 2011). Rather, the ostensive guides and accounts for actions, while the performative maintains, recreates, and even modifies the ostensive (Feldman and Pentland, 2003; Parmigiani and Howard-Grenville, 2011). In this vein, routines are defined as *"repetitive, recognizable patterns of interdependent actions, involving multiple actors*" (Feldman and Pentland, 2003: 96).

By focusing on the enactment of routines, the routine dynamics school of thought illuminates that stability and change should not be conceptualized as two alternative states of being, but rather stability is part of change and change is part of stability (Farjoun, 2010; Feldman, 2016). Often times it takes significant effort to produce the "same" pattern of action (Danner-Schröder and Geiger, 2016). Hereby, while the actual level of effort can vary widely, doing the same thing is potentially more challenging than doing something different (Feldman et al., 2016). Reproducing patterns is therefore referred to as *effortful accomplishment* of routines (Pentland and Rueter, 1994). In a similar vein, each enactment of a routine creates an occasion for

variation and some amount of reflection (Dittrich et al., 2016). Evaluating whether these variations are retained is done based on factors such as - among others - effectiveness, familiarity, and fit with other routines (Feldman et al., 2016). This process of potentially altering the pattern is incorporated in the notion of routines as *emergent accomplishments* (Feldman, 2000). Thus, while *effortful accomplishments* stem from people taking different actions to produce the same or similar pattern, *emergent accomplishments* stem from actors taking the same or similar actions and thereby produce new patterns (Feldman, 2016). Performing routines is therefore by no means a mindless act, but rather requires mindful, reflexive, and knowledgeable actors (Feldman et al., 2016). In this vein, change is endogenous to routines themselves and routines are by no means inert, but typically change over time (Becker, 2004). Due to these internal dynamics routines contribute to both organizational stability and change, as well as organizational flexibility (Feldman and Pentland, 2003; Feldman, 2000; Parmigiani and Howard-Grenville, 2011).

Routine Interdependence: Between Stability and Change

Research on single routines has long dominated the academic debate on the subject. Interdependence, however, not only occurs within routines but also between them (Kremser and Schreyögg, 2016) as "*parts of any routine are enmeshed in far-reaching, complex, tangled webs of interdependence*" (Feldman and Pentland, 2003: 104). Organizations must therefore be perceived as networks of interdependent routines that directly influence organizational dynamics (Feldman et al., 2016). As a result, the scholarly debate has recently shifted its attention towards the interdependencies between routines. In the following, I review the respective discourse on interdependent routines.

Interdependent Routines

Following the fundamental concept of division of labor, complex organizational tasks are divided into multiple specialized routines that each contribute to the accomplishment of the

overall task (Kremser and Schreyögg, 2016; Lawrence and Lorsch, 1967; Smith, 1776). Organizations hence consist of multiplicities of routines that have to be integrated sufficiently to ensure that organizational tasks are accomplished efficiently and effectively (Kremser and Schreyögg, 2016; Lawrence and Lorsch, 1967). As a result, organizational outcomes are brought about by the integrated efforts of multiple interdependent routines (Kremser and Schreyögg, 2016). Conceptualizing organizations as networks of interdependent routines hence facilitates a better understanding of how organizations accomplish the majority of their work.

Conceptualizing organizations as networks of interdependent routines refers us back to the organizational principle of differentiation and integration (Lawrence and Lorsch, 1967). Differentiating complex organizational tasks into multiplicities of routines particularly results in challenges of cooperation and coordination (Cyert and March, 1963; Lawrence and Lorsch, 1967; March and Simon, 1958; Thompson, 1967). This renders the coordination processes among multiple interdependent routines fundamental for the proper accomplishment of organizational tasks (Kremser and Schreyögg, 2016). The corresponding interactions between interdependent routines hereby directly influence organizational stability and change (Feldman et al., 2016).

Viewing organizations as configurations of interdependent routines opens up exciting avenues for research on the functioning of organizations, as well as their dynamics. As a result, the scholarly focus has recently extended towards the different ways routines can interact, intersect, and be interdependent. And in particular how these interdependencies support organizational stability and/or change (Feldman et al., 2016). In the following I review the respective scholarly discourse.

Coordination of Interdependent Routines

Recent studies have begun to explore the different ways how routines interact and affect each other (Feldman et al., 2016). Hereby, the coordination processes that occur at the interfaces

between multiple interdependent routines have particularly sparked the scholarly interest. Spee et al. (2016), for instance, study intersections between interdependent routines in a context where it is crucial to balance stability and flexibility. The scholars reveal that skillful actors constantly balance the orientation of a routine towards standardization or customization and thereby play an essential role in the coordination processes between interdependent routines (Spee et al., 2016). Quite similarly, Sele and Grand (2016) also foreground the importance of actors in coordinating routines. They show that connections between routines can be more or less generative depending on the way they are enacted. Based on actor network theory (Latour, 2005), the scholars classify actors that maintain routine connections as intermediaries, whereas actors that modify routine connections are classified as mediators. The study unveils that only the ladder can create generative outcomes (Sele and Grand, 2016). Kremser and Schreyögg (2016) shift the focus from individual coordination practices towards organizational measures that ensure the efficient coordination of interfaces between routines. They argue that these interfaces need to be carefully programmed and controlled in order to exploit complementarities between the routines. According to the study, this type of coordination offers important advantages in accomplishing complex organizational tasks (Kremser and Schreyögg, 2016).

The Impact of Interdependent Routines on Stability and Change

In addition to generating important insights into the ways routines can intersect and inter-depend, researchers have also begun to explore the implications of these interactions for organizational stability, change, and innovation (Feldman et al., 2016). Birnholtz et al. (2007) identify interdependent routines as stabilizing mechanisms in the re-production of an organization after a period of dormancy. Also addressing the subject of organizational stability, Turner and Rindova (2012; 2018) show that interdependencies between routines lead to increased levels of consistency and expectability. In particular, their studies illustrate the development of a time regime between several routines, which enables more stable, efficient, and reliable organizational outcomes (Turner and Rindova, 2012; Turner and Rindova, 2018).

Finally, Kremser and Schreyögg (2016) reveal that routine interdependencies significantly narrow the scope of possible change in organizations. Their study emphasizes that the programming of interfaces between interdependent routines is essential for the creation of synergies, but also aggravates the integration of new routines in an established conglomerate of routines. As a result, they observe that the scope of possible change is significantly narrowed and organizations tend to become path-dependent (Kremser and Schreyögg, 2016). Hence, following these studies, interdependent routines significantly contribute to organizational stability in different forms, such as organizational regeneration (Birnholtz et al., 2007), reliable outcomes (Turner and Rindova, 2012), and even path-dependence (Kremser and Schreyögg, 2016).

In addition to these stabilizing effects, scholars have also created important insights into the generative potential of interdependent routines. Deken et al. (2016), for instance, illuminate how multiple actors accomplish interdependent routines that are directed at novel outcomes and how their engagement influences routine dynamics over time. Their study reveals that actors experience new routines as more or less novel, which respectively requires them to engage in different types of routine work. Following this line of thought, the scholars develop a process model involving three types of routine work - flexing, stretching, and inventing - that bring about increasingly novel actions and outcomes (Deken et al., 2016). In a similar vein, Sele and Grand (2016) unveil that mediators at the interfaces between interdependent routines generate dynamic effects, such as endogenous change and radical innovation. Scholars have thus begun to illuminate that interdependent routines do not just contribute to organizational stability, but also enable organizational change.

Research Agenda

As the brief overview of the overview of the literature reveals, research on interdependent routines has only recently begun to spark the scholarly interest. Despite the important insights

that have already been generated, a number of gaps remain in the literature. In the following, I distill the major areas of research, which this dissertation aims to address.

The first dissertation paper reviews the literature on interdependent routines. It unveils that the scholarly debate has deviated into two schools of thought: routine ecologies and routine clusters. By extracting and juxtaposing their underlying assumptions, the paper shows that both schools of thought conceptualize the coordination of interdependent routines, as well as their influence on organizational stability and change very differently. The routine ecologies school of thought describes flexible coordination principles that foster organizational change (Sele and Grand, 2016; Spee et al., 2016), whereas the routine clusters school of thought emphasizes efficient coordination mechanisms that sooner or later result in organizational path-dependence (Kremser and Schreyögg, 2016). Responding to these inconsistencies, the paper develops a conceptual framework that bridges the gap between both schools of thought and addresses the following research questions:

How are interdependent routines coordinated?

How do interdependent routines contribute to organizational stability and change?

The second dissertation paper aims to improve theorizing on routine interdependencies and related methodological implications. The paper unveils that the literature on routine interdependence conceptualizes routines as clearly distinguishable processes that are interrelated either via actants or programmed interfaces (Kremser and Schreyögg, 2016; Sele and Grand, 2016; Spee et al., 2016). Hereby, these studies implicitly assume that routines have stable and identifiable boundaries. The paper aims to challenge this assumption by empirically researching how routine boundaries form and evolve. In particular, it addresses the following research question:

How do boundaries between routines develop and change over time?

By challenging the assumption that clear boundaries between routines consistently exist, the paper also questions the presence of consistently identifiable interfaces between routines. Hereby, it scrutinizes current research which emphasizes that the coordination of interdependent routines occurs at these particular interfaces (Kremser and Schreyögg, 2016; Sele and Grand, 2016; Spee et al., 2016). Respectively, the paper also addresses the following research question:

How do the interfaces between routines emerge and change over time and how does this influence the coordination of interdependent routines?

The third dissertation paper introduces the concept of granularity into routine studies. It develops a phenomenological perspective on actions - the fundamental unit of observation in identifying routines (Feldman, 2016). By conducting an extensive literature review the paper reveals that researchers unconsciously diverge in the levels of granularity they apply in their empirical studies (i.e. the operationalized actions range from the smallest bodily movements to complex, collective actions that endure over long timespans). Different levels of granularity, however, foreground very different coordination challenges whilst at the same time backgrounding others. This results in a lack of comparability between routine studies that operate on different levels of granularity without any reflection. Addressing this important methodological challenge, the third paper answers the following research question:

How should researchers go about in establishing the appropriate level of granularity for observing actions in empirical research on routine dynamics?

Overall, this dissertation aims to close important conceptual, empirical, and methodological gaps in routine interdependence research. Conceptually, it contributes to an improved understanding of the coordination processes among interdependent routines and their important role for balancing organizational stability and change. Empirically, it unravels the dynamics of these coordination processes and shows that coordination does do not occur - as commonly

assumed - at the clear interfaces between routines. In this vein, it reveals that such clear interfaces between routines do not necessarily exist because routine boundaries potentially shift and dissolve over time. Triggered by this important empirical insight, the dissertation addresses a related methodological question: if routine boundaries are sometimes hardly recognizable and shifting, how can researchers identify routines in their empirical work? Responding to this important challenge, the dissertation develops a methodological framework that enables researchers to precisely identify actions and thus routines. Hence, this work contributes important conceptual, empirical and methodological insights to the academic debate on routine interdependencies.

Methodology

This chapter elaborates on the methodological aspects of this dissertation. It establishes a detailed and re-constructible chain of evidence from research question to conclusion (Yin, 2003). Hereby, it is structured as follows. First, it provides a general overview of the applied methodologies in all three dissertation papers. Subsequently, the chapter focuses on the qualitative research approach that was employed in the empirical work of this dissertation. In this vein, the research design, as well as the detailed setting are described. Finally, the data collection and data analysis strategies are unveiled before concluding the chapter with a discussion of the quality criteria of the empirical work in this dissertation.

Overview of Applied Methodologies

The research agenda of this dissertation generates the need for further theoretical conceptualization, methodological clarification and empirical investigation. This dissertation hence builds on a conceptual, as well as an empirical approach. Table 1 summarizes the particular method and procedure for each of the three dissertation papers.

Paper	Research Question(s)	Methodology
Paper I: Bridging the Gap Between Ecologies and Clusters: Towards an Integrative Framework on Interdependent Routines	*How are interdependent routines coordinated?* *How do interdependent routines contribute to organizational stability and change?*	Conceptual
Paper II: Exploring Routine Interdependence: Fluid Boundaries and Adaptive Patterning	*How do boundaries between routines develop and change over time?* *How do the interfaces between routines emerge and change over time and how does this influence the coordination of interdependent routines?*	Empirical, Qualitative
Paper III: Granularity Matters! Towards a Methodological Framework for Routine Studies	*How should researchers go about in establishing the appropriate level of granularity for observing actions in empirical research on routine dynamics?*	Conceptual

Table 1: Research Questions and Applied Methodology (Own Illustration)

As illustrated in table 1, paper I and III are conceptual in nature, whilst paper II relies on empirical research. Paper I and paper III develop theoretical arguments that improve theorizing on routine interdependencies and address methodological, as well as conceptual shortcomings in the current academic debate. Paper II employs empirical research to generate detailed insights into the functioning of routine interdependencies. In the upcoming sections, I outline the guiding principles that shaped the respective empirical work. I dedicate most of the chapter to

aspects that are not included in the paper due to space constraints in the targeted journal. In particular, I thoroughly reflect on the underlying research paradigm, the epistemological approach, the research design, as well as the quality criteria for qualitative research. The remaining sections (research setting, data collection, and data analysis) are exhaustively covered in paper II and thus only shortly summarized in this chapter.

Qualitative Research Approach

The empirical part of this dissertation aims to explore routine interdependencies in-depth. Pursuing this particular research agenda requires important choices between different research traditions, epistemological approaches and methods. In the following, I reveal the empirical approach employed in this dissertation.

Traditional research on routines builds on a positivist research paradigm as scholars follow the notion that the purpose of theory lies in the creation of testable and falsifiable hypotheses (Popper, 1959). In this vein, they closely orient their research towards the ideal of natural sciences and thereby presume that the social world can be objectively uncovered based on causal relationships and correlations (Tarski, 1946). Accordingly, they typically subscribe to quantitative, deductive methods. This approach, however, does not allow scholars to distill and comprehend the internal dynamics of routines (Feldman et al., 2016). As understanding these dynamics is essential for the generation of in-depth insights into routine interdependencies, the positivist paradigm does not fit to the research agenda of this dissertation.

The empirical investigation of (interdependent) routines requires the generation of deep insights into organizational dynamics and in particular into the processes by which organizing and organizations unfold (Langley, 1999). Hereby, routine dynamics scholars commonly subscribe to an interpretive research paradigm. In this vein, researchers must appreciate the nature of the social world and how we (can) know that world (Gioia et al., 2012). This requires a focus on the study of social construction processes which can be best achieved through analyzing the

means by which organizational members construct and make sense of their experience (Gioia et al., 2012). In line with this perspective, the interpretive research paradigm specifically focuses on understanding the world from the perspective of those studied (Pratt, 2009). Thereby, it perfectly fits the research agenda of this dissertation and thus constitutes its methodological foundation.

Epistemologically, the study of routine dynamics deliberately puts actors and in particular their respective actions in the foreground (Feldman et al., 2016). This sets the empirical focus on tracing actions and associations between actions in order to acknowledge and accentuate the way actions construct social order (Feldman and Orlikowski, 2011; Feldman et al., 2016; Pentland et al., 2012). An inductive qualitative research approach has particular strengths for understanding such processes due to its ability to capture temporally evolving phenomena, such as interdependent routines, in a very rich level of detail, which could hardly be achieved with methodologies based on quantitative surveys that tend to only touch the surface of processes (Langley, 1999). It thus enables researchers to study "how" and why" questions (Yin, 2003) that are set in complex social and institutional contexts (Langley, 1999). Based on this line of argumentation, I adapt an inductive qualitative research approach to generate in-depth insights into interdependent routines as complex social phenomena.

Research Design

Studying interdependent routines calls for a research design that accounts for the complexity and dynamics of routine enactments (Pentland and Feldman, 2005). Addressing this requirement, a case study facilitates an in-depth investigation of a contemporary phenomenon in its real world context (Siggelkow, 2007; Yin, 2017). Hereby, particularly focusing on one case allows the exhaustive investigation of the aspects being studied (Cassel and Symon, 2004). A single case study design is thus highly suitable for a detailed investigation of routine interdependencies and thus employed in this dissertation.

Investigating interdependent routines generates the need to incorporate an extended timespan in which routine interdependencies can dynamically evolve. By employing a longitudinal single case study, I account for the underlying processual nature of routines and their interdependencies in order to illuminate, for instance, changes in routine boundaries over time. As a result, choosing a longitudinal design enables me to sharpen and extend existing theory by pointing to gaps and starting to fill them (Burgelman, 2002; Siggelkow, 2007).

Interdependent routines are always embedded in an organizational context that must be reflected in the respective research design (Yin, 2003). By incorporating multiple departments from the respective organization, I employ an embedded case study design that allows me to investigate the unfolding interdependencies between routines that cross functional borders of, for instance, departments or particular projects (Yin, 2003). Thereby, I manage to describe and incorporate the relevant context that is necessary to fully understand routine interdependencies.

Finally, I define routines - or more specifically action steps and action patterns - and their unfolding interdependencies as units of analysis. Thereby, I ensure a specific empirical focus on the dynamics of routine enactments. In combination with the embedded single case study design (Burgelman, 2002; Leonard-Barton, 1995) this results in a consistent approach that facilitates the high level of analytical and descriptive detail necessary to account for to the complex and dynamic nature of interdependent routines.

Research Setting

I chose AB Industries[2], a medium-sized manufacturer of industrial packaging machines and the respective cartons, as empirical setting. AB Industries has a long history of producing a variety of different machines for multiple industrial sectors. Since the early 2000's, the company solely focuses on the packaging industry and has become one of the top players in Europe and Asia.

[2] Due to confidentiality reasons, AB industries is a synonym

AB Industries is organized on a regional basis according to their four core markets: Americas, Asia-Pacific, Middle-East, and Europe with a total of 5000 employees worldwide.

Prior to the beginning of my research endeavor, AB Industries had been working on the development of a new machine generation for the past three years. Within this timeframe they established specific development and production processes and thereby developed and manifested a large set of interdependent routines. Throughout the course of the development project, however, consumer demands quickly changed and AB Industries was unable to adapt their machines to these shifting market requirements. At this point, the management board came together and decided that AB Industries needed a new way of developing machines in order to be able to quickly adapt to such fast changes in the market. They agreed to develop a platform design that could be re-used for all machine generations to come, as well as a modular product architecture that would enable them to quickly adapt to changing customer requirements. In an effort to implement this strategic shift, AB Industries launched a development project called Next Gen in November 2016. Within the scope of this project, AB Industries aimed to apply this new way of working to the development process of their newest machine generation. Thereby, Next Gen provided a highly dynamic setting and thus became the central element of my ethnographic study (Van Maanen, 2011).

I purposefully sampled (Patton, 2002) AB Industries and in particular the Next Gen project based on three important criteria. First, the development of a new machine generation, as well as the introduction of new ways of working, provided a setting in which an established set of interdependent routines was confronted with a new set of routines. This particular setting thus enabled me to research the dynamics of existing and emerging routine interdependencies. Second, AB Industries was confronted with high levels of uncertainty due to changing technical requirements and costumer demands. As a result, interdependent routines and specifically their respective boundaries and coordination processes were constantly challenged. Thereby, this

highly dynamic setting provided me with an example of complex routine interdependencies. Finally, multiple departments - marketing, project management, and R&D - were involved in the development project. As I was granted access to all of these respective departments, I was able to fully capture all relevant routine interdependencies, irrespective of functional department borders.

Data Collection

I gained access to the research site by first sending and then presenting a research proposal to the management board of AB Industries. After approval of the proposal, on-site primary data collection took place during a period of 11 months, beginning approximately three weeks after the launch of Next Gen. Within this timeframe, I spent an average of two working days per week at AB Industries.

AB Industries allowed me to gather data in three particular ways. Firstly, observations were perhaps the most important aspect of my data collection strategy, particularly for observing the dynamics of enacted routine interdependencies. Secondly, I used formal and informal interviews to inquire detailed information about the impressions and cognitions of key players. Finally, I collected secondary data, such as documents and artifacts, that served as a source of triangulation for the ideas emerging from the qualitative data (Jick, 1979). Table 2 provides a detailed overview of the respective data sources.

Data Source	Description of Data Sources
Observations	21 Meetings (≈ 27 hours) 10 Workshops (≈ 44 Hours) Every day interactions / job-shadowing (≈ 188 hours) **Total amount of observational data: ≈ 259 hours**
Interviews	29 formal interviews (≈ 34 hours) 50 informal interviews (≈ 25 hours) **Total amount of interview data: ≈ 59 hours**
Documents and Artifacts	Process Charts, Project reports, Presentations, Meeting minutes, Strategy papers, Intranet pages, E-mails **Total amount of secondary data: ≈ 5000 pages**

Table 2: Overview of Data Sources (Own Illustration)

I conducted non-participant observations between November 2016 and October 2017. I attended 21 meetings and 10 workshops during my research endeavor at AB Industries. In addition, I acquired minutes for the remaining meetings and workshops that I was not able to attend. I observed internal meetings of the R&D department, the marketing department, and the project management department to get insights into their individual ways of working. Further, I had access to project steering meetings in which the project progress and the respective problems were discussed and sometimes resolved. Finally, I observed meetings between the departments. Here, coordination issues were at the core of the agenda. While the meetings were generally focused on management and coordination issues, the observed workshops introduced new ways of developing the upcoming machine generation. Thus, overall, this large number of diverse observations enabled me to collect data covering complex routine interdependencies between established and newly developing routines.

I conducted a total of 79 formal and informal interviews to follow up my observations and distill more fine grained insights into routine interdependencies. The 50 informal interviews mainly

consisted of talks in the office, as well as informal conversations during lunch and coffee breaks. For the 29 formal interviews, I adapted a semi-structured design. Thereby, I ensured that the interview was focused on a pre-defined area of concentration – routine interdependencies – while leaving enough room for the interpretations of the interviewees (Dieckmann, 2004). In combination with my observations, this provided the strong analytical focus necessary to distill and focus on a specific set of interdependent routines over time.

I collected approximately 5000 pages of secondary data to triangulate my observations and interviews (Jick, 1979). The data sources included project reports, presentations, strategy papers, intranet pages, E-mails, meeting minutes and process charts. Especially the latter were of great value because they contained formal descriptions of the interdependent routines. The collected secondary data therefore provided valuable insights into the context of the development project and even helped facilitate discussions with the informants about the themes emerging from the data (Clark et al., 2010).

Data Analysis

My data analysis procedure followed grounded theory in order to remain open and distill categories from the field (Strauss and Corbin, 1990). In accordance with this approach, I contrasted data and theory throughout the data collection and data analysis process. Hereby, the evolving theory directed attention to previously established dimensions, while the actual data simultaneously focused attention on the suitability of the theory as a frame for the most recent data collection efforts (Isabella, 1990). As a result, by circling among data, emerging theory, and relevant literature, I developed a deeper understanding of the evolving routine interdependencies.

First, I aimed at distilling routines as “repetitive, recognizable patterns of interdependent actions, involving multiple actors” (Feldman and Pentland, 2003: 96). In this vein, I thoroughly coded the observational data and the interview data based on the informant’s own doings and sayings

(Gioia et al., 2012). Thereby, I generated a list of actions that were the basis for the identification of relevant interdependent routines. Based on the definition by Feldman and Pentland (2003), I then identified recurring action patterns that were performed by multiple actors as routines. After having identified the respective set of routines, I presented my description of the routines to my informants to validate and refine them (Lincoln and Guba, 1985). Going back into my dataset, I then wrote thick descriptions for each of these routines. Hereby, I relied on narrative networks by asking who, does what, when, how, and why (Pentland and Feldman, 2007). Second, I focused on analyzing interdependencies between the respective routines. Hereby, I purposefully operated on different levels of analysis, starting at the interdependencies at the interfaces between routines and zooming in (Nicolini, 2009) into the interdependencies between actions steps among various routines. As a result, I was able to analyze routine interdependencies in-depth. Third, I created an event sequence list (Poole et al., 2000) to add the important longitudinal perspective to my analysis. I further wrote detailed narratives (Langley, 1999) to describe the enactments of routine interdependencies throughout the course of the development project. Thereby, I was able to specifically analyze the dynamics of interdependent routines over time. Fourth, I held meetings with my main informants in order to receive valuable feedback on the studies and jointly discuss the results. Thus, by letting the informants themselves discuss and reflect on the results of the study, I was able to ensure the descriptive validity of the findings (Yin, 2003).

Quality Criteria for Qualitative Research

Methodological rigor is essential to claim relevance in management research (Scandura and Williams, 2000). Researchers therefore need a set of quality criteria that enables them to establish and evaluate the credibility of their methodological procedures (Silverman, 2005). As this dissertation relies on qualitative research, this evaluation process, however, proves to be quite challenging because - in contrast to quantitative research - the procedures to ensure methodological rigor in qualitative studies are much less standardized (Pratt, 2008).

The most frequently used set of quality criteria for methodological rigor of qualitative research initially stems from the positivist tradition. Here, natural science is perceived as the ideal that social science should try to adapt (Eisenhardt and Graebner, 2007; Pikkari and Welch, 2009). In this vein, validity and reliability are defined as key concepts for attaining methodological rigor. Respectively, numerous research actions are clustered under four types of quality criteria: *construct validity, internal validity, external validity, and reliability* (Behling, 1980; Campbell and Stanley, 1963; Cook and Campbell, 1976; Yin, 2017). Despite the fact that these quality criteria stem from the positivist tradition, they are frequently adapted by scholars from the interpretative camp (Gibbert and Ruigrok, 2010). Following these scholars, the concepts of validity and reliability are overarching constructs that can be appropriately used in all scientific paradigms. Particularly focusing on validation, which means to check, investigate, question, and theorize (Kvale, 1989) represents activities that are integral to qualitative inquiries. Therefore, the concepts of validity and reliability can be used in qualitative research without derailing it from its philosophical underpinnings (Hammersley, 1992). Thus, being clearly rooted in the interpretive tradition, I follow other scholars in this epistemological camp by addressing the rigor of my qualitative study via the criteria of *construct validity*, *internal validity*, *external validity*, and *reliability* (Behling, 1980; Campbell and Stanley, 1963; Cook and Campbell, 1976; Yin, 2017).

Construct validity

Construct validity refers to the extent to which a study actually investigates what it claims to investigate and therefore provides an accurate observation of reality (Denzin and Lincoln, 1994). Whilst this notion of an objective reality has been particularly criticized in an influential interpretive text by Silverman (2005), who argues that qualitative research is "*typically not compatible with the assumption that an objective reality can be obtained from different ways of looking at it [since] many of the models that underlie qualitative research are simply not compatible with the assumption that 'true' fixes on 'reality' can be obtained separately from*

particular ways of looking at it" (Silverman, 2005: 212), there is also a vast number of scholars who apply the concept of construct validity to their qualitative research. Hereby, they essentially follow two strategies that each contain concrete research actions to ensure construct validity (Gibbert and Ruigrok, 2010). In the following I apply these strategies and research actions to the empirical work in this dissertation.

First, in order to ensure construct validity, researchers can triangulate, meaning that they adopt different angles from which they look at the particular phenomenon by using different data sources and data collection strategies (Cohen and Levinthal, 1990; Denzin and Lincoln, 1994; Jick, 1979; Pettigrew, 1990; Yin, 1994, 2003, 2009). Following this notion of triangulation, I collected data from different sources, in particular observations, semi-structured interviews, as well as documents and artifacts. Thereby, I was able to study interdependent routines from different perspectives and thus ensure an accurate observation of the phenomena in question (Yin, 2003).

Second, researchers are encouraged to establish a clear chain of evidence that enables the reader to reconstruct how the researcher moved from the initial research question to the final conclusions (Yin, 1994). Following the underlying suggestions for concrete research actions, I provide a careful explanation of my data collection procedures that includes - among other aspects - the interviewee selection process and the time frame. Moreover, I discuss my data analysis procedures and provide thick descriptions of my findings (Gibbert and Ruigrok, 2010). Therefore, by employing the concept of triangulation and establishing a clear chain of evidence, the empirical work in this dissertation fulfills the requirements for a high level of construct validity.

Internal validity

Whereas construct validity is mainly relevant in the data collection phase, internal validity applies predominantly to the data analysis phase, despite the fact that many decisions are made

in the design phase (Yin, 1994). Here, the researcher must establish a plausible causal argument that is robust enough to defend the research conclusions (Gibbert and Ruigrok, 2010). In this vein, I follow Silverman (2005) by ensuring that all findings are genuinely based on a critical analysis of all data, instead of using only few well-chosen examples. I further provide a thorough documentation of the coding process that is fully revealed based on original data (Silverman, 2005). Finally, I handle the data and findings by using multiple data analysis techniques (Yin, 2003) such as for instance coding, narrative networks, visual mapping, and member checks. Thereby, the empirical work in this dissertation achieves a high level of internal validity.

External validity

External validity - or in other words generalizability - is grounded in the notion that theories must account for phenomena not only in the setting they have initially been studied in, but also in other settings (Gibbert and Ruigrok, 2010). A single case study, as conducted in this dissertation, however, does not allow for statistical generalization, meaning that it cannot infer conclusions about a population (Lee, 2003; Numagami, 1998; Yin, 1994). At this juncture, the differentiation between statistical and analytical generalization is of utmost importance. Whereas the former refers to generalizing from observation to population, the latter refers to generalizing from empirical observations to theory, rather than a population (Yin, 1994, 2003). Following this line of thought, a single case study can certainly be a sound basis for analytical generalization (Gibbert and Ruigrok, 2010). The conceptual constructs developed in this dissertation are therefore generalizable on a theoretical level.

Reliability

Reliability stands for the absence of random error, which implicates that subsequent researchers would generate the same insights, if they conducted the study with the same procedure again (Denzin and Lincoln, 1994). Achieving reliability firstly requires transparency, which can be

enhanced through strategies such as careful documentation and the clarification of the research procedures (Gibbert and Ruigrok, 2010). Respectively, I thoroughly documented the entire research process and transparently provide insights into every step from data collection to data analysis (Yin, 2003). Secondly, I enable replicability of the study by providing a database that contains the interview transcripts, field notes, documents collected throughout the study in an organized way to enable retrieval for later investigators (Yin, 1994). Thus, in sum, the empirical work in this dissertation achieves a high level of reliability.

Evaluating the empirical work based on the four quality criteria - construct validity, internal validity, external validity, and reliability - underlines the methodological rigor of this dissertation. Following these important methodological reflections, in the following chapter I provide summaries of the three dissertation papers.

Summary of Essays

Paper I: Bridging the Gap between Ecologies and Clusters: Towards an Integrative Framework on Routine Interdependence

This conceptual paper proposes an integrative model on routine interdependence. It contributes to an emerging stream of research which shifts the scholarly interest from the endogenous dynamics of single routines (Feldman and Pentland, 2003; Feldman, 2000; Rerup and Feldman, 2011) towards the different ways multiple routines interact, intersect, and thus inter-depend (Birnholtz et al., 2007; Deken et al., 2016; Kremser and Schreyögg, 2016; Sele and Grand, 2016; Spee et al., 2016). Within this particular stream of literature, the paper specifically enriches the scholarly debate on the coordination processes between interdependent routines, as well as their impact on organizational stability, change, and innovation.

The paper builds the argument that within the literature on routine interdependencies two diverging schools of thought have emerged: routine ecologies (Birnholtz et al., 2007; Sele and Grand, 2016; Spee et al., 2016) and routine clusters (Kremser and Schreyögg, 2016). By

distilling and juxtaposing the respective underlying assumptions of each school of thought, the paper unveils that the routine ecologies school of thought conceptualizes the interactions between routines as mindful balancing acts that generate the potential for emergent change, as well as innovative outcomes (Birnholtz et al., 2007; Sele and Grand, 2016; Spee et al., 2016). In contrast, according to the routine clusters school of thought, interdependencies are resolved via the programming of the interfaces between routines. The re-configuration of the respective interfaces then increasingly aggravates the integration of new routines into the cluster, thereby shaping and restricting its evolution. Thus, according to this school of thought, interdependent routines contribute to organizational stability and path-dependence (Kremser and Schreyögg, 2016). At this juncture, the paper unveils the diverging nature of both schools of thought: whilst routine ecologies focus on flexible coordination processes and their generative potential for the endogenous dynamics of interdependent routines, routine clusters strongly foreground coordination mechanisms, such as programmed interfaces, that severely limit organizational dynamics and change.

Despite these differences, the paper argues that combining insights from both schools of thought has the potential to improve current conceptualizations of routine interdependencies. Building on Thompson (1967), it illuminates that coordinating different degrees of interdependence requires switching between different modes of coordination. In this respect, programming interfaces between interdependent routines (Kremser and Schreyögg, 2016) is sufficient for addressing low levels of interdependence, whilst endogenous balancing acts (Spee et al., 2016) are feasible for addressing high levels of interdependence (Victor and Blackburn, 1987). Coordinating interdependent routines hence ultimately results in a dynamic process of switching between different modes of coordination stemming from both – the routine ecologies and the routine clusters – schools of thought. The integrative model developed in this paper provides important insights into these dynamic coordination processes beyond ecologies and clusters.

The paper further establishes a connection between these dynamic coordination processes and their influence on organizational stability and change. Building on Farjoun (2010) it argues that flexible coordination principles, such as endogenous balancing acts (Spee et al., 2016), contribute not only to generative outcomes, but also possess the potential to have stabilizing effects. Vice versa, stable coordination mechanisms, such as the programming of interfaces (Kremser and Schreyögg, 2016), may bring about organizational stability, as well as change (Farjoun, 2010). The paper thus extends current conceptualizations that exclusively link routine ecologies to organizational change and routine clusters to organizational stability. Hereby, it unveils the important role of interdependent routines and their underlying coordination processes in balancing both organizational stability *and* change.

Paper II: Exploring Routine Interdependence: Fluid Boundaries and Adaptive Patterning

This essay focuses on routine boundaries and their influence on the coordination of routine interdependencies. Initially, the paper reviews recent empirical work on interdependent routines and thereby unveils that routine scholars currently at least implicitly assume that routines have clearly identifiable and distinguishable boundaries which sustain over long periods of time, regardless of the dynamics within or between the routines (Birnholtz et al., 2007; Deken et al., 2016; Kremser and Schreyögg, 2016; Sele and Grand, 2016; Spee et al., 2016). Hereby, the question how these boundaries emerge and change is inherently side-stepped. Scholars further implicate that routines are interrelated and coordinated at the interfaces between the routines (Kremser and Schreyögg, 2016; Sele and Grand, 2016; Spee et al., 2016). This is, however, only possible if the respective routines have clearly identifiable boundaries and thus interfaces. The question how these interfaces emerge and potentially change is again entirely side-stepped in the current academic debate. This paper aims at closing these gaps by illuminating how routine boundaries emerge and change over time and how this affects the coordination of interdependent routines.

Based on a longitudinal ethnographic case study, the essay uncovers that routine boundaries are by no means always stable, but rather shift, blur, and potentially even dissolve. Building on this important finding, the paper argues that it is inherently difficult to group (interdependent) action steps into discrete routines that sustain over time. In this vein, it raises an important methodological issue for routine studies by asking how routines can be identified in the first place. Hereby, the paper illuminates that by searching for routines researchers often construct orderliness in a more fluid process of patterning. As result, the paper argues that routines should no longer be taken for granted as units of analysis.

Addressing the question how the coordination of interdependent routines is impacted by unstable and shifting boundaries, the paper further pinpoints that routine interdependencies are not necessarily resolved at the interfaces between the routines. Rather, the findings illuminate that coordination takes place as a fluid process between action steps reciprocally responding to each other. Routine interrelations thus do not happen at level of actors as commonly assumed, but instead on the level of actions. The paper hence provides an improved conceptualization of routine interdependencies as dynamic webs of interrelated actions steps, rather than routines that are simply linked with each other at their interfaces.

Based on these findings the paper suggests introducing the concept of granularity into routine studies (Kremser et al., 2019). It argues that researchers who dive into fine grained levels of observation and analysis will, for instance, identify interrelated action steps, whereas zooming out (Nicolini, 2009) to a more coarse level of granularity could lead researchers to re-construct distinct routines interrelated via interfaces. The discussion what a routine is and how it inter-depends with other routines is thus a matter of the perspective taken. Accordingly, insights into routine dynamics, as well as organizational stability and change, will differ based on the respective level of granularity. Hence, by illuminating the significance of granularity for routine

studies, this paper also marks an important step towards more stringency and comparability of routine studies.

Paper III: Granularity Matters! Towards a Methodological Framework for Routine Studies

This paper introduces the concept of granularity into routine studies. As actions are the central unit of observation in routine dynamics, researchers are confronted with the challenge to (re)-construct specific actions out of a stream of observations (Folger et al., 1984). Due to the fact that these actions can be broken down into arbitrarily fine-grained detail (Abell, 1987), researchers must decide what constitutes *one* action, i.e. where it starts and ends, how many actors enact the action etc. These important decisions regarding the grain-size of the unit of observation can be subsumed under the concept of granularity (Pentland, 2003). The level of granularity of the unit of observation (actions) hereby directly defines the level of granularity on which researchers identify and analyze the routines in their empirical study. On different levels of granularity, researchers observe and analyze very different performing and patterning dynamics (Goh and Pentland, 2019). The paper hence builds the important argument that routine dynamics studies need to take the concept of granularity seriously, both conceptually and methodologically.

The paper develops a phenomenological perspective on granularity. It establishes three levels of granularity - fine-grained, medium-grained, and coarse-grained - as empirically useful and analytically fruitful differences in routine dynamics research. As a unit of observation, an action that is performed by a specific single actor "without further ado" (Schatzki, 2008: 122) is considered to be on a fine-grained level of granularity. If an action is enacted by a group of actors who rely on ad-hoc coordination, the threshold to a medium-grained level of granularity is crossed. Finally, if an action is enacted by a group of actors who rely on a mix between ad-hoc and programmed modes of coordination, the threshold to a coarse-grained level of granularity is passed. In the following, the paper applies these three levels of granularity to an

authoritative sample of empirical studies to reveal how the levels of granularity are applied in research on routine dynamics.

By conducting an extensive literature review, the paper finds that routine researchers operationalize actions and thus routines on very different levels of granularity without reflecting on this issue. The essay reveals a variety of differences ranging from fine-grained studies that analyze actions an individual actor enacts at a single location within seconds or minutes to coarse-grained studies that analyze collective actions that are enacted by multiple different individuals in dispersed locations over the course of multiple months or even a year. Reflecting on these diverging levels of granularity, the paper argues that (unconsciously) side-stepping the concept of granularity significantly impedes the comparability of routine dynamics studies since different levels of granularity foreground very different coordination challenges.

In response to this issue, the paper develops a four step procedure that is meant to support scholars to conduct their empirical study on the appropriate level of granularity. The general approach of this empirical framework is to first establish the level of granularity that best fits the research question and the phenomena of interest, then to identify the actions on the chosen level of granularity, fit these actions into distinct routines, and iteratively check for consistent levels of granularity throughout the research process. Further, in order to ensure comparability between studies, the paper provides useful recommendations how granularity can be reported in writing up research on routine dynamics. Hence, by addressing the issue of granularity the paper sheds light on an important construct that has long been side-stepped in research on routine dynamics.

Future Research

By enriching the routine dynamics and routine interdependence literature with important conceptual, empirical, and methodological contributions, this dissertation opens up several avenues for further research.

First, this dissertation has shown that conceptualizing organizations as networks of interdependent routines provides an exciting new perspective on organizations beyond formal structures and organizational charts. This new perspective combines formal and informal elements and enables new ways of visualizing organizations. Organizational structures and processes could, for instance, no longer be portrayed in static organizational charts, but rather as dynamics networks of interdependent routines. Developing digital methods and tools that enable researchers and practitioners to create such new forms of visualizing organizations could, for instance, be an exciting avenue for future research.

Second, a routine interdependence perspective enables scholars to get a much better grasp of organizational dynamics. For a significant amount of time, scholars have focused on the impact of single routines on organizational stability and change. Regardless of the fact that this has created important insights, fully understanding these organizational dynamics requires scholars to focus on the (dynamic) interplay between multiple routines. As this dissertation illustrates, conducting research from this perspective brings scholars closer towards answering essential questions, such as how do organizations balance organizational stability and change.

Third, conceptualizing organizations as networks of interdependent routines sheds new light on fundamental organizational concepts, such as differentiation and integration. Current research has only begun to explore how organizational tasks are differentiated into multiplicities of routines and how these interdependent routines are re-integrated. Scholars thereby took a first step towards understanding how the multiplicities of interdependent routines contribute to the generation of organizational outcomes. Further research should build on these insights to illuminate how organizations really achieve the majority of their work.

Fourth, particularly the question how interdependent routines are (re-) integrated puts an emphasis on the coordination processes among routines. Even though, this dissertation has generated conceptual and empirical insights into the coordination processes among

interdependent routines, there is still a lot to be explored in this area of research. It would, for instance, be interesting to empirically illuminate the dynamic interplay between different modes of coordination. In addition, it would be highly relevant to find out how coordination functions in different settings. In this vein, it would be interesting to see if one finds different coordination processes in presumably stable organizations versus organizations that have a strong focus on creativity and innovation. Here, a qualitative multi-case study could be of great benefit.

Fifth, this thesis has shown that routine boundaries are morphing, shifting, and even dissolving over time. A detailed qualitative inquiry into the underlying practices that contribute to the respective (in) stabilities of routine boundaries would certainly be of high relevance. Moreover, it would be interesting to find out whether routine boundaries can be purposefully designed and/or stabilized by an organization or whether they are necessarily emergent and continuously evolving.

Sixth, this dissertation has developed a methodological framework for empirical research on (interdependent) routines and in an even broader sense process studies. In the future, the application of this framework, as well as an evaluation of its feasibility and applicability, will be of utmost importance. In this vein, it would be great to find out whether the framework actually helps researchers to identify and operationalize actions and thus routines. Further, it will be very interesting to see whether the framework really enables researchers to establish and report on the level of granularity they operate on. In this vein, the respective heuristics should be applied and potentially improved, if necessary. And finally, it will be exciting to find out whether the methodological framework accomplishes its mission to facilitate a more transparent research process.

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Paper I

Bridging the Gap between Ecologies and Clusters: Towards an Integrative Framework of Routine Interdependence

Jan Hoekzema

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ABSTRACT

This paper advances theorizing on routine interdependencies. It presents a review and comparison of the two dominant schools of thought in this stream of research: routine ecologies and routine clusters. While the former emphasizes generativity and flexibility, the latter conceptualizes interdependencies as limiting to organizational dynamics and change. Despite these diverging assumptions, I suggest combining – rather than separating – insights from both schools of thought. I thereby contribute to routine interdependence research in three ways. First, I develop an integrative framework that emphasizes the complementary dynamics between both schools of thought. Second, I suggest that coordinating interdependent routines is an ongoing process of addressing different degrees of interdependence with specific modes of coordination. Third, I reveal that interdependent routines and the underlying coordination processes play a central role in balancing organizational stability and change.

Keywords: interdependent routines; integrative model; coordination; routine dynamics; balancing stability and change

Introduction

Research on organizational routines has expanded significantly in recent years as scholars have recognized the importance of routine processes for understanding organizational dynamics (Feldman et al., 2016). Particularly research on single routine dynamics, which is essentially concerned with the notion that routines are practices with internal dynamics contributing to both stability and change (Feldman and Pentland, 2003; Pentland et al., 2011), has been dominating the academic debate. While lots of interesting insights on the endogenous dynamics of single routines have been generated (Feldman and Pentland, 2003; Feldman, 2000; Rerup and Feldman, 2011), research on multiple interdependent routines is just recently gaining increasing scholarly attention. Within this new stream of research, the focus has shifted from stability and change within individual routines towards the different ways routines can interact, intersect, and be interdependent, thereby contributing to organizational stability and change (Feldman et al., 2016). Hereby, routine interdependence research has begun to contribute to a better understanding of the practices and processes that support stability and change in organizations.

The debate on interdependent routines has diverged into two schools of thought: routine ecologies and routine clusters. In the former stream of research, scholars conceptualize interactions between interdependent routines as mindful individual balancing acts that bring about the generative potential for innovative outcomes and emergent change (Birnholtz et al., 2007; Sele and Grand, 2016; Spee et al., 2016). Quite contrary, in the latter stream of research, scholars emphasize that interdependencies are resolved via programming and re-configuring routines is thus limited to the degree as the interface is not affected. As a consequence, new routines are investigated in terms of their fit with the current cluster and its corresponding internal interfaces, resulting in a trajectory that shapes the evolution of the cluster. Thereby,

interdependent routines contribute to organizational stability and path-dependence (Kremser and Schreyögg, 2016).

In this paper I review the conceptualizations of routine ecologies and routine clusters in detail. By juxtaposing their underlying assumptions I carve out their diverging nature: whilst routine ecologies emphasize the generativity, flexibility and endogenous dynamics of interdependent routines, routine clusters conceptualize interdependencies as significantly limiting for organizational dynamics and change. Despite these differences, I argue that combining - rather than separating - insights from both streams of research has the potential to generate a more holistic view on routine interdependence. In this vein, I develop a framework that integrates insights from both schools of thought. Here, I argue that coordinating interdependent routines does not either occur via programmed interfaces or individual balancing acts, but rather through an ongoing process of combining different modes of coordination. I further point out that interdependent routines do not necessarily lead to either endogenous flexibility or path-dependence. Rather, I show that alternating modes of coordinating interdependent routines play a central role in the process of balancing organizational stability and change.

The paper proceeds as follows. In section two, I review the development of the academic debate from single routine dynamics towards the interdependence of multiple interrelated routines. In section three, I examine the two dominating schools of thought - routine ecologies and routine clusters - and uncover their underlying assumptions. In section four, I juxtapose routine ecologies and routine clusters to illuminate their (in) compatibility. In section five, I develop a framework that integrates insights from both schools of thought and thus generates a more holistic picture on routine interdependence.

From Single Routine Dynamics towards Routine Interdependence

The idea that routines are not only a source of stability and efficiency, but also the drivers of endogenous change in organizations (Feldman and Pentland, 2003; Feldman, 2000; Pentland et

al., 2011), has shifted the academic debate on the subject significantly. Whereas the underlying dynamics of single routines have long been at the center of the scholarly focus, research on the interdependence of multiple routines has received much less attention and the respective debate has only recently begun to evolve.

Single Routine Dynamics

Routines are crucial for the accomplishment of work (Cyert and March, 1963). After initially being conceptualized as sources of inertia and mindlessness (Ashford and Fried, 1988; Hannan and Freeman, 1984), scholars later found empirical evidence that routines change continuously and endogenously (Pentland and Feldman, 2005: 794). The study of routine dynamics elaborates on stability and change in routines, driven by their internal dynamics (Feldman, 2016: 26). By defining routines as "*repetitive, recognizable patterns of interdependent actions, involving multiple actors*" (Feldman and Pentland, 2003: 96) the black box of organizational routines was opened and scholars began to zoom in (Nicolini, 2009) on the endogenous micro-dynamics of routines (Foss et al., 2012). In this vein, they altered the granularity of analysis and shifted the focus towards the actions that constitute routines (Feldman and Pentland, 2003; Rerup and Feldman, 2011; Turner and Rindova, 2012). Methodologically this required the adaption of ethnographic research as well as data analysis concepts from ethnomethodology, phenomenology and practice theory (Feldman and Pentland, 2003; Feldman, 2000; Pentland and Rueter, 1994). Ontologically, this conceptualization builds on the perception that routines consist of a duality of structure and agency. By introducing the ostensive and the performative aspects of routines, Feldman and Pentland (2003) reflect this duality and specifically illuminate the interlink between pattern and performance. In this vein, the ostensive accentuates the relationality of pattern and performance as well as the constitutive action in patterns. This enables routine dynamics to recognize abstract patterns without prioritizing them over the practices that are integral to them (Feldman, 2016: 27).

Towards Routine Interdependence

Recently, the strong complementarity between routine dynamics and process studies has fertilized the academic debate. "*Process studies focus attention on how and why things emerge, develop, grow, or terminate over time. They take time seriously and illuminate the role of tensions and contradictions in driving patterns of change*" (Langley et al., 2013: 1). Correspondingly, "*routines exist through a process of (re)-production, over time and space, through the ongoing effort of actants (people + things)*" (Feldman et al., 2016: 505). From a process perspective, routines are therefore not seen as fixed response to a defined stimuli (March and Simon, 1958) but rather as effortful accomplishments that persist, emerge, or change (Howard-Grenville et al., 2016; Pentland and Rueter, 1994).

Examining in detail the endogenous dynamics of single routines through zooming in (Nicolini, 2009) is only part of studying and understanding organizational routines. Routines, in fact, never happen in insolation and cannot be carried out independently from other routines that exist in an organization (Pentland et al., 2016: 2). Rather, as a consequence of division of labor, complex organizational tasks are achieved via the performances and interactions of multiple routines (Kremser and Schreyögg, 2016; Victor and Blackburn, 1987). In this respect, interdependencies not only occur between actions within routines, but also between them (Kremser and Schreyögg, 2016). The study of routines can therefore not be limited to the details of their accomplishment, but must rather be accompanied by an overarching perspective that incorporates the multiplicities of routines that exist and interact in an organization (Kremser and Schreyögg, 2016; Nelson and Winter, 1982; Thompson, 1967).

Zooming out (Nicolini, 2009) to the multiplicities of routines in an organization raises the question of how organizational routines are interrelated and which effects these interdependencies have on organizational dynamics (Kremser and Schreyögg, 2016). These (dynamic) effects, however, have been mostly disregarded in the past (Kremser, 2016). Instead

of intensively dealing with the subject, scholars rather created the general impression that interrelated routines most certainly result in stability, efficiency, reliability, and mindlessness (Gersick and Hackman, 1990; Nelson and Winter, 1982; Weiss and Ilgen, 1985). Only few authors, such as for instance Schumpeter (1934), who emphasized that the creative destruction of existing linkages between routines is essential for the generation of novelty and innovation, contradicted this viewpoint by linking interdependent routines to dynamic outcomes (Schumpeter, 1934). Despite these early insights into the important implications of interdependent routines on organizational stability and change, research on the subject has only recently intensified. Hereby, two major schools of thought evolved: routine ecologies and routine clusters.

Routine Interdependence: Ecologies and Clusters

Research on routine ecologies and routine clusters has advanced the academic debate on routine interdependence. By individually outlining the conceptualizations, as well as the underlying assumptions of both schools of thought, the next chapter provides a comprehensive overview of the academic status quo.

Routine Ecologies

The Concept of Routine Ecologies

Birnholtz et al. (2007) first introduced the notion of routine ecologies by assigning a central role to networks of action dispositions in organizational regeneration processes (Birnholtz et al., 2007). Action dispositions are an individual's persistent collection of premises, response tendencies, and structural capabilities that produce action with recognizable character. Because these patterns are usually acquired and performed without high levels of self-conscious analysis and each pattern is to a certain level co-adapted to previously developed dispositions, they usually form a quite durable and interdependent system (Birnholtz et al., 2007: 317). Hereby,

these "*interdependencies constitute the core of what is often labeled routines*" (Birnholtz et al., 2007: 330).

The term ecology denotes the mutual adaption within the ensembles of action dispositions on the organizational level. Recurring actions are interdependent within an organization and must form an effective ensemble through a series of implicit and explicit negotiations. In these negotiations interfering or incompatible action dispositions are filtered out and disappear. Consequently, an ecology that has the property of organizational character is formed via a coherent system of mutually adapted action dispositions that shapes the experience of newcomers and ultimately leads to the achievement of organizational regeneration (Birnholtz et al., 2007). While Birnholtz et al. (2007) do not provide additional insights into the underlying mechanisms, current research extends their conceptualization

Turner and Rindova (2012) add that the same set of routines can simultaneously have complementary (compatible) and competitive (interfering or incompatible) interactions (Turner and Rindova, 2012). More specifically, complementary routines have the potential to become competitive if their relationship develops towards tighter coupling and the potential for adverse systemic effects caused by conditions of change increases (Turner and Rindova, 2012). According to Birnholtz et al. (2007) such conflicts between routines could lead to their ultimate failure, while Turner and Rindova (2012) observe the existence of organizational measures to minimize the interference perceived by customers (Turner and Rindova, 2012). While this extension of the concept of routine ecologies incorporates the organizational context, the details of such organizational measures remain unspecified

Spee et al. (2016) specifically concentrate on the coordination mechanisms between interdependent routines and their impact on the balancing of coexisting ostensive patterns. Within the context of professional services, the scholars develop a dynamic framework that reveals how skillful performances at the routine intersections directly influence the orientation

of a routine towards stability or flexibility. Hereby, this balancing act strongly relies on the skill and judgement of the respective actor (Spee et al., 2016).

Sele and Grand (2016) further elaborate on the internal dynamics of routine ecologies by analyzing the generative nature of routine interactions in relation to the innovation capacity of an organization. In their study of an artificial intelligence lab, the scholars find out that actors either maintain or modify routine connections. In case of the ladder, routine ecologies can lead to radically innovative outcomes (Sele and Grand, 2016).

The Underlying Assumptions of Routine Ecologies

Having outlined the basic conceptualization of routine ecologies, I will now distill the underlying assumptions of this school of thought. Hereby, I firstly illuminate how routine ecologies are formed via informal patterning processes, in which actors play a central role in coordinating interdependent routines. Afterwards, I pinpoint that the routine ecologies school of thought presumes organizational change to be emergent and unplanned.

Constant change, informality and coordination as individual balancing act

Routine ecologies are formed via the mutual adaption of action dispositions that eventually constitute an effective ensemble. Hereby, actors engage in a process of implicit and explicit negotiations to generate this coherent system of mutually adapted action dispositions (Birnholtz et al., 2007). By focusing on practices, while also depicting the world in relational terms as being composed by a network of practices, this understanding of the underlying social phenomenon is in line with practice theory. In this vein, the emergence of organizational patterns is accomplished by the manifold practices that are performed by actors at all organizational levels (Nicolini, 2013).

In "*a world that is constantly changing"* (Birnholtz et al., 2007: 328), as it is presumed by the routine ecologies school of thought, the adaptive performances of routines rely on informal principles, rather than formal artifacts. Particularly, in contexts where *"variability and change*

appear to dominate" (Turner and Rindova, 2012: 44) artifacts such as workflow models for instance inscribe, but do not determine, the workflow pattern to be performed as some kind of dynamic adaption between model and reality is necessary (D'Adderio, 2008, 2011, 2014). Artifactual representations thus guide action patterns (Pentland and Feldman, 2008), but actors will potentially bypass their rules to adapt them to capture newly emerged adapted performances (D'Adderio, 2003; D'Adderio, 2014) or to perform tasks in a novel way, if necessary (Orlikowski, 2002). Hereby, an appropriate application of an artifactual representation and its underlying rules in different contexts can be achieved (Ortmann, 2010). To appropriately adapt routine performances to high levels of uncertainty and unpredictability, informal principles thus provide more flexibility than formal rules, such as the ones inscribed in artifacts (Gherardi and Nicolini, 2002).

Informality is also prevalent in the coordination processes among multiple, interrelated routines within ecologies. Routine intersections cause the need to simultaneously enact coexisting ostensive patterns which amplifies pressure toward one or the other ostensive pattern. In this particular moment "*the point of intersection with another routine provides an impulse that orients the performance of the focal routine performance towards either towards customization or standardization"* (Spee et al., 2016: 773). The actor then "*reorients the performance to counteract the initial impulse and rebalance coexisting ostensive patterns within the focal routine*" (Spee et al., 2016: 775) by using his professional judgement. This act of coordinating reciprocal task interdependence occurs within the specific moment of attending to and rebalancing the impulse from each intersection. Coordination is therefore conceptualized as an informal individual act of continuously balancing orientation and reorientation (Spee et al., 2016).

Emergent change and radical innovation

Focusing on the internal dynamics of routine ecologies, Sele and Grand (2016) reveal that the performances of actors at the intersections between routines have a major effect on organizational change (Sele and Grand, 2016). In this vein, the researchers classify actants at the interfaces between interdependent routines either as intermediaries or mediators. Intermediaries simply transfer meaning without any adaptions or potential for novel outcomes, whereas mediators generate the capability of creating new things leading to generative effects, including radically innovative outcomes, the adaption of extant routine performances, the evolution of new routine performances and thus endogenous change (Sele and Grand, 2016). Seen this way, organizational change is a product of continuous micro changes in which actants act differently in the next iteration of a routine and the respective intersections, if their performances fall short of a given task (Geiger and Schröder, 2014). In this vein, change is conceived as purely emergent and unplanned as solely the engagement of actants renders routine ecologies more or less generative (Sele and Grand, 2016).

Routine Clusters

The Concept of Routine Clusters

The conceptualization of routine clusters initially relies on the differentiation and integration model by Lawrence and Lorsch (1967). With increasing size the organization must be differentiated into several separate parts, while also making sure that these separate elements are subsequently integrated to form a well-functioning system (Lawrence and Lorsch, 1967). Applying this to a more granular level, a complex organizational task is divided into several specialized routines, which must be subsequently integrated to ensure that each routine partially contributes to the accomplishment of the overall task (Kremser and Schreyögg, 2016: 700).

Programming is defined as key mechanism for guaranteeing a successful integration process by efficiently coordinating the interfaces between intersecting routines (Kremser and Schreyögg,

2016: 700). Programming requires a normative prescription of the sub routines that incorporates the coordination requirements between the routines. Hereby, semi-autonomous routines are intentionally created to ensure that actors can mainly concentrate on the continuous achievement of their pre-defined subtask and realize the respective economies of specialization. In this vein, specifically the results of the routines must remain the same to ensure predictability for others and hence successful integration (Kremser and Schreyögg, 2016: 700).

Routine clusters are often confronted with situations of innovation and change, which require them to integrate new, envisioned routines. The major challenge of this complex and time consuming process lies in the integration of new routines into a well-functioning set of routines that currently exploits the complementarities between the existing routines by means of programmed coordination (Kremser and Schreyögg, 2016: 701). Yet, resolving interdependencies via programming in the past significantly increases the complexity of re-configuring these interfaces without losing these particular complementarities in the future. New routines are investigated in terms of their fit with the current cluster and its corresponding internal interfaces, resulting in a trajectory that shapes the evolution of the cluster via the rejection of non-complementary new routines (Kremser and Schreyögg, 2016: 702). This eventually leads to self-reinforcing dynamics under which systems are likely to become path-dependent and eventually experience lock-in effects that limit organizational change (David, 1985; Kremser and Schreyögg, 2016; Sydow et al., 2009).

The Underlying Assumptions of Routine Clusters

In the following I turn to the underlying assumptions of the routine clusters school of thought. I firstly illuminate how routine clusters, as well as the interfaces between interdependent routines, are formally designed. Building on these assumptions, I subsequently illustrate that the routine clusters school of thought presumes organizational change to be plannable and controllable.

Task certainty, formal structuring and programmed coordination

Routine clusters (Kremser and Schreyögg, 2016) are anchored in the fundamental principle of division of labor (Smith, 1776). Following classical organizational design, an overall task is divided into multiple sub-tasks (Kosiol, 1962) or in this case several separate, but interdependent routines (Kremser and Schreyögg, 2016). Hereby, it is presumed that the overall task is well-known, unambiguous, stable, and fully comprehensible, because otherwise it would not be possible to distill sub-tasks or in this case (sub-) routines that lead to its efficient fulfillment. The resulting wide range of routines creates the necessity to reduce the internal complexity to a manageable scope (Kremser and Schreyögg, 2016: 702).

On an organizational level, a reduction of complexity can be achieved by forming specific routine clusters for instance along objects (e.g. products) or activities (e.g. marketing) (Kremser and Schreyögg, 2016: 701). Yet, differentiating routines into clusters has to be properly balanced with the respective need to (re-) integrate the results accomplished by the individual clusters (Lawrence and Lorsch, 1967). Hereby, the notion of clustering routines along objects or activities is congruent with classical formal organizational designs such as divisional or functional structures.

On the cluster level, dividing overall tasks into sub-tasks/routines creates a large number of routines enacted by multiple human agents at different times and places. Efficiently integrating these separately performed routines thus becomes increasingly difficult. Responding to this challenge, the literature on routine clusters proposes programming (Luhmann, 1995; Simon, 1978) as preferred mechanism for their efficient integration (Kremser and Schreyögg, 2016: 700). Programs represent formal rules that anticipate potential coordination issues and aim to resolve them prior to their actual occurrence (March and Simon, 1958: 159 ff.). The underlying performance specifications to achieve such an efficient coordination process consist of three

parts: (1) the triggering information, (2) the major steps to program execution, and (3) the expected output (Luhmann, 1995; Simon, 1978).

Defining the triggering information ex-ante presupposes that the respective trigger is clearly predictable. Accurately anticipating the trigger requires a high clarity of information, sufficient certainty of causal relationships, as well as a definite and relatively fast feedback from the environment (Lawrence and Lorsch, 1967). Additionally, it brings about the need for the triggering event to occur repeatedly in the same or at least in a similar, recognizable fashion. If this is the case, it is assumed that the same event can always be resolved with the same pre-determined major steps. The event or problem must therefore be fully comprehensible to guarantee that the solution is well-known and can thus be pre-defined (Simon, 1960). If the formal program is then executed accurately, it guarantees constant results and thus the expected output for others (Baldwin and Clark, 2000). This plan-determined conceptualization of programming as main coordination mechanism thus presupposes high levels of consistency, certainty, homogeneity and predictability. Moreover, it renders deviating from the underlying formal rules undesirable, since such alternations could jeopardize the reliability of the expected program outcomes.

Planned change and incremental innovation

By putting a strong emphasis on formal structuring and coordination mechanisms, scholars in the field of routine clusters perceive changes to routine clusters and thus organizational change to be plannable and controllable. In this vein, when dealing with situations of innovation, the (mis)-fit costs of integrating the respective new routines determine whether they will become part of the cluster (Kremser and Schreyögg, 2016: 701). In case of an incremental innovation these new routines have to be adapted to the cluster and not vice versa. This can be achieved by keeping the new routines apart from the established operations and thus minimizing disruptions of the cluster (Kremser and Schreyögg, 2016: 702). Changes of the cluster are

therefore planned and executed in accordance with (programming) decisions made in the past. Hereby, change is perceived as steerable and manageable. A radical innovation, however, creates extremely high misfit costs which make the integration of the respective new routines an unfeasible endeavor (Kremser and Schreyögg, 2016: 717). Thus, it is assumed that radical innovation and change are not compatible with routine clusters.

Juxtaposing Ecologies and Clusters

Having outlined the concepts of routine ecologies and routine clusters, as well as their underlying assumptions, in the following I summarize the main differences and juxtapose the respective position with regards to the dimensions outlined above. The underlying structure is illustrated in table 1. It aggregates insights from both schools of thought into two main blocks each constituting a sub-chapter: (1) the coordination of interdependent routines and (2) the impact of routine interdependence on stability and/or change. Each sub-chapter juxtaposes the main insights of routine ecologies and routine clusters within these main blocks.

Routine Ecologies	**Routine Clusters**
Coordination of Interdependent Routines	
Informal patterning • Constant change • Informal principles Coordination as balancing act • Performed ad-hoc • Focus on human agency	Formal structuring • Task certainty • Formal design Coordination via programming • Defined ex-ante • Focus on formal rules
The Impact of Interdependent Routines on Stability and Change	
Emergent change • Unplannable • Radical innovation	Planned change • Controllable • Incremental innovation

Table 1: Juxtaposing the underlying assumptions of routine ecologies and routine clusters

Coordination of Interdependent Routines

Scholars in the field of routine ecologies presume that organizations deal with constant change and respectively emphasize that human agency and informal principles contribute to the flexible creation and re-creation of informal patterns which eventually form routine ecologies. Within these ecologies, the coordination of interfaces between intersecting routines is conceptualized as individual balancing act in which human agents respond to an impulse that is generated at the point of intersection between multiple routines. Coordination therefore occurs ad-hoc, flexible and unplanned whilst being achieved by reflexive actants based on their professional judgement (Spee et al., 2016).

Scholars in the field of routine clusters presume high levels of certainty in which a well-defined task can be divided into multiple sub-tasks. In order to reduce the resulting internal complexity, the routines are then formally structured, for instance along objects or functions (Kremser and Schreyögg, 2016: 701). Throughout this structuring process, the respective routines are efficiently integrated by programmed interfaces. Since this requires pre-defined results, predictability and planning, coordination is achieved by a formal mechanism that is specified exogenously and ex-ante (Kremser and Schreyögg, 2016: 700).

In sum, scholars from both schools of thought explicate the coordination of interdependent routines quite differently: within the field of routine ecologies the emphasis is on human agency, informality, and flexibility, whilst within the field of routine clusters scholars prioritize formal structures, rules, and efficiency. Among other factors, as elaborated in the next section, these diverging conceptualizations of the coordination of interdependent routines irradiate on the scholarly perception of the impact of routine interdependence on stability and change.

The Impact of Interdependent Routines on Stability and Change

Through researching how internal interactions within routine ecologies can be more or less generative, scholars in this school of thought illuminate that mediators at the interfaces between

interdependent routines may enable and create radical innovation (Sele and Grand, 2016). Hereby, actants perform routines and the respective intersections differently whenever performances fall short of a given task. In this vein, organizational change is seen as product of continuous micro changes which occur in a specific moment and thus cannot be planned. Thereby, change is conceived as purely emergent (Birnholtz et al., 2007; Deken et al., 2016; Sele and Grand, 2016; Spee et al., 2016).

When researching the internal dynamics of routine clusters and their impact on organizational change, scholars in this school of thought emphasize that the integration of new routines into a cluster gets increasingly harder after having efficiently programmed the interfaces between interdependent routines. Through these restrictive dynamics, which aim at conserving existing complementarities, merely incremental innovation can be achieved. Thus, as changes to the cluster are carefully investigated in respect to decisions made in the past, organizational change is perceived as plannable and controllable (Kremser and Schreyögg, 2016).

At this juncture, the differences between both schools of thought become very clear: whilst routine ecologies emphasize the generativity, flexibility and endogenous dynamics of interdependent routines, routine clusters conceptualize interdependencies as significantly limiting for organizational dynamics and change. The former perspective hereby perceives change as purely emergent, whilst the latter perspective regards change as plannable and controllable. The fact that these important, but diverging insights were created separately from each other within the respective schools of thought, however, raises the question if and how this knowledge can be integrated to advance the overall academic debate on routine interdependence.

Towards an Integrative Framework of Routine Interdependence

Research on routine ecologies and clusters has provided valuable insights into the coordination of interdependent routines, as well as the implications of routine interdependence on stability

and change. As I will show in the following chapter, combining – rather than separating – this knowledge generates a more holistic picture on routine interdependence. I therefore propose a framework that integrates insights from both schools of thought.

Coordinating Different Degrees of Interdependence

Despite the large body of literature on organizational interdependence, surprisingly little is said about interdependence between routines. Thus, it is necessary to transfer what we already to know about interdependence to the realm of routines (Kremser et al., 2017). A common notion is that interdependence flows from a shared pool of resources (Pfeffer and Salancik, 1978; Thompson, 1967) and thus results from a potential overlap of artifacts, actions, or actors. Thompson (1967) defines three categories of interdependence between structural entities, each representing a different degree or intensity of linkage. *Pooled* interdependence describes loosely coupled units that act independently from each other, while contributing to the entire system. It therefore represents an absence of work flow between units, while each unit makes independent contributions to the organization. *Sequential* interdependence puts an emphasis on time since the output of one unit is a necessary input for the performance by the next unit (Thompson, 1967). It is thus a unidirectional pattern in which one unit's inputs are the outputs of another unit and quite similarly each unit's outputs are another unit's inputs (Victor and Blackburn, 1987). Lastly, *reciprocal* interdependence adds the attribute of being cyclical to the concept of sequential interdependence (Thompson, 1967). It is a contingent pattern in the work flow in which each unit's inputs are its own outputs, recycled through other units (Victor and Blackburn, 1987). According to Thompson (1967) interdependence can be conceptualized as the extent to which the relationship between work unit could be characterized by one of these three types of interdependence.

Interdependence comes together with - but nonetheless differs from - contingence (Kremser et al., 2017: 5). Thompson (1967) explicates that increasing degrees of interdependence pose

increasing degrees of contingency to interdependent units. Hereby, this increasing level of contingency is equivalent to increasing uncertainty and ambiguity in the coordination process (Jones, 1984). In this vein, the degree of contingency posed by interdependence affects the volume and frequency of communication and decision making between units (Victor and Blackburn, 1987).

"*With pooled interdependence, action can proceed without regard to action in other positions. With sequential interdependence, however, each position in the set must be readjusted if any one of them acts improperly. With reciprocal interdependence the actions of each position in the set must be adjusted to the actions of one or more others in the set*" (Thompson, 1967: 58).

Thompson (1967) proposes associating a preferred mode of coordination to each type of interdependence. With an increasing degree of interdependence "*organizations seek to localize interaction and confine it to conditionally autonomous groups-to cluster positions and groups into the smallest possible inclusive units in order to minimize coordination costs*" (Thompson, 1967: 60).

Increasing degrees of interdependence are positively associated with increasingly lateral and organic coordination principles, such as for instance unscheduled meetings, horizontal communication channels and even improvisation. Low levels of interdependence, however, relate to the use of vertical coordination mechanisms such as plans, rules, and programs (Victor and Blackburn, 1987).

Extending these insights to routine interdependencies allows the creation of a more holistic understanding of the coordination of interdependent routines. Rooted in the literature on routine clusters, programming is a coordination mechanism that is defined ex-ante, fosters efficiency and presupposes a low level of uncertainty. Hereby the ultimate goal is the creation of semiautonomous routines or – put differently- modules that are performed independently from each other (Kremser and Schreyögg, 2016). Following Thompson (1967), this fulfills the

definition of pooled interdependence since the actions in one routine can proceed without regard to actions in other routines. Such a low level of interdependence and contingency is positively associated with vertical coordination mechanisms, such as programming.

Routine ecologies emphasize the individual balancing act, in which mindful actors are at the core of coordination. In this vein, endogenous coordination practices occur ad-hoc, unplanned and flexible (Spee et al., 2016). In line with Thompson (1967), Spee et al. (2016) explicitly identify their concept of a dynamic balancing act as a case of reciprocal task interdependence. Conceptually this links routine ecologies and the respective coordination principles to reciprocal (routine) interdependence.

Despite these first insights, current research does not incorporate the notion that all forms and degrees of interdependence occur in organizations. This results in an ongoing process of addressing different degrees of interdependence with specific modes of coordination stemming from both - the routine ecologies and routine clusters - schools of thought. The details and underlying dynamics of this process, however, are currently underexplored and need further conceptual and in particular empirical clarification.

Balancing Stability and Change

The dual search for stability and change is inherent in all forms of organizing (Weick, 1979: 136) as "*to survive and prosper, organizations must reconcile stability, reliability, and exploitation with change, innovation, and exploration*" (Farjoun, 2010: 202). Whilst it is well - researched that single routines contribute to both stability and change, the role of multiple interdependent routines for organizational stability and change is yet to be fully understood. In the following I address this gap by linking insights from the routine ecologies and the routine clusters schools of thought to the main streams of literature on stability and change.

The prevailing view on organizational stability and change conceives the two elements as paradoxical concepts and thus defines them as opposites and, by implication, separate (Poole

and Van de Ven, 1989). For instance, according to the prominent organizational ambidexterity framework, there is a fundamental distinction between two gestalts of organizational behavior*:* *exploration* which engages individuals and organizations in variation, experimentation, search, and innovation (March, 1991) and *exploitation* which enhances static efficiency, reliability, productivity, repetition, and consistency (Lavie et al., 2010; Levinthal and March, 1993; Schumpeter, 1942). A central premise of the exploration-exploitation framework are the inherent trade-offs between the two. Organizations that concentrate on exploitation trade flexibility for stability, whereas focusing on exploration creates challenges in terms of stability and efficiency. These inherent trade-offs manifest the conceptualization of exploration and exploitation as two opposing sides of a continuum (Lavie et al., 2010). In, this vein, stability and change, as well as the processes, practices, and forms that support them, are considered mutually exclusive and largely incompatible. This results in a highly differentiated organizational design, in which some sub systems are held completely stable, while others operate fully flexible (Gilbert, 2006; Raisch et al., 2009).

An alternative approach, which purposefully shifts the focus from specialization and the respective trade-offs towards the simultaneous balancing of paradoxical tensions on the systems level, has recently evolved (Farjoun, 2010; Luhmann, 1995; Schreyögg and Sydow, 2010). In this vein, stability and change are conceptualized as countervailing processes that must be concurrently managed by organizations and their subunits (Schreyögg and Sydow, 2010). Hereby, the two elements are not seen as separate or opposed, but as fundamentally interdependent, both contradictory and complimentary (Farjoun, 2010: 203). This results in a changed perspective that differentiates between stability/change manifested as an outcome and stability/change manifested as a mechanism. In this vein, mechanisms can support the same kind of outcomes, but not exclusively. Specifically variable mechanisms not only enable change and innovation, but are also essential in maintaining stability. Vice-versa, stable mechanisms, while supporting stable outcomes, also foster exploration, adaptability, and innovation.

Coherently, "*attaining one type of outcome requires some elements of the other*" (Farjoun, 2010: 205).

Extending these insights to routine interdependencies allows the creation of a more holistic understanding of the role of interdependent routines for organizational stability and change. Rooted in the literature on routine ecologies, variable mechanisms such as dynamic patterning, informal principles, and coordinative balancing acts (Birnholtz et al., 2007; Sele and Grand, 2016; Spee et al., 2016) do not necessarily just contribute to organizational generativity, but they are also essential in maintaining stability. Quite similarly, rooted in the literature on routine clusters, stable mechanisms such as formal structuring, the efficient programming of interfaces and the exploitation of complementarities (Kremser and Schreyögg, 2016) not only support stable outcomes, but they can also promote innovation and change. Thus, instead of considering ecologies and clusters, as well as their underlying principles, mechanisms and outcomes, as separate and incompatible, I suggest that both schools of thought remain conceptually distinct, while acknowledging that they are interdependent and a constituent of one another. In the following, I therefore introduce an integrative model that merges insights from both schools of thought and thereby acknowledges their compatibility and potentially symbiotic nature.

Integrative Framework

I propose a framework that integrates insights from the routine ecologies and the routine clusters schools of thought. The respective model generates a more holistic picture on the coordination of interdependent routines and reveals that these coordination processes have a direct impact on the balancing of organizational stability and change.

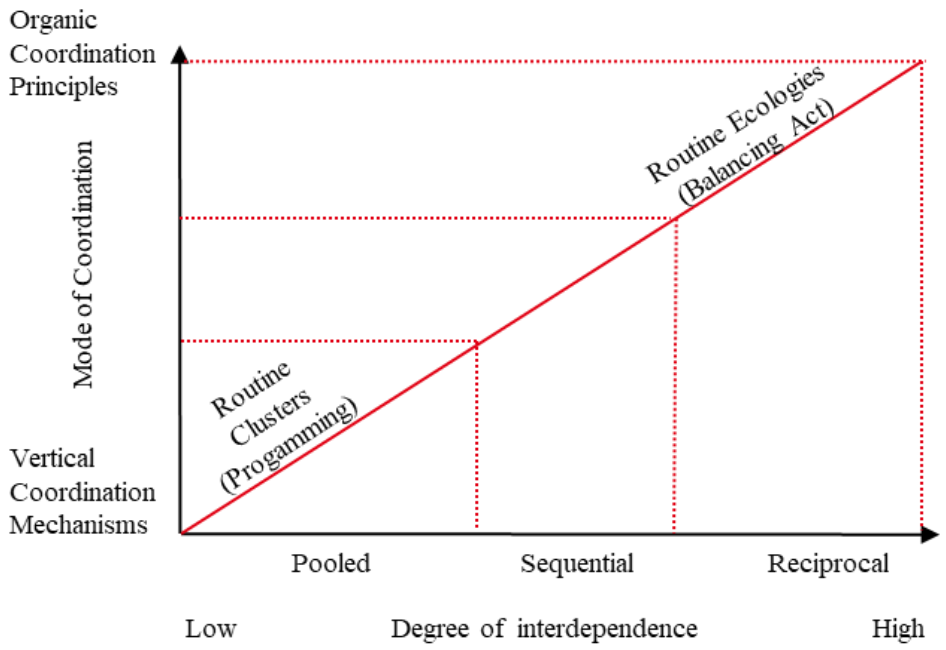

Figure 1: Integrative framework

As portrayed by figure 1, specific degrees of interdependence between routines are addressed with specific modes of coordination. Programming - a vertical coordination mechanism that originates from the routine clusters school of thought - is linked to the coordination of routines with a low level of (pooled) interdependence. It is thus located on the low level interdependence end of the continuum. On the opposing end, routine ecologies and the respective organic coordination principles, such as for instance the dynamic balancing act described by Spee et al. (2016), are capable of addressing high levels of (reciprocal) interdependence. Since all kinds of interdependence occur in organizations, coordinating different degrees of interdependence requires dynamically alternating between different modes of coordination. Hereby, stable (vertical) mechanisms can result in stable, as well as dynamic outcomes. Vice-versa, variable (organic) principles may lead to generative, as well as stable outcomes. Thereby, the alternating modes of coordinating interdependent routines directly impact organizational stability and change and thus play an important role in the process of balancing these two inherently

paradoxical elements. The details of this process, however, are currently underexplored and should be subject to future research.

Conclusion

This paper advances an integrative framework on routine interdependence. Hereby, it enriches the current debate on routine intersections and the respective coordination principles, as well as the implications of routine interactions and intersections on organizational stability, change, and innovation. In this vein, it makes three distinct contributions.

Contributions

As a first contribution, I introduce a holistic perspective on routine interdependence that incorporates - rather than separates - knowledge from the routine ecologies (Birnholtz et al., 2007; Sele and Grand, 2016; Spee et al., 2016) and the routine clusters (Kremser and Schreyögg, 2016) schools of thought. By distilling and juxtaposing the underlying assumptions of both schools of thought, I show that routine ecologies and routine clusters are currently situated in two diverging paradigms: the former emphasizes endogenous coordination principles, unrestricted innovation, and emergent change, while the latter highlights ex-ante defined coordination programs, path-dependence, and high levels of stability. I illustrate that, despite these conceptual differences, routine ecologies and routine clusters are highly compatible as their underlying principles and mechanisms jointly contribute to the coordination of interdependent routines and thereby influence organizational stability and change. As a result, I pave the way for a holistic perspective on routine interdependence beyond ecologies and clusters.

Second, by developing an integrative framework, I show that the respective coordination modes between routines differ based on the degree of interdependence: a low level of interdependence allows the programming of interfaces, whereas endogenous coordination principles address

high levels of (reciprocal) interdependence. Coordinating different degrees of interdependence between routines thus requires dynamically switching between different modes of coordination.

Third, also within the scope of this framework, I shed light on the role of interdependent routines for balancing organizational stability and change. In this vein, I show that variable (coordination) principles can contribute to flexibility and stability, while stable (coordination) mechanisms may lead to stable, as well as generative outcomes. I therefore extend current perspectives that exclusively link routine ecologies to change (Birnholtz et al., 2007; Sele and Grand, 2016; Spee et al., 2016) and routine clusters to stability (Kremser and Schreyögg, 2016). Hereby, I illuminate the important role of interdependent routines and the respective modes of coordination in the process of balancing organizational stability and change.

Further Research

This framework may open up new avenues for future research. First, I have shown that interdependent routines are coordinated via alternating modes of coordination. As these coordination principles and mechanisms have only been researched individually (Kremser and Schreyögg, 2016; Spee et al., 2016) thus far, a qualitative inquiry into the dynamic interplay between different modes of coordination could certainly advance the academic debate. In this vein, particularly the role of the group's social capital (Sargis-Roussel et al., 2017) in these collective processes should be explored.

Second, there is still considerable scholarly interest in how organizations balance stability and change (Farjoun, 2010; Schreyögg and Sydow, 2010; Weick, 1979). In response to this query, I have shown that coordination processes between interdependent routines contribute to organizational stability and change. Based on this foundation, future empirical inquiries should explore how exactly interdependent routines and the respective alternating modes of coordination contribute to the organizational process of balancing stability and change.

Third, studying interrelated routines will require a more thorough conceptualization and understanding of interdependence. Applying the notion of different degrees of interdependence (Thompson, 1967) could provide a solid basis for studying the enactment of different kinds of interdependencies between routines.

Fourth, the development and handling of disruptions and breaches between interdependent routines should be further analyzed. This particular research would be highly significant specifically in complex and turbulent environments.

Fifth, it would be interesting to explore the role of interdependent routines in managing the unexpected and particularly how routines and interdependencies evolve and potentially change over time.

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Paper II

Exploring Routine Interdependence: Fluid Boundaries and Adaptive Patterning

with Daniel Geiger

(Under review at: Journal of Management Studies)

ABSTRACT

This paper advances theorizing on routine interdependencies and related methodological challenges. We aim to challenge the implicit assumption within current conceptualizations of routine interdependence that routines are clearly distinguishable processes that are interrelated via interfaces and/or people. Building on an ethnographic longitudinal case study of routine change within a manufacturing firm, we develop a framework that explains routine interdependence beyond clusters or ecologies. Thereby we contribute to routine dynamics research in three ways: First, routine boundaries are blurry and dynamically shifting rendering it difficult to identify them ex-ante and ex-post. Second, as a result the coordination of routine interdependence occurs between dynamically, reciprocally interrelated actions rather than at the interface between routines. Third, these insights raise important methodological questions of granularity, which have significant implications for our interpretation and study of routine stability and/or change. Stability and/or change thus become a matter of different levels of analysis which need to be taken into account when comparing routine interrelations as either clusters or ecologies.

Keywords: Coordination, Dynamic Patterning, Granularity, Interdependent Routines, Routine Boundaries

Introduction

Research on organizational routines has grown significantly in recent years as scholars have recognized the importance of routine processes for understanding organizational dynamics (Feldman and Rafaeli, 2002; Feldman, 2000; Feldman et al., 2016). Particularly research on single routine dynamics, which is essentially concerned with the notion that routines are processes with internal dynamics enabling both stability and change (Feldman and Pentland, 2003; Feldman and Rafaeli, 2002; Pentland et al., 2012; Turner and Fern, 2012), has been dominating the scholarly debate. While lots of interesting insights on the endogenous dynamics (Bapuji et al., 2012; Miller et al., 2012) and micro-foundations (Cohen, 2012; Felin et al., 2012) of *single* routines have been generated, research on *multiple* interdependent routines is just recently gaining increasing scholarly attention (Kremser et al., 2019). The evolving debate centers around different ways routines can interact, intersect, and be interdependent, thereby contributing to stability, change and innovation (Feldman et al., 2016). Within this emerging field of research, two different conceptualizations or schools of thought have developed: routine ecologies and routine clusters.

Although both schools of thought arrive at opposing insights into the coordination of interrelated routines, both share - as we argue - some important, yet critical, assumptions: in order to identify interrelated routines, scholars commonly start with the assumption that it is possible to clearly distill and distinguish the respective interrelated routines. Hereby, scholars at least implicitly assume that routines have clearly definable, discrete and empirically identifiable boundaries that even sustain over the course of time (Kremser et al., 2019). These identifiable yet interdependent routines are then either linked via programmed interfaces (routine clusters), or routine participants balance competing logics by giving preference to one routine or another at different points in time (routine ecologies). Meanwhile the routines which are interrelated are assumed to largely remain unaffected by this interrelation. Our study intends

to challenge these assumptions (Alvesson and Sandberg, 2011) by exploring in more detail how the boundaries of routines actually emerge and evolve over time. In our empirical study, which is based on an ethnography of routine change in a medium-sized manufacturing company, we therefore address the following research questions: How do boundaries between interdependent routines develop and change over time? And how does this affect the coordination of interdependent routines?

Our findings have the potential to contribute to theory on routine interdependence in at least three ways: (1) As our findings show, the boundaries of routines are constantly changing over time and sometimes even become unidentifiable. Clustering patterns of interdependent action steps to discrete routines is difficult, if patterns of interdependent actions serve multiple routines simultaneously. Identifying routines is therefore only a snapshot at a specific point in time. As we will outline in the paper, routines and routine interdependencies cannot be taken for granted as a unit of analysis. (2) Our findings also show that discussing routine interdependencies either as clusters or as ecologies neglects the circumstance that interrelations happen as a form of dynamic patterning. Analyzing routine interdependencies on the level of dynamic patterning reveals that interdependencies do not occur as programmed and stable interfaces, but actions reciprocally respond to each other. Instead of speaking of interdependent routines that are either linked via interfaces or skilled practitioners, we suggest conceptualizing routine interdependence as a dynamic web of interrelated action steps. (3) From our findings we suggest introducing the concept of granularity (Nicolini, 2009; Schlegloff, 2000) into the routine dynamics debate. As our findings reveal, routine studies are a matter of granularity: zooming in (Nicolini, 2009) i.e. diving down into finer grained levels of observation and analysis provides different insights on routine dynamics compared to zooming-out to more coarse granularity.

Routine Interdependence: Between Cluster and Ecology

The growing understanding of the dynamics of single routines shifted our scholarly attention from understanding single routines towards an increasing interest in grasping the interconnection between different routines (Feldman et al., 2016; Kremser et al., 2019; Turner and Rindova, 2018). This debate acknowledges that routines do not unfold in isolation, but are interconnected with other routines in organizations. And particularly this interconnection is at the center of recent scholarly interest. Emerging insights reveal that at least two different conceptualizations, or even schools of thought, which hold different insights into our understanding of these interconnections, have emerged: the routine ecologies school and the routine clusters concept.

In their pioneering work on routine ecologies, Birnholtz et al. (2007) show that routine ecologies, which they conceptualize as networks of action dispositions, play a central role in shaping the dynamic reproduction of an organization. In a related study, Sele and Grand (2016) illuminate how the engagement of actors between interrelated routines influences if routine ecologies have more or less generative potential. Quite similarly, Deken et al. (2016) illustrate how actors who handle interdependent routines are able to create novel outcomes. Finally, with a specific focus on the coordination of interdependent routines, Spee et al. (2016) show that skillful performance at the routine intersections impacts the orientation of a routine towards stability or flexibility. Taken together, scholars contributing to the stream of routine ecologies conceptualize interactions between interdependent routines as mindful individual ’balancing acts’ (Spee et al., 2016: 760) that determine the generative potential for innovative outcomes.

Quite contrary, according to the concept of routine clusters (Kremser and Schreyögg, 2016), a complex organizational task is divided into several specialized routines that eventually form specific clusters along, for instance, products or functions (e.g. marketing). Within these clusters, the respective routines must be integrated to ensure that each routine partially

contributes to the accomplishment of the overall task. This creates the need to exploit complementarities between interdependent routines by programming their interfaces (Kremser and Schreyögg, 2016: 698). From this point of view, re-configuring routines is limited to the degree as the interface is not affected. As a consequence, new routines are investigated in terms of their fit with the current cluster and its corresponding internal interfaces, resulting in a trajectory that shapes the evolution of the cluster. Eventually, according to this perspective, these mechanisms lead to path dependence and discourage radical innovation (Kremser and Schreyögg, 2016).

Here, the differences between the two schools of thought become obvious: whilst routine ecologies emphasize the generativity, flexibility and endogenous dynamics of interdependent routines, routine clusters conceptualize interdependencies as significantly limiting organizational dynamics and change. However, although both schools of thought arrive at opposing insights into the dynamics of interrelated routines, both share some important, yet critical assumptions concerning routine boundaries and the coordination of their interdependencies.

Routine Boundaries

When studying multiple, interdependent routines, scholars from both schools of thought commonly start with the assumption that it is possible to clearly distill and distinguish the respective interrelated routines in the first place. For instance, as part of their study, Spee et al. (2016) observe actions, sequentially order these actions into a flow chart, thereby identifying routines in their data. They then provide thick descriptions of - among others - the deal appraisal routine, the broking routine, and the modeling routine (Spee et al., 2016: 760). Sele and Grand (2016) identify routines as recurring actions in their data by building on the definition of routines as *"repetitive, recognizable patterns of interdependent actions, carried out by multiple actors"* (Feldman and Pentland, 2003: 95). As part of their data analysis, they clearly distill 30

routines, such as for instance the lecturing routine, the writing abstracts routine, and the searching for proposals routine (Sele and Grand, 2016: 728). In a similar vein, Deken et al. (2016) set out to observe actions, use interviews to gain deeper insights into these actions, and finally cluster them into distinct routines which they then label as 'the toll gate routine' and 'the partner selection routine (Deken et al., 2016: 663). Finally, Kremser and Schreyögg (2016) use retrospective interviews to re-construct routines, which they then identify as, for instance, the 'splicing routine' and the 'sorting routine' (Kremser and Schreyögg, 2016: 708). Thus, as summarized in table 1, despite using different methodological and conceptual approaches, all scholars empirically identify a stable set of routines in their data. Therefore, by clearly distinguishing routines from each other, they at least implicitly assume that routines have definable, discrete and empirically identifiable boundaries.

Authors	Empirical identification of routines	Identified routines
Birnholtz et al. 2007	(1) Identification of action patterns via observations and interviews	• Term avoided
Spee et al. 2016	(1) Observations of actions in the field (2) Use actors own language as in-vivo codes or developing descriptive labels (3) Sequential ordering of the activities into flow chart (4) Thick descriptions of routines	• Deal appraisal routine • Broking routine • Modeling routine • Client meeting routine • Business planning routine
Sele and Grand 2016	(1) List of recurring actions gradually combined (2) Definition (Feldman and Pentland 2003) (3) Description of routines for within routine analysis (4) Validation by actors	30 routines; i.e.: • Lecturing routine • Writing abstracts routine • Searching for analogies routine
Deken et al. 2016	(1) Observations of actions and interviews to gain insights into these actions (2) Identification of routines via definition (Feldman and Pentland 2003)	• Toll Gate routine • Partner selection routine
Kremser and Schreyögg 2016	(1) Identification of routines via retrospective interviews	• Sorting routine • Splicing routine • …..

Table 1: Identification of routines in the existing literature

These identifiable, yet interdependent routines are then either linked via programmed interfaces (routine clusters), or routine participants balance competing logics by giving preference to one routine or another at different points in time (routine ecologies). While the former can lead to a rejection of new routines if the misfit costs are too high (Kremser and Schreyögg, 2016), the later may generate innovative outcomes such as the adaption of routine performances (Sele and Grand, 2016). Regardless of such dynamics between and within routines, it is assumed that the boundaries of the routines remain largely unaffected by these interrelations in all of the present studies. Following both schools of thought, the interrelation of routines happens between either interfaces or between people, but the routine itself is not affected by the interrelation. As a result, although routines are considered as interdependent, both schools at least implicitly assume that routines have clearly definable, discrete and empirically identifiable boundaries that even sustain over the course of time. The question, however, how the boundaries between routines actually emerge and change over time (Dittrich et al., 2016), has, as a result of these shared assumptions, not received much attention in the current debate on routine interdependencies. Our study therefore addresses this question by asking how boundaries between interdependent routines develop and change over time?

As we will show in the next section, shedding light on these dynamics not only creates a better understanding of routine boundaries, but is also necessary to elaborate theorizing on the coordination of interdependent routines.

Coordination of Interdependent Routines

The issue of how coordination is achieved between interdependent routines has sparked the interest of scholars from both schools of thought. In their research on routine ecologies, Spee et al. (2016) point out that actors need to simultaneously enact coexisting ostensive patterns at the intersections of interrelated routines. In this particular moment of coexisting ostensive patterns, actors then decide if they reorient the performance of a focal routine towards either to

standardization or customization (Spee et al., 2016: 760). By using his/her professional judgement, the actor then "…reorients the performance to counteract the initial impulse and rebalance coexisting ostensive patterns within the focal routine" (Spee et al., 2016: 775) in order to achieve coordination. Coordination is thus conceptualized as an endogenous balancing act that occurs ad-hoc when actors rebalance the impulses from of different, interrelated routines. In a similar vein, Sele and Grand (2016) conceptualize actants at the intersection between routines as either intermediaries or mediators. Whereas intermediaries transfer meaning between routines without any adaptions, mediators cause generative effects, such as the adaption of routine performances, innovative outcomes and endogenous change. The respective coordinative engagements of actants at the intersections between routines thus play an important role in generating more or less generative outcomes (Sele and Grand, 2016: 730). Finally, within the routine clusters school of thought, Kremser and Schreyögg (2016) emphasize that routines are interrelated by an ex-ante programmed interface. Such an interface builds a key mechanism for an efficient coordination process (Kremser and Schreyögg, 2016: 700). Programming such an interface requires a normative prescription of the outcome of each of the interrelated routines, including a definition of the coordination requirements (i.e. interdependencies) between them. If the interface remains unchanged, actors can concentrate on the continuous and autonomous enactment of each of the routines. As long as those routines deliver expectable and stable results, these routines can then be easily integrated via the interface (Kremser and Schreyögg, 2016: 700).

Comparing the two schools of thought, it becomes apparent that they diverge in their conceptualizations of the coordination processes between interdependent routines: whereas scholars in the field of routine ecologies point out that coordination occurs ad-hoc, flexibly and endogenously, scholars in the field of routine clusters emphasize the importance of ex-ante defined, stable, and exogenous interfaces as coordination mechanisms. Despite these differences, both streams of research conclude that coordination is achieved at the intersection

of interdependent routines. This is, however, only possible if the boundaries between these interrelated routines are clearly identifiable and persist over time. Without such clear and stable boundaries, identifiable intersections between routines cannot exist. As a result, although both schools differ in their conceptualization of coordination at the intersection of different routines, they both share the assumption that coordination happens at the intersection between routines. It is, however, less well explored, how these intersections actually emerge, how they are enacted and how they change over time (Kremser et al., 2019). In addition, the question arises if coordination of interdependent routines necessarily takes place at identifiable intersections (either emerged or programmed) or if we cannot identify different forms of routine coordination. The research questions of this paper are thus: How do routine boundaries emerge and change over time? How is coordination enacted between interrelated routines?

Methods

We conducted a real time, longitudinal exploratory case study (Eisenhardt, 1989; Eisenhardt and Graebner, 2007; Yin, 2003) that examines the micro dynamics of routine boundaries, as well as the coordination of interdependent routines. By adopting an interpretative approach we give voice to the people experiencing the events (Van Maanen, 1979). Hereby, the insider's point of view becomes the foundation of our analysis (Van Maanen, 1988). By then formulating deeper and more theoretical second-order interpretations (Van Maanen, 1979) and linking the interpretations of informants to both contextual factors and existing literature our aim is to develop an emerging grounded theory (Gioia et al., 2012; Strauss and Corbin, 1990).

Research Setting

Our empirical setting is AB Industries, a medium-sized manufacturer of industrial packaging machines. Throughout its long company history, the organization produced a variety of different machines and products. In the early 2000s, AB Industries began to specifically focus on the foods and beverages industry. Ever since, the company has been one of the top players

in Europe, as well as Asia. AB Industries employs more than 5000 people and operates production sites all over the world.

We were granted access to the organization's main manufacturing facility where the most recent machine generation, called Next Gen, was under development. Next Gen was inaugurated because AB Industries had previously failed to adapt their machines to the fast-changing and hardly predictable market requirements. As a consequence, the management board decided that the organization needed a new way of developing and constructing machines. They agreed on implementing a platform strategy which would enable them to offer the same machine size to every customer, whilst optional, pre-developed modules could be added, if required. Thereby, they hoped to achieve high levels of flexibility and adaptability for the new machine generation. The development project was launched in November 2016, only a few weeks prior to the beginning of our research endeavor. Thus, this development of the new machine generation became the central element of our non-participant field observation study (Van Maanen, 2011).

We purposefully sampled (Patton, 2002) this case since the development of a new machine generation provided us with a typical example of complex routine interdependence in which the development of innovative technologies and new ways of working created the need to integrate new routines into established settings. Throughout this endeavor the company was facing new technological demands, they had to deal with unknown and often changing customer requirements, and thus their established ways of working were challenged. Developing this new machine generation meant that new ways of working had to be introduced, multiple departments were involved in this process and multiple interrelated routines were affected. As a result the change processes addressed multiple, interrelated routines.

Data Collection

We collected longitudinal data throughout a period of 11 months. As a non-participant observer (Spradley, 1980), the first author spent on average two working days per week at AB Industries.

In line with studies of routine dynamics, we defined action steps and the patterns of actions that emerged as our unit(s) of analysis (Pentland and Feldman, 2005; Pentland et al., 2012) and collected data on how they were unfolding over time. Throughout the study we gathered data in the form of observations, informal and formal interviews, and secondary data such as, for instance, documents. Table 2 presents an overview of the respective set of collected data.

Data Source	Description of data sources	Amount of data
Observations	21 Meetings	≈ 27 hours
	10 Workshops	≈ 44 Hours
	Every day interactions/job shadowing	≈ 188 hours
	Total amount:	**≈ 259 hours**
Interviews	29 formal interviews	≈ 34 hours
	50 informal interviews	≈ 25 hours
	Total amount:	**≈ 59 hours**
Secondary Data	Process Charts, Project reports, Presentations, Meeting minutes, Strategy papers, Intranet pages, E-mails	≈ 5000 pages
	Total amount:	**≈ 5000 pages**

Table 2: Data collection overview

Observations

This paper is based on an ethnographic study carried out by the first author between November 2016 and October 2017. After an adaption phase of two weeks, the first author conducted regular observations, while the second author joined in occasionally to observe particularly important meetings and events. AB Industries provided the first author with changing workspaces, giving him the opportunity to alternate between office spaces and informally observe the interactions of different staff members. After a short time, the first author was invited to join their coffee and lunch breaks. He was therefore able to gain a deep understanding of the daily work and the culture of AB Industries.

The fieldwork focused on every-day activities, either by individually shadowing certain people or by collectively observing a group of staff during workshops and meetings. The first author watched and observed how marketing members conducted market analyses, how the engineers constructed and tested technological solutions, how project managers developed and adapted their project plans, and how all of them interacted in common workshops and meetings. After each day at AB Industries, the first author wrote extensive field notes (Emerson et al., 2011) which he then intensively discussed with the second author. Hereby, fine grained insights into the actions performed within the scope of interdependent routines were gathered.

Interviews

By conducting a total of 79 formal and informal interviews, we followed up on our observations to get a deeper grasp of how the interrelatedness, coordination, evolution, and boundaries of the observed routines were perceived by the respective actants. With this particular focus in mind, the first author conducted 29 formal semi-structured interviews over the entire observation period phase.

	Function	No. of Interviews	Time (hrs.)
1st Phase (N=14)	Head of R&D	1	1
	Project Manager Next Gen	1	1,5
	Project Manager Platform Strategy	1	1
	Pool Leaders	5	5,5
	Technical Leader	1	1,5
	Development Engineers	5	6
2nd Phase (N=15)	Director Global R&D	1	1
	Head of R&D	1	1
	Head of Process Management	1	1,5
	Head of Marketing	1	1,5
	Project Manager Next Gen	1	1,5
	Project Manager Platform Strategy	2	2
	Pool Leaders	2	2,5
	Technical Leader	1	1,5
	Development Engineers	5	5

Table 3: Summary of the formal interview data

As illustrated in table 3, interview partners were selected from all departments involved in the development process and all hierarchical levels, reaching from development engineers to the director of global research and development. Interviews lasted between 45 and 90 minutes and their structure varied slightly based on the position, seniority and hierarchical level of the interview partner. For instance, we asked the development engineers to tell us exactly what they do on a regular working day, why, and how. When interviewing the director of global research and development, however, we aimed at understanding much broader subjects such as, for instance, past decisions and future strategic directions. We conducted the first set of interviews (N=14) at an early stage of the project in order to gain deeper insights into the participant's perception of relevant interdependent routines and their performances. Combined with our

observations, this gave us the necessary analytical focus to concentrate on a specific set of routines over time. The remaining interviews (N=15) were conducted at later stages of the project and specifically aimed at reflecting and elaborating on the actions the interviewees engaged in, who they engaged with and how these practices changed and emerged over the course of time. All formal interviews were recorded and transcribed by a research assistant verbatim. Additionally, the first author informally interviewed the people he observed in meetings (N=50). Hereby, we distilled an even more granular understanding of informal phenomena, such as for example the individual interpretations of action steps.

Documents and Artifacts

We collected around 5000 pages of secondary data to support our observations. These included process charts, project reports, presentations, intranet pages, E-mails, meeting minutes and strategy papers. In particular the process charts and project reports were highly relevant because these artifacts contained formal descriptions of the development and project management routines at AB Industries. Thus, by triangulating these documents with our interviews and observations we were able to deepen our understanding of the interdependent routines.

Data Analysis

In our data analysis approach we followed grounded theory in an effort to remain open and distill the categories from the field (Strauss and Corbin, 1990). We were interested in the stability and change of boundaries between interdependent routines. Hereby, consistent with our definition of routines as interdependent action steps, action steps themselves provided an observable, meaningful basis on which to proceed for the study of routines (Pentland et al., 2012: 1487). Through constant comparison of our empirical observations to our emergent theorizing and by incorporating existing theory, we developed and refined our theoretical categories (Gioia et al., 2012). Our data analysis unfolded in four steps.

First, we aimed at identifying routines as "repetitive, interdependent patterns of action involving multiple actors" (Feldman and Pentland, 2003: 96). To get a first overview of potentially relevant routines we analyzed the product development process as inscribed in artifacts. Such artifacts may serve as a proxy for the ostensive aspect of a routine and can be enrolled in the performance of a routine by varying degrees, at the discretion of the actors (Pentland and Feldman, 2005). Afterwards, we coded the data to distill the actions that constituted the working days of AB Industries' members. This first round of coding generated a list of actions that were gradually discussed with each other in a data reduction process (Strauss and Corbin, 1990). Those actions that - based on the definition by Feldman and Pentland (2003) - formed a recurring action pattern performed by multiple actors, were considered routines. We presented our descriptions of these routines to our informants to validate and refine them (Lincoln and Guba, 1985). Collectively with our informants we then selected three focal routines that were most relevant for the development of Next Gen: the market research routine, the product development routine and the project management routine. For each of these routines, we went back into the data and wrote thick descriptions. Hereby, we relied on narrative networks (Pentland and Feldman, 2007) and asked who, does what, when, how, and why.

Second, we aimed at identifying the development of the interdependencies between the different routines. When we initially coded for intersections between routines, we realized that that action steps that were allocated to different routines also interacted with each other. Thus, we zoomed in (Nicolini, 2009) into the underlying action patterns of the interrelated routines and analyzed interdependencies between action steps. Thereby, we were able to illustrate the development and change of interdependencies not only on the intersections between routine boundaries, but also on the action step level.

Third, to add the important longitudinal perspective, we created an event sequence list (Poole et al., 2000). We then wrote detailed narratives (Langley, 1999) describing how routine

participants actually enacted the interrelated routines at these different events over time. Thereby, we were able to specifically analyze the changes of routine boundaries and explore the interactions among actions steps within and between routines and the implications of these for routine patterns over time.

Fourth, after conducting this highly detailed analysis, we held a meeting with our main contact persons from AB Industries to receive feedback on our results. Hereby, we were able to check the descriptive validity of our findings (Yin, 2009) because the members themselves discussed and reflected on the results of our study.

Findings

In this paper we explore how boundaries between interdependent routines develop and change over time and how this affects the coordination of interdependent routines. We do so by illustrating the interactions of action steps and the impact of these dynamics on the stability and change of routine boundaries. We focus on three interrelated routines that we, together with members of *AB Industries*, identified as being central for the development of Next Gen: the market research routine, the product development routine and the project management routine. To provide detailed insights into the dynamics of these interrelated routines we present our findings in the form of two thick descriptions.

Narrative 1: Blurring Boundaries

Narrative 1 describes the unfolding interrelationship between the market research and the product development routines and illuminates how interactions of action steps which were initially identified as being part of separate routines lead to the dissolution of routine boundaries both on the level of performing actors and on the level of performed action steps.

Episode 1:

The main task of the market research routine was the identification of Next Gen`*s* core markets and the respective requirements demanded by customers in these markets. In our early

observations, the routine was solely performed by Claudia, Matt and Kathrin from the marketing department. Initially, they divided the markets by region and analyzed each segment in terms of previous sales, size and growth of the market, upcoming machine replacements, potential sales and demand for a particular output rate (low/medium/high). After ranking the regions based on their market potential, Kathrin and Matt forecasted the technological requirements that needed to be satisfied in order to be successful in highly ranked markets, such as for example Asia. These technological requirements included, for instance, different packaging formats, different production speeds, and options such as an augmented reality function. The marketing experts emphasized that these forecasts could never be entirely thorough and would have to be adapted continuously. Therefore, the previously described action steps were repeated in regular intervals. Hereby, as stated by Claudia, the amount of uncertainty remained constantly high:

"One day our colleagues in Asia wanted to offer machines in Tibet meaning that our machine would be required to fully function at an altitude of 3000 meters. Every day we are surprised about the new things that we are confronted with"

Despite these uncertainties, the marketing experts came up with an initial list of 24 requirements that they defined as crucial to satisfy the most important market demands. These requirements constituted an important input for the R&D departments to ensure that the respective engineers knew what technological solutions to develop. Hereby, two requirements - the desired packaging formats and the required production speeds – had particularly strong technological implications for the development of Next Gen. Different packaging formats, such as smaller packaging shapes, for instance significantly influence the filling procedure and thus require different technological solutions than larger shapes. In a similar vein, different production speeds have strong implications for the structural design of the machine. A detailed clarification of these two specific requirements, as well as 22 additional ones (e.g. augmented reality

function, automatic cleaning etc.), was thus of utmost importance for the engineers developing Next Gen. The marketing department hence filled in an excel spreadsheet called the "Product Requirements Specification" (PRS) that contained all 24 specific requirements and handed this artifact over to the R&D department. At this point the PRS was the main, pre-defined interface between the departments and the respective routines.

In the R&D department the PRS triggered the product development routine. The requirements addressed different technological areas and the team leaders distributed the tasks between their employees based on their respective areas of expertise. If possible, the engineers roughly estimated the feasibility of certain requirements by looking at previously used technological solutions. Additionally, the engineers conducted feasibility analyses for unfamiliar technological solutions. These analyses included draft versions of technical drawings, experiments and simulations as well as predictions of product costs and upcoming technical risks and hurdles. As stated by Tom, throughout this process the engineers did not get involved in any specific market related activities:

"Marketing defines the requirements and we focus on delivering the technological solutions."

Episode 2:

A few months into the project the R&D department hosted a steering meeting in which they discussed the progress of the project. 12 people, mainly in management and team leading positions, participated. The atmosphere was quite relaxed, the head of R&D fixed himself a cup of coffee and opened the session. After a short introduction, the next point on the agenda was the review and evaluation of the technological drivers, which were equivalent to the 24 requirements defined by marketing. When the host of the meeting switched to the PowerPoint slide presenting the requirements, people immediately started mumbling and shaking their heads. After a few seconds, Frank an *AB Industries'* veteran raised his hand.

"*We must not forget that this project will only work if we find the right technological drivers. We have to critically asses if those requirements from marketing are correct. And we have to avoid that marketing gets the feeling that they can ask for anything and we will simply fulfill their wishes."*

An intense and lively discussion started. After a while they came up with the idea to weight the requirements by importance in order to prioritize and filter out the less important ones. Again, Frank, who started to become very emotional, raised his hand.

"*I'm having a deja-vu. We have tried weighting all requirements against each other for so many times in the past. The question what is more important, for instance speed or flexibility, pops up again and again. We must focus on 3-4 requirements in order to get out of this never ending discussion. Has anyone talked to marketing about this issue?"*

After a few seconds, Tom, who had organized all meetings and workshops concerning the development project, responded.

"We have not been able to get any information about this issue because the people from marketing have not accepted the invitations to our meetings. As usual they are doing their thing and we are doing ours."

At this point the discussion became highly emotional. People began talking to each other and the host of the meeting struggled to keep the meeting on topic. After a while, the head of R&D, raised his voice:

"*We cannot start this discussion all over again! We do not have to cover all requirements. If we ask marketing, they of course want to have everything covered. But these stupid requirements change every 3 months. So we must prioritize and create our own list of requirements. It can't go on like in the past, in which the R&D has been producing solutions and marketing keeps saying that they want everything differently. And then their boss goes on my nerves and keeps complaining to our CEO. That needs to stop!"*

After this intense speech, the engineers agreed on the proposed way forward: instead of relying on the requirements defined by the marketing department within the scope of the market research routine, they created their own list of technological requirements. The meeting hence terminated with a finalized list created by the engineers covering the technological requirements for Next Gen.

Following this important meeting, each time the engineers discussed the progress of Next Gen, they updated their list of requirements. For instance, they recurrently analyzed the desired production speed for Next Gen. Here, the engineers strongly disagreed with the marketing guys who requested high output rates. Instead, they followed their colleague Paul who proposed a strong focus on flexibility, rather than speed:

"*Our main competitor is currently producing a filling machine with very high output rates. This machine will be on the market prior to Next Gen. It makes absolutely no sense to target the high speed market as well! Rather, we must focus on flexibility and modularity!"*

The engineers frequently analyzed potential changes for all - from their perspective - relevant requirements in order to keep up with the continuously changing market demands. As a result, new action steps such as "scrutinizing the market analysis" and then "defining our own requirements" were introduced into the product development routine by the engineers. These actions were conducted on a recurring basis and thus became integral parts of the respective routine. The routine participants thus purposefully replicated action steps from the market development routine in order to stabilize the boundary between both routines, instead of adapting their interface. Hence, by defining their own list of market requirements in parallel, the engineers consciously minimized interdependence with the market research routine.

Episode 3:

2 months later, in addition to the definition of technological requirements, the analysis of target markets became a central topic for the engineers. The R&D department had not received the

necessary input and felt blind-sided by the marketing department. Frank communicated this issue to his boss George:

"Currently we don't have any information about the markets, which ones are emerging, which ones we have to defend and so on. We don't even have prognoses. I thought that we would have received all these information by now so that we could do our job and develop the machines accordingly. But we have absolutely no clue. It's insane!"

When this issue was addressed to the marketing department in an informal conversation, Matt a member of the marketing department, answered:

"The markets are extremely volatile. All of the sudden one of our competitors' products sells like crazy. And we have no idea why and did not see it coming. It's impossible to forecast!"

After learning about this conversation, George became frustrated about this fuzziness because he was unable to tell his team what to develop for what markets:

"*I can't believe it. We're entirely blind on both eyes. I really don't know what to tell my guys. We have no clue what we're supposed to develop."*

As a result, Tom from the R&D department was asked by George to initiate a workshop in which R&D staff got together with guys from the marketing department to get clarity on the market projections. Prior to the workshop the initiators were not sure whether the colleagues from the marketing department would actually participate. However, the participation rate was good and all required representatives joined the meeting. The organizers arranged the chairs in a circle in order to create a more inclusive feeling for the participants. They opened the workshop with an introductory round in which the participants were given the opportunity to express their hopes and expectations for the upcoming three hours. The formulated expectations were clear: The R&D side wanted to learn more about the developments in the markets and the respective technological requirements, while representatives from the marketing department hoped to gain insights into the technological possibilities and solutions. In order to generate a

common understanding they conducted a SWOT analysis together. Hereby, two strands of analysis, one concerning a technological solution (strength or weakness) and one concerning a specific market demand (opportunity or threat) sparked our interest.

The workshop began and the engineers directly jumped into analyzing if the applicator (an important feature of the machine) is a strength or a weakness. They emphasized that in order to be a strength, the applicator had to be reusable from previous versions of the machine because developing a new one would be costly, time consuming, and thus a weakness. Whilst a potential re-usability would certainly make it a strength due to the cost saving potentials, the engineers were uncertain about the technological feasibility of this solution due to the significant alterations of the new machine. Despite having a highly detailed and quite extensive discussion, the engineers were unable to come to an agreement. At this point, Claudia from the marketing department jumped into the analysis.

"When I raised this question in a previous discussion, the engineers were also very insecure. And that got me thinking. From my point of view this should not be a technical problem at all. Let me explain to you why….."

After hearing her line of argumentation, the engineers agreed with Claudia and decided to involve her in the further development of the technological solution.

Having clarified this technological issue, the conversation shifted towards the question of what the market really demanded: machine flexibility or speed. According to the Product Development Plan (PDP) this should have been clarified by marketing department within the scope of the market research routine. However, nobody in the room was able to answer this important question. After a moment of silence, the following discussion emerged.

Paul (R&D department): "*From our point of view the machine has to have a high degree of flexibility to ensure that our customers can produce specific solutions for their customers. We*

are technologically capable of developing such a flexible machine, but it will certainly be more expensive. How price sensitive are our customers?"

Matt (Marketing): "*We did not know to what extend flexibility was technologically possible. But it is good to hear that a high degree of flexibility would be feasible. In terms of the costs it is all about the trade-off between the additional benefits and the costs. If there is a good trade-off we are okay with higher costs. As long as it doesn't cost twice as much."*

Tom (R&D): "*If we have to watch the costs, we should re-consider whether we should really target the high-speed market. From our point of view it would make much more sense to limit the output rate at a level that is sufficient for the "normal" speed market and rather invest in an increased flexibility of the machine. That's what the customers really want."*

Matt (Marketing): "*Okay that makes sense! We will incorporate your arguments into our market analysis."*

In this situation, Tom, who is a R&D guy, begun to be actively involved in the market research routine. Thus, as illustrated by these two examples, action steps that previously clearly belonged to one or the other routine were now jointly enacted by routine participants of both routines. Actors and action steps such as for instance "*analyze markets*" and "*define requirements*" were now overlapping and the product development routine and the market research routine were actively mixed. Consequently, as stated by Tom in an interview after the workshop, he did not know any more which routine he was actually performing.

"At some point I was not sure any more whether I was still working as an engineer. I felt like I was doing marketing's job. That was weird. "

At this stage, routine participants themselves were no longer able to identify to which of the routines they were actually contributing. Hence, boundaries between the two routines became increasingly blurred. This dissolution of the boundaries made the two routines inseparable. This inseparability was further underlined by Ron who stated:

"We must be aware that we are looking into a crystal bowl to predict the future. Of course that is impossible. But at least we have started to look into this crystal bowl together and we have found some common ground! We cannot separate technological development and market research any longer."

Analysis of Narrative 1

Table 4 summarizes the evolution of the market research routine and the product development routine by illustrating the changes in actors, the underlying action patterns, and routine boundaries.

	Episode 1		**Episode 2**		**Episode 3**
Routine	Market Research	Product Development	Market Research	Product Development	Unknown
Unit of Analysis	Patterns of action		Patterns of action		Patterns of action
Who	Claudia, Matt, Kathrin	Tom, Frank, George….	Claudia, Matt, Kathrin	Tom, Frank, George….	Claudia, Frank, Matt, George
What	Analyze markets, Define requirements….	Receive requirements, Develop technological solutions……	Analyze markets, Define requirements…..	Define own requirements, scrutinize market analysis….	Analyze markets, define requirements, develop technological solution
Interrelationship	PRS (Excel Sheet) - 24 requirements - Created by marketing		PRS (Excel Sheet) - 24 requirements - Created by marketing - Scrutinized by R&D		Interrelationship between actors
Boundary	Enacted	Enacted	Enacted	Stabilized	Dissolved/ Blurred

Table 4: Summary of Narrative 1

In episode 1, both routines were initially separated by clear, functional boundaries. The respective action steps were performed by a stable set of actors and unambiguously attributable to either the market research or the product development routine. Through the usage of an excel

file (the PRS), the pre-defined interface between both routines was enacted. Therefore, the respective routine boundaries were clearly identifiable.

In the second episode, by replicating action steps from the market research routine and autonomously enacting them, the product development engineers generated input, which they should have received from the market research routine, themselves. With this mindful practice of replicating action steps, they purposefully decreased interdependencies with the market research routine, thereby stabilizing the boundaries between both routines. At this stage, the patterns of the routines paradoxically became more similar despite the actual intention of the actors to clearly differentiate both routines from each other.

In the third episode, due to the increasing need to realize complementarities, the previously existing boundaries between both routines were dissolved. This rendered using the excel sheet as pre-defined interface useless and led to an interrelationship not between routines, but rather between actors trying to achieve a common goal through interacting with each other. As a result, a new action pattern consisting of action steps that previously belonged to either the market research or the product development routine, evolved. At this stage, even the actors themselves were unable to identify which routine they were performing. Hence, the boundaries between the previously clearly distinguishable routines became increasingly blurred both on the level of action patterns and on the level of actors. Therefore, as can be seen in narrative 1, routine boundaries are not necessarily continuously stable and clearly identifiable, but also potentially change and dissolve over time. Table IV provides an overview of the findings based on our coding scheme.

Narrative 2: Dynamic Patterning

Narrative 2 describes the interdependencies between the product development and project management routines. It provides an example that illustrates how the coordination between

these routines shifted from an interface-based coordination towards a coordination of reciprocally interrelated action steps.

Episode 1:

As AB Industries had faced significant delays in the timely execution of previous development projects, the management decided to introduce a project management function to "*professionalize project management, implement best-practice methods and introduce industrial standards."* Theo, who became project manager for Next Gen, was a key actor in the enactment of the project management routine. This routine incorporated developing a detailed project schedule, monitoring the progress of the project, and reporting to the management board. At the beginning of the project, Robert, the head of project and process management, instructed Theo to generate a highly detailed project plan for Next Gen:

"The project has a clearly defined project manager, who develops a highly granular project plan aiming at 100% accuracy. Afterwards he reports the status of the project every 4 to 8 weeks to the management board."

In order to prepare this project plan, Theo initiated a meeting with the actors that he considered highly relevant:

"*I gathered the 10 most important people and said: Guys let's focus and estimate the required efforts as accurately as possible. It was a highly energetic meeting and afterwards we had to let in some fresh air because it was so intense. But afterwards we had very detailed plan. Then we added some project and market information such as the business case and finished up our project sheet."*

The project plan incorporated the necessary resources, milestones such as quality gates and a highly detailed timeline. Theo was required to present the project plan to the management board. In this meeting the necessity to strictly follow this plan, in particular in terms of the pre-defined date of delivery for the first machine, was specifically emphasized as Theo reports:

"The only relevant target for our management board is delivering the first machine in 2019. And of course I have to do everything to make this plan work. That is my top priority and I have to avoid everything threatening this goal."

The responsibility of project management for the timely delivery of the machine generated an interdependence between the project management routine and the product development routine: project management entered the milestones and the specific timeline into the product plan spreadsheet and product development entered their anticipated to do's for each of the milestones. Thus, the project plan became the interface coordinating the interrelationship between both routines.

In this early phase of the project, the development engineers adapted the prescribed timeline and the underlying principle of a highly detailed planning process. As stated by Tom, one of the development engineers:

"The R&D always looks for a 120% solution to be 100% sure. Especially in terms of planning the input for Next Gen."

The project management and product development routines both engaged in planning for Next Gen. In the project management routine, routine participants set a very detailed timeline and demanded high levels of accuracy in its execution. In the product development routine, the underlying notion of planning accurately and precisely was adapted and reflected in their own product development plans. Thus, by demanding highly detailed input from the product development routine, the project management routine pre-defined the interpretation of the planning action step in both routines. The interaction between both routines was therefore unidirectional, i.e. the planning action in the product development routine was simply reproduced in the project management routine. As a result, both routines shared a common understanding and interpretation of planning in terms of timing and accuracy.

Episode 2:

A few months into the project, the development engineers started to doubt the planning approach of project management. Bob, who was a leading voice in the R&D department, stated:

"By the end of 2019 the machine is supposed to be finalized. Counting backwards we have to do some testing, which must be done by mid-2018. That means that we would have to order the parts by January 2018. And developing a solid construction takes about 6 months. But we also need to consider the procurement times of 3 months, which only leaves us 3 months for a solid construction, instead of 6. And now it's Mid-March and we haven't even done any testing. But I guess we'll figure it out somehow."

While project management`s schedule remained unchanged, the development engineers increasingly struggled to keep up with it. Especially the fact that developing a new machine required new technological solutions made it impossible for them to propose a 100% accurate plan. Such a high level of accuracy would only be possible if the technological solutions already existed. However, since Next Gen required the development of new technologies, the engineers faced particularly high levels of uncertainty. Nonetheless, a high level of accuracy was still requested by project management. This lead to a conflict between the head of R&D and the project manager. George, the head of R&D stated:

"We work in such traditional way. Project management plans years in advance and we don't have time to think about new methods or solve technological issues. We definitely need a more modern approach to the management and planning of our projects. "

At this stage of the project, routine participants of the product development routine perceived the highly detailed planning requirements as unrealistic and even harmful, given the uncertainties and fast changing customer demands they were dealing with. As a result, the engineers began to interpret planning differently. Bob stated:

"We are not looking for 100% solutions and plans any longer. Instead the whole process must be much more individual and adaptive. I am also happy with an 80% solution, which then evolves and creates a feeling of progress and satisfaction. That's why I will just start working on solutions and solve problems on the run instead of dealing with unrealistic and static plans."

Instead of following project management's interpretation of planning as 100% accurate, the routine participants in the product development routine shifted their own interpretation of planning towards 80% accuracy. This, however, was not officially communicated in the project plan. Rather, the engineers left their initial to-do list in the project plan unchanged. Internally, however, they started working towards their own interpretation of the plan. Thus, by re-interpreting the internal planning action the engineers enabled themselves to work more flexibly internally whilst still satisfying the externally given planning requirement they had to hand over to the project management routine.

Episode 3:

In the following weeks, the pressure on the project increased significantly. When Tom attempted to invite his colleagues to workshops that dealt with new and innovative methodological approaches, he struggled to get their attention:

"*When they see me they usually say: Oh there is the time thief again. The colleagues don't even notice that our workshops take place. And they don't care because they are so heavily involved in their daily business and deadlines. They simply don't have the time to deal with issues that don't provide an immediate output!"*

In addition to having no time or flexibility for the development of new technological or methodological approaches, the project plan turned out to be severely wrong in several instances. For instance, as stated by Bob from the R&D department, important parts that were necessary for the development of Next Gen were not available as projected by the project plan:

"*It's ridiculous. They force us to follow this stupid project plan and on the other hand we don't even receive the necessary materials on time. Project management constructs these ridiculous timelines that make absolutely no sense."*

To cope with such issues the engineers strongly departed from the stringent plans prescribed by the project management routine and began to develop their own heuristics. As emphasized by George from the R&D department, they saw no other option to deal with the extremely high level of uncertainty:

"We can't make any plans, we have to trust our gut feeling. All assumptions that we make now might be wrong in 2-3 months. That's why from now on we have to work with rules of thumb!"

In response to the high level of uncertainty, the engineers again re-interpreted the accuracy of planning towards simple heuristics. Furthermore, they stopped entering their to do's in the project plan. Thereby they knowingly departed from the expectations of project management and disregarded the formal interface between both routines. As Bob from the R&D department stated, they saw no other way of dealing with the situation:

"*We were drowning in work and it took up so much additional time to fill in and update the project plan. We therefore decided to focus on our work and stopped wasting our time with project management tasks."*

At this stage the product plan as official interface between the product development routine and the project management routine was no longer intact. While this new interpretation of planning in the product development routine gave the development engineers more room and freedom, it also created tensions with the project management routine. Robert, the head of project and process management clearly disliked the "*cowboy-like behavior"* of the development engineers and demanded more rigor and accuracy:

"We need a higher level of detail in terms of how the R&D is doing their work and how they plan to stick to our schedule. That's why we need a so called detail-level in our product

development process. They will have to describe how they develop a machine, how they set-up their planning etc. I have addressed this request to their managers and now I expect results."

Robert was angry because the engineers stopped providing their detailed to-do's in the project plan. The engineers thereby ignored the project plan as official interface and refused to fill in and update the plan. At this stage, the interpretation of planning in both routines diverged substantially: whilst the engineers increasingly relied on a set of flexible heuristics, the project management guys strongly disliked this interpretation and instead requested even more accurate plans. The interface was abandoned and played no significant role in the coordination between the two interrelated routines.

In the following weeks, an alignment between participants of both routines about their interpretation of planning took place. The development engineers realized that project management strongly relied on their input and offered to informally discuss the project progress with participants of the project management routine. Initiated by Bob, the R&D guys contacted Theo from project management to propose such a more direct and informal exchange between project management and product development:

"*We know that you guys [project management] need these detailed plans to report to our management board. Of course we are willing to help you with that as long as we also have room to do some real development work that requires time and flexibility. So if you need our input for your planning, in the future you could simply ask us and must not rely on an outdated and unrealistic project plan."*

In response to this proposal from the R&D guys to initiate a closer and more informal conversation between participants from both routines, Theo from project management decided to no longer require the engineers to fill in their detailed to-do's into the project plan, but rather asked them to keep project management in the loop of their activities:

"*Of course I understand your wish to work more flexibly. As long as we somehow know what you're doing and how long it approximately takes, I am fine. But there must also be some way for us to ensure that you guys also take care of your daily business!"*

Following this conversation, participants from both routines re-adapted their interpretation of planning accuracy. The R&D guys moved from entirely flexible heuristics that disregarded any form of formal planning towards an informal and flexible exchange of planning information with project management. In response, the project management guys re-adapted their interpretation of planning accuracy from a focus on highly detailed plans towards a more flexible perception of planning. As a result an informal truce (Salvato and Rerup, 2018) was reached: engineers were given the freedom to develop novel technological solutions as long as the core project tasks were fulfilled in a timely manner. In case the project progress was significantly threatened, the engineers were expected to deliver towards the timelines of project management. Here, the focus was on the necessary results and not on the pre-defined to-do's leading towards these outcomes. The project spreadsheet was thus no longer used. Instead, the coordination between both routines was achieved by reciprocally adapting interpretations of planning accuracy. Thereby a manageable level of accuracy that allowed the coordination of both routines was created. Thus, the coordination of interrelated routines was not achieved via programmed interfaces, but through the emergence of a dynamically interrelated action pattern. Interrelation of routines hence happened on the level of reciprocally interrelated action steps, each responding to one another.

Analysis of Narrative 2

Table 5 summarizes the changing interpretations and performances of the planning action steps enacted in the product development routine and the project management routine. It shows the evolution of interrelationships between these action steps, as well as the influence of these interactions on the coordination practices among both routines.

	Episode 1		Episode 2		Episode 3	
Routine	Product Development (PD)	Project Management (PM)	PD	PM	PD	PM
Unit of Analysis	Action Steps (Planning)		Action Steps (Planning)		Action Steps (Planning)	
Who	Tom, Frank, George….	Theo, Robert	Tom, Frank, George….	Theo, Robert	Tom, Frank, George….	Theo, Robert
Performance of planning	100% accuracy	100% accuracy	80% accuracy	100 % accuracy	Adapting interpretations of planning accuracy	Adapting interpretations of planning accuracy
Interaction	Unidirectional		Unidirectional adaption		Reciprocal adaption	
Coordination	Interface		Between action steps		Dynamically interrelated action pattern	

Table 5: Summary of Narrative 2

In episode 1, the project management routine demanded highly detailed planning input from the product development routine. Since the product development routine then simply adopted these planning requirements whilst the planning practices in the project management routine remained entirely unchanged, the interaction between both action steps can be classified as unidirectional. At this stage, both interpretations of planning were in line and coordination occurred through the jointly completed project plan as interface between both routines.

As the technological challenges increased in episode 2, planning was re-interpreted in the product development routine. With a shift towards less accuracy in planning, the engineers aimed at giving themselves more flexibility to achieve the pre-defined plan from project management. The action steps were therefore uni-directionally adapted, meaning that the interpretation and enactment of planning shifted in the product development routine in order to remain aligned with the non-changing interpretation and enactment of planning in the project

management routine. The re-interpretation of accuracy enabled the engineers to decouple from the rigorous interpretation of project management whilst keeping the project plan as interface seemingly intact. At this stage, even though the project plan was still officially the interface between both routines, it was no longer sufficiently updated by the engineers. Changing interpretations thus provided flexibility in coordination whilst keeping the facade of compliance with the interface intact (DiMaggio and Powell, 1983).

In episode 3, the interpretation and enactment of planning initially diverged substantially between both routines. Within the product development routine the engineers began to rely on heuristics, which caused the project managers to strive for even higher level of accuracy in their planning. After these diverging interpretations and enactments of planning eventually clashed, an alignment process between both action steps took place. Participants in both routines re-adapted their interpretation and enactment of the planning action step until they arrived at a commonly agreed upon level of planning accuracy. This informal truce then laid the foundation for the direct and informal exchange of planning information between both routines, which caused the project plan as official interface between both routines to become almost non-relevant. Instead, the action steps became increasingly reflective of each other, resulting in a reciprocal adaption process between them. Coordination thus did not occur at the interfaces between routines, but through the emergence of a dynamically interrelated action pattern.

Discussion

Our findings have the potential to contribute to theory on routine interdependence in at least three ways: (1) We argue that routines usually do not have clearly identifiable boundaries and can thus not be easily taken for granted as unit of analysis. (2) We introduce the concept of dynamic patterning to emphasize that routine interdependence occurs at the level of action steps reciprocally responding to each other. And (3) we foreground the concept of granularity into the routine dynamics debate to account for different levels of analysis in routine studies.

Blurry Boundaries of Routines

The commonly accepted definition of routines, which also builds the foundation of our paper, as patterns of interdependent action steps carried out by multiple actors, at least implicitly implies that we can easily identify patterns within action steps that are then called routines (Feldman and Pentland, 2003). Research interested in the interdependence of routines has so far also built on this definition of routines and scholars have thus identified discrete routines in their datasets that are interrelated via interfaces or actors. However, as our findings show, the boundaries of routines are constantly changing over time, and sometimes even become unidentifiable. As we can show, patterns of interdependent actions sometimes serve multiple routines simultaneously and even actors themselves find it difficult to identify which routine they are actually contributing to. Hence, routines do not have one single, clearly identifiable boundary. This finding confirms insights from Kremser et al (2019: 3) who argue that the boundary of a routine is a matter of the perspective taken: "routine boundaries are multiple because they depend on the focus of attention and point of view of the participants performing the routine". This finding corresponds with insights from process theory (Emirbayer, 1997; Hernes, 2007; Tsoukas and Chia, 2002) and helps in better understanding that routines are not `things´ but processes as patterns of action (Feldman, 2016). Identifying routines can therefore only represent a snapshot in a specific point in time. Actions are situated in time and space and are thus constantly evolving (Suchmann, 1987). Thus, in following process thinking, what is presented as a routine pattern at one point in time, might look different at another point in time. Hence, boundaries of routines are fluctuating since they are in a constant process of enactment and re-enactment.

This raises a related, important methodological challenge for routine studies: how are we identifying routines in our data at the first place? By searching for routines and re-constructing them for our analysis, we potentially artificially construct orderliness in more fluid processes of patterning. The boxes that are commonly used to graphically represent routines with clearly

identifiable boundaries are thus not well suited to describe more fluid processes such as routines (see also (Danner-Schröder and Geiger, 2016; Feldman, 2017). Routines have blurry boundaries that are continuously morphing, taking new forms, building new connections (Feldman and Rafaeli, 2002) and leaving different traces. Routine boundaries are thus by no means stable but rather fluidly changing as the routine is performed (Kremser et al., 2019). As such, the question how routines interdepend is less easy to address as it seems in the first place. Conceptualizing routine interdependence logically implies separating distinct routines that inter-dependent. But if, as our studies have shown, the boundaries of routines are constantly changing and shifting, it is a methodological and epistemological problem to identify these interdependencies. As we argue in the next section, routine interdependence is potentially better understood as a process of dynamic pattering that takes the fluid and shifting nature of routine boundaries into account.

Routine Interdependence as Dynamic Patterning

Our findings also show that discussing routine interdependencies either as clusters (Kremser and Schreyögg, 2016) or as ecologies (Birnholtz et al., 2007; Sele and Grand, 2016; Spee et al., 2016) neglects the circumstance that interrelations happen as a form of dynamic patterning rather than at well-defined intersections that are either balanced or programmed. Analyzing routine interdependencies on the level of dynamic patterning reveals that interdependencies do not occur as programmed and stable interfaces, but action steps are reciprocally responding to each other. In our findings we could not identify a clear set of interfaces that marked the boundaries between routines and which were programmed to interact with each other. Instead, singular action steps of particular routines responded to action steps of other routines, thereby adapting to each other. This also reveals that interdependencies are not managed by mindful individual balancing acts, as the ecologies school suggests, but happen on the level of action steps, not on the level of actors (see also (Dittrich and Seidl, 2018)). Interdependence between routines is therefore clearly action-centric (Kremser et al., 2019). Instead of speaking of

interdependent routines that are either linked via interfaces or skilled practitioners, we suggest conceptualizing routine interdependence as a dynamic web of interrelated action steps. Routine interrelations thus happen as a form of dynamic patterning, a process we define as dynamically interaction of action steps. Dynamic patterning describes that routine interrelations happen on the level of action steps between routines. This makes the drawing of boundaries between routines empirically and epistemologically difficult since the interrelationship plays out between action steps that are dynamically responding to each other. This also calls for novel approach for visualizing routine interdependencies. Instead of drawing boxes that are interlinked by arrows, using actor networks or sequence maps seem to be far more appropriate to capture the dynamic nature of interdependencies (Feldman, 2017; Pentland and Feldman, 2007). Furthermore, studies of routine interdependencies need to become more sensitive to event-time (Orlikowski and Yates, 2002) in order to better capture their dynamic nature. Each representation of interrelationships represents a particular snapshot in time; capturing the dynamic and situated nature of these interrelationships would call for a time-sensitive way of representation such as flow-charts or time-grids.

Granularity in Routine Studies

Building on our findings we suggest introducing the concept of granularity (Nicolini, 2009; Schlegloff, 2000) into the routine dynamics debate. As our findings reveal, routine studies are a matter of granularity: zooming in (Nicolini, 2009) i.e. diving down into finer grained levels of observation and analysis provides different insights on routine dynamics compared to zooming-out to more coarse levels of granularity. Where one researcher distills interrelated action steps on a highly granular level of analysis, on a more coarse level of analysis another researcher might potentially re-construct distinct, interdependent routines programmed via interfaces (Kremser et al., 2019). For instance, Feldman (2000: 618) in her famous study of student housing identified ‘hiring’ as one of the central routines. As part of this routine, applicants were observed and evaluated by resident staff. From an alternative level of

granularity, one might choose to dig deeper into this evaluation process and describe this process itself as a distinct routine. This evaluation routine would then potentially consist of actions such as 'develop evaluation sheet', 'design exercises for the applicant', 'observe body language', 'observe interaction behavior', 'fill in the scores into the spreadsheet', 'compare applicants' etc. As a result, what was portrayed as a hiring routine could, from a different level of granularity, be described as a set of interrelated routines. This aspect renders the discussion around what is the routine and how do routines interdependent also as a matter of perspective taken. Moreover, it makes the comparison of routine studies with regards to stability and change difficult: the higher the degree of granularity, the more change and dynamics will be observed (Helfat and Winter, 2011). What looks static and path dependent from a macro-level, is potentially highly dynamic on a micro-level since a micro perspective would reveal movements, changes, adaptations etc. (Geiger and Schröder, 2014). Comparing insights with regards to stability and change thus requires specifying the level of granularity involved. Analysis of routine clusters is, as we would argue, situated on a different level of granularity compared to studies of ecologies of routines. Although both schools conceptualize routines as patterns of interrelated action steps, the question of what an action steps is, i.e. how it is aggregated, is a matter of granularity, both, methodologically and conceptually. Dwelling in into routine interdependence on the level of action steps as we have done in our study, reveals a different perspective on routine coordination which does not happen at the interfaces but rather between action steps. It is therefore – again – a matter of granularity. Seen this way, our insights on routine dynamics significantly depend on the level of granularity taken: retrospectively asking for routines and their interdependencies, as the cluster study has done (Kremser and Schreyögg, 2016), reveals stable boundaries and programmed interfaces since interviewees recall routines on the basis of their general relatively stable purpose. Conducting the same study with an ethnographic focus on action steps would potentially reveal a different picture of interdependencies, as Kremser and Schreyögg (2016: 716) note themselves: "We would not

have come to the same conclusions, had we conducted, for instance, a six-month participant observation." As a result, routine boundaries would be less easy to identify and become blurred, and interdependencies would be observable on the level of action steps rather than between interfaces. And the similar problem repeats itself on the level of action steps: in his sequential analysis, Pentland (2003) disentangles work processes into action steps to account for sequential variety. However, the question how granular action steps are defined is again of importance. The action step 'Letter to customer' for example (Pentland, 2003: 535) could be easily de-composed into higher levels of granularity such as: open MS Word, select appropriate template, search for name of customer, type letter, save it on drive, print it out etc…This could potentially lead to different insights with regards to the sequential variety of the observed work processes. Hence, specifying granularity seems to be important to contrast and compare insights from studies on routine dynamics.

Limitations and Future Research

We argue that analyzing routines, particularly in longitudinal data, is just a snapshot in time. This, is also the case with the analysis conducted in this paper. As a result, the observed interdependencies we have analyzed might have converted into an interface between routines at a later point in time. We thus have potentially only seen an immature stage of routine interdependence. It is possible that the coordination of routines as we have observed were the main coordination principle at a specific point in time, but later developed into a distinct interface between the routines. We show the development of the coordination process in one direction - from interfaces towards reciprocally interacting action steps - but the other way around is certainly also possible. As such, we recommend that further research should investigate these coordination processes in greater detail and over longer time horizons.

In addition we have argued that the level of granularity plays a key role in research on routine dynamics. Yet, the level of granularity taken in our study also limits our insights into routine

dynamics and coordination processes. From a different level of granularity, we might have arrived at different insights into how multiple routines are coordinated. Further research is therefore necessary to enable researchers to specify meaningful levels of granularity. This would allow for a comparability between studies on similar levels of granularity.

A related issue is how researchers identify routines and their respective boundaries in the first place. Methodologically, we relied on our observatory data, as well as the feedback of our interviewees in identifying routines based on the definition of routines as "repetitive, recognizable pattern of actions carried out by multiple actors" (Feldman and Pentland, 2003: 95). The resulting set of routines is, however, highly subjective and could have been entirely different when identified by different researchers and/or interviewees. Even though we analyzed and triangulated our data thoroughly, there is currently no debate in the scholarly community that would have guided our approach of identifying and distinguishing routines in our dataset. Such a discourse would, however, be of great value for researchers who conduct empirical studies and thus face the challenge of identifying and distinguishing (interdependent) routines.

Conclusion

Routine interdependence research commonly builds on the implicit assumption that routines have clear boundaries and can thus be easily distinguished from each other. Following this line of argumentation, the coordination of multiple routines occurs at the interfaces of the respective routines. In contrast, we have shown that routine boundaries are not always stable, but rather shift, morph, blur, and potentially even dissolve over time. As a result, the coordination between multiple interrelated routines does not necessarily occur at their potentially blurry interfaces, but coordination is achieved between dynamically, reciprocally interrelated action steps. These findings have important methodological implications. First, they emphasize the necessity to re-think the way researchers identify routines in the first place: by looking for routines, scholars

have the tendency to construct clear boundaries. Second, we suggest introducing the concept of granularity into routine studies. Hereby, we aim to add different levels of analysis which need to be taken into account when comparing routine interrelations.

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Paper III

Granularity Matters! Towards a Methodological Framework for Routine Studies

with Waldemar Kremser and Daniel Geiger

(Conditionally accepted at Organization Theory)

ABSTRACT

This paper introduces the concept of granularity into routine dynamics studies. To establish levels of granularity we develop a phenomenological perspective on action, the central category of routine dynamics studies. By conducting an extensive literature review we show that routine dynamics scholars have at least unconsciously applied diverging levels of granularity in their empirical studies. We argue that side-stepping questions of explicitly addressing granularity significantly impedes the comparability of studies since different levels of granularity bring different aspects of performing and patterning processes into focus. Following this, we develop a methodological framework that allows scholars to establish and report on the level of granularity in their study. Finally, we sketch out some implications of taking granularity seriously for writing up research on routine dynamics.

Keywords: Routine dynamics, Granularity, Methodological framework, Actions, Coordination

Introduction

Traditionally, routines were conceptualized as internally stable coordination mechanisms that enable organizations to accomplish their outcomes in an efficient and reliable way (Cyert and March, 1963; March and Simon, 1958; Nelson and Winter, 1982). This perception of routines as stable, even mindless, was challenged by the emergence of the routine dynamics perspective. Pioneered by Feldman (2000), routines are now conceptualized as generative patterns with internal dynamics that can bring about both stability and change in organizations (Danner-Schröder and Geiger, 2016; Dionysiou and Tsoukas, 2013; Feldman, 2000; Feldman and Pentland, 2003; Feldman et al., 2016; Pentland and Feldman, 2008; Pentland et al., 2012; Pentland et al., 2010; Pentland et al., 2011; Rerup and Feldman, 2011).

The processes of performing and patterning are at the core of routine dynamics research (Feldman, 2016; Feldman et al., 2016; Goh and Pentland, 2019). Following the notion of performing, routines entail situated actions (Feldman et al., 2016) that are enacted by "specific people, in specific places and times" (Feldman and Pentland, 2003: 101). The notion of patterning focusses our analysis on how these actions are fit together to a dynamic and generative pattern of actions - or in other words: a routine (Feldman, 2016; Goh and Pentland, 2019; Turner and Rindova, 2018). Situated actions are thus the central units of observation in routine dynamics studies, whilst the performing and patterning processes constitute their analytical focus.

Importantly, one action is not an ex-ante defined, quasi-natural and self-evident unit of observation (Schütz, 1967; Vallacher and Wegner, 1987). Defining actions as units of observation in routine dynamics studies therefore confronts researchers with the challenge to (re)construct distinct actions out of a continuous stream of observations (Folger et al., 1984). As such, actions can be broken down into arbitrarily fine-grained detail (Abell, 1987). Consequently, it is the researchers who establish where an action starts and where it ends. To

do so one must answer (implicitly or explicitly) questions regarding the granularity of actions (Pentland, 2003). The level of granularity routine scholars establish for their primary units of observation, actions, has important implications for the level of granularity at which they will construct their unit of analysis, i.e. routines as patterns of action. In other words, if actions are observed on a fine-grained level of granularity, the corresponding routine will automatically be identified and analyzed on a finer-grained level of granularity as well. Vice, versa, operating on a coarse-grained level of granularity will cause researchers to observe and analyze rather more coarse-grained action patterns. This is a central concern for routine scholars because conceptual arguments and empirical observations suggest that the underlying performing and patterning processes might be very different on different levels of granularity (Kremser and Schreyögg, 2016). Despite its relevance for routine dynamics, the question of granularity is often side-stepped.

In this paper, we put granularity front and center. First, we develop an understanding of the granularity of action, the central unit of observation in routine dynamics research. Second, we analyze existing empirical studies in routine dynamics with regards to the levels of granularity that have been taken in these studies. This review reveals that routines are often operationalized on very different levels of analysis, a problem that is not reflected in the debate. In a next step we outline the problems of ignoring granularity for routine dynamics studies. In the last part of the paper we develop some heuristics that should help researchers interested in studying actions as their unit of observation to identify and operationalize actions and thus routines on appropriate levels of granularity. Finally, we provide some suggestions how granularity should be reflected and reported in empirical papers.

Routine dynamics and the granularity of actions

Routine dynamics studies take a processual view at the patterning and performing of actions that accomplish organizational work (Feldman, 2016). Patterning refers us to how “participants

engage in and reflect on action sequences, and share information and understanding through connections with other routine participants" (Turner and Rindova, 2018: 1253). Through patterning processes, actions are made to "fit together to form joint action" (Dionysiou and Tsoukas, 2013: 186). This puts our analytical focus on the ongoing coordinating work necessary to perform a routine as a dynamic and generative pattern of actions (Bechky and Chung, 2018; Faraj and Xiao, 2006; Jarzabkowski et al., 2012). Performing, on the other hand, focusses our analytical attention on the issues that promote and inhibit specific, situated actions. "The idea that routines entail situated actions is a deep and important point, crucial for everything that follows" (Feldman et al., 2016: 506). Taking situated action as the unit of observation in routine dynamics, implies an understanding of routines as "effortful accomplishments" (Pentland and Rueter, 1994: 488) and focusses the analysis on the specific socio-material context in which a given routine performance is embedded (Bertels and Howard-Grenville, 2016; Howard-Grenville, 2005).

The analytical focus on the performing and the patterning of routines establishes specific, situated actions as the central unit of observation in studies of routine dynamics. Nevertheless, the question of what should count as *one* specific action is usually side-stepped in the literature (Kremser et al., 2019). Taking the definition of the performative aspect of routines as "specific actions, by specific people, in specific places and times" (Feldman and Pentland, 2003: 101) we can already deduce three dimensions of an action - actor, place/context, and duration - that will play an important role in this regard. This definition does not, however, clearly establish the number of people, the variety of places/contexts or the duration of one action that is considered as being specific enough in empirical research on routine dynamics. Is it appropriate to work with actions taken by individual actors in one specific place/context within a few seconds or minutes as the unit of observation in routine dynamics research? Or is it appropriate to take complex actions that rely on the joint effort of a large group of actors who are dispersed

in different places/contexts and might need months or years to be accomplished? Or both? Or neither? In this paper, we subsume these and related questions under the notion of granularity.

Referring back to the performative aspect of routines, *we understand the granularity of an action as being defined by the number of actors, the variety of places/contexts, and the amount of time it takes to successfully accomplish that action*. From this definition it is apparent that there will be an almost endless space of possible levels of granularity in the realm of actions. One actor might take an action - like writing a paper - that takes place in a variety of contexts - e.g. in the office, in the plane, at home, etc. - and takes weeks, even months to be accomplished successfully. Or a large group of actors could take an action - like applauding - at one specific place - e.g. in the auditorium of a theater - which only takes a few seconds, maybe one minute to be accomplished successfully. Importantly, these differences can even be observed when we talk about the same task. Analyzing a problem, for example, can be done by an individual person at one place in a rather short amount of time, or over the course of multiple months, by hundreds of people who are distributed over multiple locations (see also (Campbell, 1988; Haerem et al., 2015; Wood, 1986). To condense this large possibility space into a few categories that are empirically useful and analytically fruitful for research on routine dynamics, we suggest taking the processes of performing and patterning - which are the analytical focus of most research on routine dynamics - into account (see Feldman (2016)).

A phenomenological perspective on granularity

The analytical focus on *performing* can be used to establish *fine-grained* actions in research on routines. It is established that routine dynamics is less interested in exploring the sub-conscious basis of human behavior, but is rather interested in understanding the contextual conditions that are reflected upon as actors perform routines (e.g. Howard-Grenville (2005)). Hence, the most fine-grained action that is of analytical relevance for routine scholars will be an action that is taken by one actor in one place, at one, rather short, moment in time.

To further specify this fine-grained level of granularity, we turn to the phenomenological work of Alfred Schütz (1967). In his oeuvre, Schütz is concerned with understanding what drives and inhibits the (social) actions of a *specific* person. He established the unity of action by linking it to Husserl's concept of projection understood as "a fantasizing of action, that is, […] an intuitive advance picturing which may or may not include belief" (Schütz, 1967: 59). Importantly, this implies that the individual action as a unit of observation is not and cannot be fixed once and for all. Instead, Schütz (1967: 62) emphasizes that "the unity of the act is a function of the span or breadth of the projection."

The span of the projection of an action, of course, will be different for different actors, contexts and times. The span of the projection of an action will usually also change as a function of experience. When the operational task is unfamiliar, difficult, or complex, the projections of actors will usually not reach very far into that actor's extended present (Vallacher and Wegner, 1987). When beginning to learn a new task an actor will have to concentrate separately on each of the specific doings and saying that are involved. However, when executing the operational task over a longer period of time, the projection of each action usually becomes larger. That is, what an actor perceives as one "functional unit" (Pentland and Feldman, 2007) in her behavior which will be changing as a task is being accomplished repeatedly.

Taking the example of a couple dance, it seems natural to assume that the span of the projection of one action will be different when two professionals dance with each other, or when two beginners dance with each other. The professional dancers will most likely have most of the bodily micro-movements and step-sequences already internalized so that they can project much more complex actions - like, for example, a specific dance figure - into their extended present. The beginners, however, will be very much concerned with focusing on how to move a specific foot in a specific place without hurting their dance partner too much. As our beginner couple attends several dance lessons, they first learn the standard sequence of steps. With the passing

of time and dance lessons, however, they will learn different figures - complex combinations and variations of these standard sequences. Over time and with exercise, also for the beginners these figures - not each one of the bodily micro-movements - become the actions that make up the pattern of their dance routine. Hence, as the span of the projection of actions changes over time, so does the pattern of the routine as a whole. Hence, by building on Schütz (1967) we can comprehensively define actions on a fine-grained level of granularity as those actions that an individual actor can accomplish "without further ado" (Schatzki, 2008: 122).

Turning to the analytical focus on *patterning* in research on routine dynamics helps us to establish a medium- and a coarse-grained level of granularity. Patterning focuses our analytical attention to the coordinating work inherent in the ongoing accomplishment of the pattern of the routine (Feldman et al., 2016). Changing the granularity of ones observations from individual to more collective forms of action constitutes an analytically significant difference when it comes to understanding such patterning processes. Hence, we suggest to establish those actions that cannot be accomplished by an individual actor alone, but rather require the collaboration of multiple actors as the threshold for the next - medium-grained - level of granularity. In routine dynamics studies that analyze patterns which consist of collective rather than individual actions, a significant amount of the patterning work inherent in the accomplishment of these patterns will not be captured by the analytical scope of this study. If, for example, an analysis of patterning processes starts with the collective actions of whole teams (e.g. the marketing group and the pricing team in Zbaracki and Bergen (2010)), and analyzes how their *collective* actions (e.g. 'doing a competitive analysis' or 'setting a list price') are fitted into a (larger) pattern, they, by implication, will not focus on the patterning work that was going on between individual team members to accomplish these collective actions in the first place.

Along the same line of argumentation one can also define an analytically useful threshold in distinguishing medium-grained from more coarse-grained levels of granularity. More

specifically, we build on the distinction between coordination by programming and coordination by feedback as the two primary coordination modes used in organizations (March and Simon, 1958). Coordination by feedback refers us to an ad-hoc mode of coordinating that relies on real-time information about the present state of certain other work units (Thompson, 1967). Coordination by programming, on the other hand, is an impersonal coordination mode that refers us to "such integrating mechanisms as the use of pre-established plans, schedules, forecasts, formalized rules, policies and procedures, and standardized information and communication systems" (Van de Ven et al., 1976: 323). A long history of coordination research has illustrated that these two modes of coordination present actors with different challenges while at the same time also providing them with very different opportunities (Okhuysen and Bechky, 2009). Consequently, we define those collective actions which only rely on ad-hoc coordination as being on a different (medium-grained) level of granularity than those collective actions that can only be accomplished through the use of a mix of ad-hoc and programmed coordination (coarse-grained level of granularity).

Summing up, we have taken the processes of performing and patterning as a stepping stone to establish fine, medium, and coarse-grained levels of granularity as empirically useful and analytically fruitful differences in research on routine dynamics. As a unit of observation, one action can be considered to be at a fine-grained level of granularity, if this action can be performed by a specific actor without further ado. The threshold to a medium-grained level of granularity is crossed if an action requires contributions from a group of actors relying on ad-hoc modes of coordination (by feedback). Finally, the threshold to a coarse-grained level of granularity is crossed if an action not only requires contributions from a group of actors, but also requires this group to make use of a mix of ad-hoc and programmed modes of coordination. In what follows, we will apply these three levels of granularity to an authoritative sample of empirical studies in order to get a better understanding of the levels of granularity presently applied in routine dynamics research.

Action(s) in empirical research on routine dynamics: A systematic review of the literature

Recapitulating how researchers operationalized action(s) in previous studies on routine dynamics provides an excellent opportunity to distill what scholars in this particular field of research presently understand as *one* action. By conducting a literature analysis of the most cited empirical studies in the field of routine dynamics, we aim to distill how action(s) have been operationalized in routine dynamics studies and discuss the consequences of these diverging operationalizations. The methodological approach and the major findings of this review are provided in the following sections.

Sample

For our literature review we basically followed the sampling strategy taken in the first authoritative literature review on routine dynamics published by Parmigiani and Howard-Grenville (2011). First, we included all those studies in our sample that Parmigiani and Howard-Grenville (2011) also included in their overview of empirical studies that follow the practice-based view on routines. This resulted in a total of eight studies for the timespan 2000-2011. For the remaining years until our cut-off date (20.2.2019), we included the nine journals identified by Parmigiani and Howard-Grenville (2011) as key outlets for routine dynamics studies. These include five top management journals (*Academy of Management Journal, Administrative Science Quarterly, Management Science, Organization Science, and Strategic Management Journal*), as well as four specialty journals that have a track record of publishing empirical work on routine dynamics (*Industrial and Corporate Change*, *Journal of Management Studies, Organization Studies, and Strategic Organization*). Within these journals, we used "routin*" as search term in the search function of the respective journal. To reduce the vast number of results and keep our specific focus on routine dynamics, we excluded all papers from our sample that did not rely on routine dynamics literature. In addition, we excluded all simulation-based and conceptual papers since we were primarily interested in the empirical operationalization of

action in routine studies. This left us with a total of 34 additional studies that we added to our sample for the timeframe 2011-2019. Overall, this resulted in a final sample of 42 empirical studies on routine dynamics.

In order to capture and be mindful of the breadth of the emerging debate on routine dynamics and get a grasp of its major areas of discussion, we clustered these 42 papers into four distinct themes which we borrowed from Feldman et al.'s (2016) introduction to the Organization Science special issue on routine dynamics. Following Feldman et al. (2016), four key topics are central in the routine dynamics debate: (1) How do routines interact? (2) How do routines inhibit and promote creativity or novelty? (3) How do routines emerge and change? (4) How do routines help organizations maintain both pattern and variety? We allocated each of the 42 papers to one of the respective categories and thereby generated a focused overview of empirical research on routine dynamics.

In a next step, we narrowed down the number of papers that we included in our analysis to allow us to conduct an in-depth analysis at the necessary level of detail. We identified the most influential papers in our sample by ranking them based on the number of citations on Google Scholar (Status: 20.02.2019) and selected the five most cited papers for each of the above categories. This resulted in a final sample of 20 empirical studies which we included in our in-depth analysis (see table 1).

Paper	Citations
How do routines interact?	
Kremser and Schreyögg (2016)	40
Spee et al. (2016)	33
Deken et al. (2016)	29
Sele and Grand (2016)	21
Nigam et al. (2016)	14
How do routines inhibit and promote creativity or novelty?	
Rerup and Feldman (2011)	442
Zbaracki and Bergen (2010)	163
D'Adderio (2003)	136
Labatut et al. (2012)	104
Obstfeld (2012)	88
How do routines emerge and change?	
Feldman (2000)	1997
Reynaud (2005)	125
Lazaric and Denis (2005)	96
Bapuji et al. (2012)	75
Dittrich et al. (2016)	37
How do routines help organizations maintain both pattern and variety?	
Howard-Grenville (2005)	497
Feldman (2003)	472
Turner and Rindova (2012)	175
Brown and Lewis (2011)	169
Pentland et al. (2011)	148

Table 1: Sample

Analysis

We distilled how researchers operationalized action(s) in the 20 representative empirical studies in the field of routine dynamics. Our aim was to show how the respective scholars (implicitly) answered the question what counts as *one* action. In order to systematically analyze and compare these operationalizations, we classified each action in terms of its granularity, i.e. the number of actors, the variety of places/contexts, and the amount of time it takes to successfully

accomplish that action. As a result, we were able to illuminate to what extend routine scholars interpret and apply the action concept differently and/or similarly. In the following, we describe the systematic analytical process that allowed us to identify the actions mentioned in these papers and allocate the respective action(s) and routine(s) to the three levels of granularity (fine-grained, medium-grained, coarse-grained) that we developed in the previous chapter.

Identification of actions and routines

We used a systematic approach to identifying actions and routines. As a first step, we identified those chapters of the papers that - across all studies - contained descriptions of actions and routines. In doing so, we noticed that some author(s) explicitly stated which actions they identified as part of the routines they were studying in their methods section, whilst other papers required a close study of the findings in order to identify action(s) from the description of the routines that were provided by the author(s). Hence, by concentrating on the methods and the findings section, we were able to thoroughly yet efficiently extract the necessary data for our analysis.

Within the methods and findings sections, we searched the text for the term "routin" to identify all routines mentioned in the study. All identified routines can be found in table 2. In the rare case that the name of the routine was not made explicit (as the name of the routine) in the text, we added a "?" to the name. Further, whenever we identified a sub-routine, the name of the sub-routine is put in parenthesis in table 2. In the next step, we aimed at identifying the constitutive actions for each routine by searching for stem of the main part of the routine name (e.g. "mov" for moving-in routine) and noting all actions that were identified as part of the routine in the surrounding text. In doing so, we first read all the text that described the pattern of the routine, focusing on understanding the cut-off points between the actions as they were implied in the text (e.g. through punctuation and through looking for re-action sequences, where a reaction was taken as the cut-off point to a previous action). In some instances, authors

described changes in the pattern of the respective routine(s) (e.g. before/after versions). Whenever that was the case, we used the version that was the focal point of the analysis (i.e. the explained pattern). Further, researchers often used tables to provide more details on the routines they were studying. Whenever that was the case, we focused our analysis on the actions provided within these detailed tables. Based on this set of rules, we were able to generate a coherent overview of all relevant actions and routines in our sample (see table 2).

Determining and comparing levels of granularity

Having identified all relevant actions, we next aimed to distill the necessary information to determine the level of granularity for every action in our sample. We hence continued our analysis by teasing out for each action the number of actors that are performing it, the variety of places/contexts in which it takes place, and the amount of time it takes to accomplish this particular action. For the first category, we analyzed who, according to the author(s), enacted a particular action. For the second category, we listed where, according to the respective author(s), a particular action was enacted. And finally, for the third category, we aimed to extract from the papers how long it takes to enact this action. However, as information on the duration of specific actions was lacking in almost all cases, we looked for additional information in the description of the routine that would allow us to understand how long one complete routine performance would take by searching for the keywords “second”, “minute”, “hour”, “day”, “week”, “month”, and “year”.

In the next step of our analysis, we classified each action into one of the three levels of granularity that we developed in the previous chapter. In some cases we could not find sufficient information to classify the level of granularity for particular actions, for instance when the actions per routine were not reported. In those cases we used the label ‘unclear’ in our tables. As a result, we were able to identify the level of granularity (fine-grained, medium-grained,

coarse-grained, or unclear) for each and every action the authors of the twenty papers have studied.

Having classified the actions in terms of their granularity, we summarized these classifications for each routine (see table 2). With this final step of our analysis, we aimed at generating the basis for a meaningful comparison of the studies in our sample. This final step once again required us to develop a set of systematic rules, in particular when the granularity ratings of certain actions in a specific routine where not entirely clear. If that was the case, we applied the following three rules in creating table 2: (1) Whenever the granularity rating of a specific action was unclear, we assigned the level of granularity that most other actions of this routine had to this specific action - and marked the overall rating of the overall routine with a "~", (2) If the granularity rating was unclear for all actions of one routine (e.g. because of unclear information regarding involved actors), we rated the whole routine as "unclear", (3) In case of divergent ratings of the specific actions within one routine, we took the modal value and marked the rating of the whole routine with a "~". With this final step, we managed to subsume the granularity levels of all actions to an aggregated granularity level for every routine in our sample. This enabled us to systematically compare the respective studies based on the level of granularity they employ on the level of actions as well as whole routines. In the following section, we present and discuss the results of this analysis.

Study	Routine	Granularity
Dittrich et al. (2016)	Shipping routine (plates)	Fine
	Shipping routine (tissues)	Fine
Pentland et al. (2011)	Data entry routine	Fine
	Approval routine	Fine
Kremser and Schreyögg (2016)	Sorting routine	Fine
	Splicing routine	Fine
	Film development routine	Fine
	Printing and paper development routine	Fine
	Cutting and packaging routine	Fine
	Pricing and shipping routine	Fine
	Quality control routine	Fine
Bapuji et al. (2012)	Towel changing routine	Fine
Reynaud (2005)	Task selection routine	Fine
Brown and Lewis (2011)	Time-keeping and billing routine	~Fine
Spee et al. (2016)	Deal appraisal routine	Fine
	Broking routine (intersecting)	Unclear
	Modeling routine (intersecting)	Unclear
	Client meeting routine (intersecting)	Unclear
	Business planning routine (intersecting)	Unclear
D'Adderio (2003)	Design workflow process routine (?)	~Fine
	Prototype verification routine (?)	Unclear
	Vehicle configuration extraction routine (?)	Unclear
Zbaracki and Bergen (2010)	Negotiate list price routine(?)	~Fine
	Set List Price routine (?)	~Medium
Deken et al. (2016)	Partner selection routine	~Fine
	Joint specification routine	Unclear
	Quality function deployment routine	Unclear
	Tree routine	Medium
	Toll gate routine (definition phase)	Medium
Feldman (2000)	Hiring routine	~Medium
	Moving-in routine	~Medium
	Closing routine (damage assessment part)	Medium
	Training residence staff routine	Medium
Turner and Rindova (2012)	Solid waste collection routine	Medium
Rerup and Feldman (2011)	Recruiting routine	~Medium
	Recruiting routine (Contracting subroutine)	Medium
	Recruiting routine (Welcoming subroutine)	Medium
Feldman (2003)	Budgeting routine (before change)	Medium
Obstfeld (2012)	Prototypes parts purchasing routine	~Medium
Labatut et al. (2012)	Breeding routine	Medium
Howard-Grenville (2005)	Roadmapping routine	~Coarse
Lazaric and Denis (2005)	Quality control routine	Coarse
	Boning line routine	Unclear

Study	Routine	Granularity
Nigam et al. (2016)	Allocating surgical blocks routine	Unclear
	Scheduling surgical blocks routine	Unclear
	Booking surgical cases routine	Unclear
	Treating urgent or emergency surgical cases routine	Unclear
	Treating urgent surgical cases during regularly scheduled hours routine	Unclear
Sele and Grand (2016)	Searching for analogies routines	Unclear
	Identifying research puzzle routine	Unclear
	Building robots routine	Unclear
	Buying material routine	Unclear
	Testing functionalities routine	Unclear
	Presenting work in progress routine	Unclear
	Writing abstracts, papers routine	Unclear
	Producing posters routine	Unclear
	Reviewing other's work routine	Unclear
	Attending conferences routine	Unclear
	Drinking beer routine	Unclear
	Hosting guests routine	Unclear
	Lab retreating routine	Unclear
	Working out routine	Unclear
	Celebrating success routine	Unclear
	Lecturing routine	Unclear
	Preparing lecture routine	Unclear
	Teaching assistance routine	Unclear
	Examining students routine	Unclear
	Supervising master thesis routine	Unclear
	Writing proposals routine	Unclear
	Developing new projects routine	Unclear
	Coordinating work packages routine	Unclear
	Writing business plan routine	Unclear
	Reporting results to funding bodies routine	Unclear
	Featuring lab in the media routine	Unclear
	Providing lab tours routine	Unclear
	Representing lab in public routine	Unclear
	Give public talks routine	Unclear
	Brown bagging routine	Unclear
Total	**18 routines**	**(~)Fine**
	14 routines	**(~)Medium**
	2 routines	**(~)Coarse**
	44 routines	**Unclear**

Table 2: Level of granularity per routine

Different levels of granularity in empirical studies on routines

As it becomes immediately obvious in table 2, the level of granularity of the observed routines varies significantly across the 20 papers that we have analyzed. Out of a total of 78 analyzed routines, 18 routines are operationalized on a fine-grained level of granularity, 14 routines on a medium-grained level of granularity, two routines on a coarse-grained level of granularity and 44 routines were unclear with regards to their level of granularity. In the following we describe some of the findings of our analysis in more detail to exemplify the differences and variations across studies. Table 3 zooms in into our table 2 for the examples described below in order to showcase exemplary details from our findings.

Fine-grained = Total of 18 routines (2 examples in the following)							
Author	**Routine**	**Actions**	**Actor(s)**	**Places/ contexts**	**Duration**	**Granularity (action)**	**Granularity (routine)**
Dittrich et al. (2016)	Shipping routine	The sales agent or CEO assigns an order number and fills in the order process router	Sales agent or CEO	Unclear	More than 100 performances in over 12 months	Fine	Fine
		Sales Agent or CEO asks employee x to prepare the shipment	Sales agent or CEO	Unclear	More than 100 performances in over 12 months	Fine	
		Employee X looks for suitable box and puts contents of shippment in it	Employee X	Unclear	More than 100 performances in over 12 months	Fine	
		The export manager chooses the appropriate shipping provider depending on the type of shipment and destination	Export manager	Unclear	More than 100 performances in over 12 months	Fine	
		Employee X closes and seals the box	Employee X	Unclear	More than 100 performances in over 12 months	Fine	
		Employee X attaches the shipping documents to the box	Employee X	Unclear	More than 100 performances in over 12 months	Fine	
		Employee X hands over the box to the shipping provider	Employee X	Unclear	More than 100 performances in over 12 months	Fine	
		Employee X handles customer complaints.	Employee X	Unclear	More than 100 performances in over 12 months	Fine	

Author	Routine	Actions	Actor(s)	Places/ contexts	Duration	Granularity (action)	Granularity (routine)
Spee et al. (2016)	Deal appraisal routine	Scanning cover mail	Underwriter	Desk in open plan office	Underwriter typically appraises 400 deals a year	Fine	Fine
		Repopulating rating sheet	Underwriter	Desk in open plan office	Underwriter typically appraises 400 deals a year	Fine	
		Providing modeling instructions	Underwriter	Desk in open plan office	Underwriter typically appraises 400 deals a year	Fine	
		Transmitting modelable raw data	Underwriter	Desk in open plan office	Underwriter typically appraises 400 deals a year	Fine	
		Reviewing analyst comments	Underwriter	Desk in open plan office	Underwriter typically appraises 400 deals a year	Fine	
		Capturing modeled outputs	Underwriter	Desk in open plan office	Underwriter typically appraises 400 deals a year	Fine	
		Customizing model outputs	Underwriter	Desk in open plan office	Underwriter typically appraises 400 deals a year	Fine	
		Calculating a technical rate	Underwriter	Desk in open plan office	Underwriter typically appraises 400 deals a year	Fine	
		Applying deal specific "loadings"	Underwriter	Desk in open plan office	Underwriter typically appraises 400 deals a year	Fine	
		Calculating a weighted technical rate	Underwriter	Desk in open plan office	Underwriter typically appraises 400 deals a year	Fine	
		Adjusting for capital scarcity	Underwriter	Desk in open plan office	Underwriter typically appraises 400 deals a year	Fine	
		Accommodating market conditions and profitability	Underwriter	Desk in open plan office	Underwriter typically appraises 400 deals a year	Fine	
		Hand over market rate to Broker	Underwriter	Desk in open plan office	Underwriter typically appraises 400 deals a year	Fine	

Medium-grained = Total of 14 routines (2 examples in the following)							
Author	**Routine**	**Actions**	**Actor(s)**	**Places/ contexts**	**Duration**	**Granularity (action)**	**Granularity (routine)**
Turner and Rindova (2012)	Solid Waste Collection routine (in 6 organizations)	Employees arrive at the organizational facility	Individual Employees	Organizational facility	One working day (800-900 households on each route)	Fine	Medium
		Formal or informal organizing meetings are held	Managers, supervisors, and/or directors, field employees	Organizational facility	One working day (800-900 households on each route)	Medium	
		Crews of field employees drive by each customer residence and empty the waste containers prepared by the customers	Crews of 1-5 people	Route locations	One working day (800-900 households on each route)	Medium	
		Crews return to organizational facility	Crews of 1-5 people	Organizational facility	One working day (800-900 households on each route)	Medium	
Deken et al. (2016)	Tree routine	Analyzing which functions" they would have to deliver as part of the program	Small group of marketing and sales managers	Meeting room	During one meeting (performed weekly)	Medium	Medium
		Discuss which data has to be collected from the vehicle to realize their cost-saving goals	Small group of marketing and sales managers	Meeting room	During one meeting (performed weekly)	Medium	
		Discuss through which [technical] methods they could collect these data	Small group of marketing and sales managers	Meeting room	During one meeting (performed weekly)	Medium	

Coarse-grained = Total of 2 routines (2 examples in the following)							
Author	**Routine**	**Actions**	**Actor(s)**	**Places/ contexts**	**Duration**	**Granularity (action)**	**Granularity (routine)**
Howard-Grenville (2005)	Roadmapping routine (Generic)	Assess future needs by process step and manufacturing generation	Roadmap owner, preferably also owners of related roadmaps	Unclear	at least 2 years from step 1 (assessment) to execution of roadmap (step 6)	Medium	~Coarse
		Establish goals	Tech Manager and Materials Manager	Unclear	at least 2 years from step 1 (assessment) to execution of roadmap (step 6)	Medium	
		Make decisions consistent with goals	Strategic Planning Council (SPC) member and multiple work groups	Unclear	at least 2 years from step 1 (assessment) to execution of roadmap (step 6)	~ Coarse	
		Ratify decisions	SPC Members	SPC meeting	at least 2 years from step 1 (assessment) to execution of roadmap (step 6)	Medium	
		Publish and communicate new roadmap	SPC members, groups who need to implement roadmap	Unclear	at least 2 years from step 1 (assessment) to execution of roadmap (step 6)	Coarse	
		Execute roadmap,	Engineers	Unclear	at least 2 years from step 1 (assessment) to execution of roadmap (step 6)	Coarse	
		Challenge roadmap if necessary	"The whole virtual factory"	Unclear	at least 2 years from step 1 (assessment) to execution of roadmap (step 6)	Coarse	

Author	Routine	Actions	Actor(s)	Places/ contexts	Duration	Granularity (action)	Granularity (routine)
Lazaric and Denis (2005)	Quality control routine	Preliminary analysis	Production department	Unclear	Unclear	~Coarse	Coarse
		Second level analysis	Internal laboratory	Unclear	Unclear	~Coarse	
		Compilation of statistics and data interpretation	Internal laboratory	Unclear	Unclear	~Coarse	
		Production control	Maintenance department and production department	Unclear	Unclear	Coarse	
		Tool maintenance and preventive maintenance	Maintenance department	Unclear	Unclear	~Coarse	
		Adjustment of quality procedures	Quality department	Unclear	Unclear	~Coarse	
		Update of quality procedures	Quality department	Unclear	Unclear	~Coarse	
Unclear = Total of 44 routines (2 examples in the following)							
Sele and Grand (2016)	30 different routines	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear
Nigam et al. (2016)	6 different routines	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear

Table 3: Level of granularity per action and routine

On a fine-grained level of granularity, the respective authors consistently focus on actions taken by specific, individual actors, in one specific location place within seconds or minutes. Dittrich et al. (2016), for instance, study the role of reflective talk in routine change by investigating the performance of the shipping routine of a pharmaceutical start-up. In their description of the shipping routine, the authors offer fine-grained insights into the actions that constitute the routine. They, for instance, distill the action 'receive customer order' (Dittrich et al., 2016: 682) which is enacted by "the sales agent or the CEO" (a single actor) more than 100 times in 12 months within the same location (presumably since the authors do not explicitly mention the

location). Similarly the action ‘employee X closes and seals the box (Dittrich et al., 2016: 682) also provides a fine-grained description of the action ‘sealing a box’. Together with six other actions, observed at a comparable level of granularity, these actions constitute the pattern of actions that the authors describe as the shipping routine (for plates). Quite similarly, Spee et al. (2016) employ a fine-grained level of granularity in their study of the deal appraisal routine. The scholars explore the interactions of the deal appraisal routine with four intersecting routines to illuminate how standardization and flexibility are balanced throughout these interactions. They describe the 13 actions that constitute the deal appraisal routine on a fine-grained level of observation. According to the scholars, the action ‘scanning cover mail’ (Spee et al., 2016: 765) is, for instance, enacted “400 times a year” (specific time) by “the underwriter” (a single actor) at “his desk” (a specific place) (Spee et al., 2016: 765). The authors consistently employ this fine-grained level of granularity for all 13 actions that constitute the deal appraisal routine.

Studies that operationalize actions and thus also routines on a fine-grained level of granularity are very different from studies that operationalize actions and thus routines on a coarse-grained level of granularity: Howard-Grenville’s (2005) study of a roadmapping routine in a high tech manufacturing firm, which is at the core of the organization’s strategic planning processes, for example, operationalizes actions quite differently. The action ‘execute roadmap’ (Howard-Grenville, 2005: 624), for instance, is enacted collectively by all engineers (multiple actors), who are based within the entire organization (dispersed place). Here, we can assume that the enactment of the action ‘execute roadmap’ takes a long period of time (likely months to a year) since executing the entire roadmapping routine takes more than 2 years. The large amount of people and the long period of time required to complete this action makes it very likely that the actors had to make use of planning to coordinate their contributions to the action ‘execute roadmap’. As this is the case for the majority of the seven actions that constitute the roadmapping routine, we classified the entire routine as coarse-grained. Quite similarly, Lazaric and Denis (2005) employ a coarse-grained level of granularity in their study of the quality

control routine in a meat-processing firm. According to the authors, the action ‘production control’ (Lazaric and Denis, 2005: 881), for instance, is enacted by the maintenance department and the production department (multiple actors and multiple places). Here, due the large amount of people from different functions, the actors could most likely not rely on ad-hoc coordination and rather depended on sufficient planning to enact ‘production control’ (Lazaric and Denis, 2005: 881). This was the case for all seven actions that constitute the quality control routine, which is why we classified the entire routine as coarse-grained. Comparing the studies on a fine-grained and coarse-grained level immediately reveals that it makes a huge difference for our understanding of routines if we talk about actions that are performed by one actor at a specific place within seconds or minutes or if we study actions that are performed by a large number of very different actors in different departments of an entire organization and which even take months to years to be enacted.

Quite alike, also studies that operationalize actions and thus routines on a medium-grained level of granularity differ from the previous ones. Turner and Rindova (2012), for instance, analyze the solid waste collection routine in six organizations to illuminate how organizations pursue consistency in routine functioning in the face of ongoing change. Here, the authors for example study the action ‘crews return to organizational facility’(Turner and Rindova, 2012: 29). This action was enacted by a small group of people (multiple actors) and - due to the fact that the performance of the entire routine took one working day - it most likely took the team minutes to hours (duration of action) to return to the facility (location/context) (Turner and Rindova, 2012: 29). Being a rather small group that interacted on a daily basis, actors could very likely rely on an ad-hoc mode of coordination. As a result, this action was classified as being of medium granularity. Quite similarly, Deken et al. (2016) employ a medium granularity in their operationalization of the tree routine. In their study, the scholars investigate how actors accomplish the performances of interdependent routines (the tree routine and four other routines) that are directed at generating novel outcomes. As part of the tree routine the authors

identify four actions - such as, for instance, ‘identifying goals’ (Deken et al., 2016: 666) - that were all enacted by a small group of marketing and sales managers (multiple actors) during a weekly meeting that most likely lasted one to a few hour(s) (duration of action). As the meeting was held in a meeting room (location) and took no longer than a few hours, the actors were very likely able to rely on ad-hoc coordination. Correspondingly, we classified the routine as being of medium granularity. Again, as these examples show, such a medium granularity is very different from coarse-grained or fine-grained routines, especially when we try to understand the underlying processes of performing and patterning. These will look very different if actions are carried out in a day, or in minutes or in years. And they will be different if they involve only a small group of actors that are all in the same room or location or if they have to coordinate the efforts of a large number of people over departmental boundaries or large geographical distances.

In addition to revealing the significant difference across the different routines studied, our analysis also shows that we were unable to specify the level of granularity for 44 routines in our sample. For example, Sele and Grand (2016) studied the interdependence of 30 routines in a renowned research laboratory. Whilst the authors most certainly identified actions as part of the routines they studied, they do not report these actions in their paper. This, of course, might be owed to the fact that it would take up a lot of space to do that for each action in each of the 30 routines. Likewise, Nigam et al. (2016) do not report on the detailed actions for the six routines in their study. Although, when looking at the literature they cite in their theory section, the authors subscribe themselves to a routine dynamics perspective, their research interest is not typical for a routine dynamics study. Instead of adopting a performative lens that would study routine performance from within, Nigam et al. (2016) adapt an external perspective on the routines in their study. Given this research interest, accounting for levels of granularity of single actions would potentially not have been appropriate at all. Seen this way, studies that operationalize routines which we have classified as unclear are not necessarily insufficient in

their analysis. However, as we will argue below, side-stepping the question on which levels of granularity we operationalize actions and hence routines is, at least when it comes to comparing the insights of the different studies, not without its problems.

The problems of side-stepping granularity in routine dynamic studies

The above review of our authoritative sample of routine dynamics studies shows significant differences across different studies when it comes to the issue of granularity. Comparing the different operationalizations of action reveals that there seems to be no established agreement, implicit or explicit, as to what should be understood as one action - the smallest analytically relevant, or atomic, unit of observation - in routine dynamics studies. Instead, we find a wide variety of differences ranging from fine-grained levels of granularity that study actions like 'scanning a cover mail' (Spee et al., 2016), to coarse-grained levels that analyze collective actions like 'executing a roadmap' for the development of new manufacturing processes (Howard-Grenville, 2005). We also find that a considerable share of the studies does not systematically report the information that would enable the readers themselves to properly establish the level of granularity for the analyzed routines.

Notwithstanding the important insights that routine dynamics studies have provided us with (for recent reviews see Parmigiani and Howard-Grenville (2011); Howard-Grenville and Rerup (2017)), we believe that further progress in our field will at least in part depend on routine dynamics scholars becoming more systematic in reporting and reflecting on the granularity of their observations. By side-stepping the issue of granularity we risk comparing studies with one another that actually deal with very different types of patterns that emerge as a reaction to very different processes of performing and patterning. A study that is situated on a very fine-grained level of granularity studies how an individual actor performs an action without further ado at one specific location in a very short amount of time. Understanding the performance of this actor thus requires us to understand his/her individual capabilities (Selznick, 1957), his/her

motivation and needs (Steers et al., 2004) for performing this action and his/her goal that the actor seeks to accomplish, his/her emotions (Fineman, 2000) and how he/she coordinates with other actors in close vicinity (O'Leary and Mortensen, 2010; Polzer et al., 2006). Studying actions that - on a medium-grained level of granularity - involve groups of actors that jointly perform a specific action brings entirely different coordination challenges to the fore: Here groups need to find an agreement on how to enact the action, which raises potential issues of group think (Janis, 1972; Janis, 1982), it alerts us to issues of power play and politics among group members (Burns, 1961; Crozier and Friedberg, 1981), it reminds us about the political nature of decision making in groups (Cohen et al., 1972) and it foregrounds questions of group composition in terms of diversity and so on (Van Knippenberg et al., 2004). Specifically knowledge sharing strongly depends on common occupational conventions, skilled performances, and the norms and values of a shared (functional) community (Lave and Wenger, 1991; Wenger, 2000). This implicit and situated knowledge is shared in homogenous groups, whilst there are differences in assumptions, meanings, and contexts in heterogeneous groups (Bechky, 2003; Gherardi and Nicolini, 2000; Lave and Wenger, 1991). Due to these differences, heterogeneous groups (e.g. Feldman (2000)) might face rather different coordination challenges than homogenous groups (e.g. Zbaracki and Bergen (2010)). Studying the performance of specific actions on a coarse-grained level of granularity by different departments within an organization again raises different questions: Here the culture and sub-cultures of the different units might play a significant role (Kellogg, 2011), the interdependence between these departments might vary (Lawrence and Lorsch, 1967) and questions of goal alignment and goal conflict might come into play (Gilbert, 2006; Salvato and Rerup, 2018).

But not only the number of different actors involved in performing an action makes a significant difference when it comes to processes of performing and patterning. Also the location, if analyzed on different levels of granularity, has significant implications. In particular, the challenges of actors who enact an action face-to face in the same location will be very different

than the complex set of challenges implied when an action needs to be enacted across multiple production facilities of an entire factory (Howard-Grenville, 2005) or when actors that are situated in dispersed locations (Adler, 1995). As it is well established, geographic dispersion places significant constraints on the social functioning of a group (Cramton and Webber, 2005: 759). People who are physically distant, for instance, communicate less often than people who are proximate (Conrath, 1973; Cramton, 2001; Gullahorn, 1952). This affects the coordination among the actors as more distance generally leads to less diffusion of task related information (Keller and Holland, 1983; O'Leary and Cummings, 2007), generates more conflict (Hinds and Bailey, 2003), and can spark very different dynamics of knowledge creation (Baralou and Tsoukas, 2015) to name just some of the most prevalent effects.

Besides the number of actors involved and the geographic location, the temporal differences on different levels of granularity also raise very distinct problems and challenges for the performing actors. If an action can be performed within minutes or hours like the 'receiving a customer order' (Dittrich et al., 2016) it confronts actors with a significant lower degree of uncertainty as compared to the action of 'executing a roadmap' (Howard-Grenville, 2005) that potentially takes months to a year to be accomplished. The longer it takes to accomplish an action, the higher the uncertainty involved (Cyert and March, 1963). The environment might have changed (Davis et al., 2009), actors might not be available any more (Shen and Cannella Jr, 2002) and so on. Furthermore, fitting different actions together in performing a routine, the amount of time that is available makes a significant difference. Here, specifically the amount of time that it takes to accomplish a particular routine has a significant impact on the enactment of the actions that constitute a routine. Time shortage, as it was the case in the moving students into residence halls routine studied by Feldman (2000), causes actors to consider less alternative ways of enacting a particular action, and gives them less opportunities to deviate in their actions from the established pattern of the routine (Turner, 2014). In contrast, when a routine stretches over multiple days, as it is for instance the case with the closing up residence halls routine

(Feldman, 2000), actors might have slack available to reflect on the task and enact the respective actions in a rather calm manner (Becker, 2004; March and Simon, 1958). It thus makes a significant difference if we study the timing of actions in routines on different levels of granularity.

However, despite the differences in the processes of performing and patterning, the issue of granularity has largely been side-stepped in routine dynamic studies. Importantly, as we will argue, this does not imply that there is a right or a wrong level of granularity in routine dynamics studies - quite the contrary: different research questions might call for different granularities. However, as this brief section has outlined, operating on different levels of granularity will bring quite different challenges for the performing actors to the fore. And instead of side-stepping these differences they could be turned into analytically fruitful differences in our theorizing about routine dynamics. In the next section we will outline how this can be done, by explicating a procedure that - as we hope - will help routine dynamics scholars to establish and report on the level of granularity in their empirical studies.

Establishing granularity in the research process

In the following we sketch-out a four step procedure that is meant to support scholars in their efforts to establish the appropriate levels of granularity in their data. This procedure provides a practicable and pragmatic way to address the above mentioned challenges. And while, to remain reader-friendly, we chose to report this approach here as a stepwise procedure, it will often turn out to be a more iterative back and forth between these steps. The general idea is to first establish a level of granularity for the study, then to identify actions on the chosen level of granularity and then fit these actions into distinct patterns, i.e. routines.

(1) Establishing the level of granularity: The first step is meant to address the two most basic concepts in routine dynamics studies: situated action (unit of observation) and patterns of action (unit of analysis). Researchers have to ensure that the granularity of the unit of observation fits

the granularity of the unit of analysis. If the unit of analysis focuses on the patterning of individual actors, a fine-grained unit of observation would allow them to identify the performing and patterning challenges that will arise for these individual actors. Hence, on a fine-grained level of observation, we are able to study the enabling and inhibiting conditions and context for individual actions and the way these actions are coordinated into patterns by specific individual actors. If the unit of analysis, however, focuses on the patterning of groups, i.e. how groups jointly enact patterns by coordinating ad-hoc, a medium-grained level of observing actions is appropriate. On a medium-grained level we are able to study how hetero- or homogenous groups interact, we can see what enables and constrains their actions and how they coordinate these actions into patterns by coordinating on the fly. Choosing this medium-grained level of observation, however, at the same time does not allow to study how individual actors align their actions with their group members, what makes an individual actor to come forward with one action and suppress another and so on. Studying performing and patterning on a coarse-grained level of analysis means we are interested in the work of larger groups (i.e. departments or even organizations) that expands over long periods of time, is dispersed across different geographical locations and, consequently, relies on programmed modes of interaction. A coarse-grained unit of observation allows us to see such interactions of large groups, departments or even organizations and the way these collective actors perform their work. Choosing such a coarse-grained level of observation, however, reduces our ability to include the challenges of performing and patterning as they are confronted by individual actors or small groups.

Choosing levels of granularity is guided by the research question and the phenomena of interest. As we have pointed out, it is important that the level of granularity of the unit of observation fits the unit of analysis. Fitting the level of granularity of the unit of observation to the unit of analysis is important to ensure that our study is actually able to cover the things we want to see. As researchers we need to be mindful to first establish what we “want to be able to say

something about at the end of the study" (Patton, 2014: 400). This defines the level of granularity taken.

(2) Identifying action(s) on the appropriate level of granularity: Once the level of granularity for the study has been established, in the next step researchers are in need of identifying actions on the respective level of granularity. At this point it seems important to remind ourselves that identifying and delineating actions is neither straight-forward nor self-evident. It requires the researcher to reflect on her analytical focus. Identifying actions on a fine-grained level of analysis refers us to actions that one individual can accomplish for him-or herself "without further ado" (Schatzki, 2008: 122). This requires observing the actions of an individual actor and identifying the boundaries of each action carried out by the actor. To identify these boundaries it might be helpful to look for behavioral chunks in situations where an actor typically has to scan her surroundings for additional information about what other routine participants are doing. Also the moment when an actor typically has to bring in additional resources or artifacts to be able to move on with the performance can serve the same purpose. In addition, longer interruptions or breaks and changes in location are useful indicators for cut-off points that enable the research to analytically decompose the continuous stream of actions of an individual actor into discrete chunks of action. Also "hand-offs" (Pentland et al., 2017) between individuals could be indications for the boundary of an individual action. As has been outlined above, the span of projection that constitutes the boundary of an individual action, varies substantially across actors and over time. Experts might have a broader span compared to novices. Researchers thus need to be very close to the actor to actually find out her individual span of projection, preferably via interviews and observations.

A medium-grained level granularity refers us to collective actions that a small group of actors can accomplish by only relying on ad-hoc forms of collaboration. To identify actions of this granularity it will again be useful to look for hand-offs; this time between groups. Oftentimes, hand-offs between groups involve partial results (Kremser and Schreyögg, 2016), or boundary

objects (Spee et al., 2016). Again, longer interruptions or breaks within the remaining chunks of interaction are a good indicator for additional cut-off points that separate collective actions of the same group from each other. Alternatively, one could also look for points in a typical performance where it *would* be possible for the group to have a long interruption without having to start all over again. For example, interrupting a meeting - understood as a collective action of a small group - for multiple days would probably make it necessary for the group to start all over when they meet again. It would thus serve as a proxy for delineating a boundary around a collective action on a medium-grained level of granularity. On a medium-grained level of granularity the researcher might therefore look for longer interruptions and/or hand-offs which are an indicator for the limits of ad-hoc forms of coordination.

Finally, identifying actions on a coarse-grained level of observation, where each action requires some amount of up-front planning for multiple groups to be able to accomplish a joint outcome, requires researchers to look for different boundaries. Useful indicators for such boundaries are formally or informally prescribed outcomes of collective actions that are expected from other groups involved in the same performance. Researchers could, for example, look for those moments where plans that are necessary to accomplish the subsequent action are negotiated and/or communicated. Also, the moments when intermediate outcomes of a performance are being reviewed before the next action is being performed are indicators of analytically useful cutoff-points in decomposing actions on a coarse-grained level. In general, it will be useful to look for those moments during the performance where the collective actors re-negotiate and specify their mutual expectations regarding the outcomes of a specific coarse-grained action.

(3) Fitting actions into routines: After having established the level of granularity, collected the data on the fitting level of observation and delineated the boundaries of actions, the next step is to cluster these identified actions into meaningful patterns, i.e. routines. In this regard, the existing literature refers us to operational tasks (Rerup and Feldman, 2011), purposes (Pentland and Feldman, 2007), programmed interfaces (Kremser and Schreyögg, 2016), spaces (Bucher

and Langley, 2016), and performative boundaries (Kremser et al., 2019) as potential starting points for identifying boundaries of routines. A comprehensive discussion of the pros and cons of these different approaches is outside the scope of this paper. For us, it is sufficient to establish that scholars need to identify single routines as sufficiently distinct units of analysis (see also Pentland and Feldman (2005)).

It is important to note that the levels of granularity taken will result in different boundaries of routines. Depending on the level of granularity taken, researchers would identify different boundaries of situated action and hence would arrive at different routines. For instance, in observing the same phenomena, a researcher who operates on a medium-grained level of granularity might identify one routine whereas a researcher working on a fine-grained level would identify multiple, interdependent routines - which might imply very different dynamics (Kremser and Schreyögg, 2016). This stresses once more the importance of being mindful of levels of granularity and shows that levels of granularity are not an arbitrary starting point. The consequences for identifying routines are - as outlined - significant.

(4) Consistency check: The last step in our procedure to establish granularity in the research process is a consistency check. First, researchers have to ensure that all actions that are clustered into one distinct routine are on the same level of granularity. One routine, for instance, should not contain actions that are carried out by one individual without further ado and actions performed by a group of actors over longer timespans. This could distort the insights into the performing and patterning processes involved. Second, researchers have to be mindful that the level of granularity of the unit of observation fits the unit of analysis. Only this ensures that they are able to observe the coordination problems their study wants to address. Third, if researchers aim at studying the interdependence of different routines, it is important that the routines that are studied in their independence are all established on the same level of granularity. Otherwise the researchers would see and compare very different ways of interaction and interdependence between routines without being mindful of these differences. Fourth, it is

important to point out that the heuristics we have outlined do not constitute a straight forward procedure. Rather, it means continuously and iteratively reflecting on levels of granularity and ensuring a fit throughout the research process. Only this ensures rigorous and comparable results.

Reporting on granularity

After having provided some useful heuristics to establish granularity within the research process, we now shortly outline some recommendation how granularity could be reported in writing up research on routine dynamics. Reporting on the granularity is important for at least two reasons: First it provides other researchers with a reconstructable chain of evidence (Yin, 2009) from the research question to the appropriate level of granularity and finally to the proper identification of actions and routines. This also helps to ensure the internal consistency (Yin, 2009) of routine dynamics studies. Second, it is important because it enables routine dynamics scholars to contrast and compare findings across different studies. As we have argued above, from different levels of granularity we analyze and thus find very different things that are often not easily compared. Reporting on levels of granularity thus helps for putting findings and contribution of studies into perspective and also highlights important limitations for each of the studies.

From a pragmatic perspective, reporting on granularity should be comprehensive, but does not need to be too extensive. More specifically, we suggest to add information to the methods section, the results section and in the limitations. In the methods sections, for example, as part of a first description of the case or focal phenomenon, it would be useful to mention why the study has chosen which level of granularity. Next to that, one sentence that explicitly states the granularity of actions would greatly help others to properly understand how actions have been identified and how they have been clustered into routines. In the results section, we would suggest that researchers report a table that specifies all actions that belong to a particular routine.

Ideally, such a table should also specify at least the actor(s) and location(s) of each action. Since the exact (typical) duration of each action is often neither easy to establish nor useful in general, we suggest to report the typical duration of a complete performance for each routine. Reporting such a table will be useful for establishing the necessary information in the first place. As we have pointed out, routine dynamics studies that take action as their atomic unit of observation should be mindful and reflective when it comes to the operationalization of actions. Crafting such a table should therefore help in facilitating this effort. Finally, and especially for more complex study designs, it would be very useful for the audience to better understand the limitations that come from the chosen level of granularity. Researcher should therefore explicitly reflect on the aspects of performing and patterning that they chose to background by means of establishing a specific level of granularity for their analysis.

Conclusion

The paper has shown that granularity is an important dimension for studies of routine dynamics and studies of processes in general that take action as their core unit of observation. We have outlined that actions can be observed and analyzed on at least three distinct levels of granularity. Each level foregrounds specific challenges of performing and patterning whilst at the same time backgrounding others. As our literature review has revealed, prominent studies of routine dynamics so far do not explicitly deal with the problem of granularity. As a consequence, the routines identified in the different studies are operationalized on different levels of granularity without any reflection of the implications. As we have argued side-stepping the concept of granularity significantly impedes the comparability of studies since different levels of granularity bring different challenges of performing and patterning to the fore. The paper suggest pragmatic ways for establishing the appropriate levels of granularity throughout the research process and gives some recommendation how to report on levels of granularity in papers.

It is, however, important to point out that since granularity is situated and will therefore depend on the actors that are studied, our framework does not and cannot propose an objective and always appropriate definition of the unity of an action - in fact, we strongly oppose such an approach. Instead we argue that routine dynamics studies need to take the concept of action seriously, both conceptually and methodologically. This implies that studies of routine dynamics need to explicitly reflect on and specify the level of granularity the study is based on. Researchers should be explicit about the reasoning behind the established level of granularity and should report on it in their studies. Addressing the issue of granularity thus sheds light on an important construct in routine dynamics studies that has long been side-stepped and only implicitly been addressed in the research process.

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Appendix

Table of Contents

A1 Summary of Dissertation

Current research reveals that organizations consist of networks of interdependent routines. These interdependent routines fundamentally contribute to the accomplishment of organizational work and directly influence organizational stability and change. Researching interdependent routines hence provides an excellent opportunity to generate a sophisticated understanding of organizations and their dynamics.

This cumulative dissertation elaborates on overall research questions about the nature of interdependent routines, as well as related methodological challenges. The first dissertation paper conceptually unveils that interdependent routines and their underlying coordination processes play a central role in balancing organizational stability and change. The second paper empirically illuminates the dynamics of these coordination processes and shows that routine boundaries are by no means always stable, but rather morph, shift, and dissolve. The third paper develops a methodological framework that enables a more transparent and consistent research process among routine scholars.

Overall, this dissertation advances a routine interdependence perspective on organizations. Its findings hereby directly relate to central questions of organizational research and practice. By unraveling the coordination processes among interdependent routines, the dissertation contributes to better understanding of how organizations accomplish complex tasks. Further, by illuminating the interactions between multiplicities of routines, this work fosters research on how organizational dynamics are generated and balanced. And finally, by developing a methodological framework, this dissertation enables more stringency in routine dynamics research, as well as studies of processes in general. Hence, in sum, this work makes important contributions to the literature on interdependent routines and beyond.

A2 Zusammenfassung der Dissertation

Aktuelle Forschungsergebnisse zeigen, dass Organisationen aus Netzwerken von interdependenten Routinen bestehen. Diese miteinander verknüpften Routinen tragen nicht nur wesentlich zur Verrichtung komplexer Aufgaben bei, sondern wirken sich auch direkt auf Stabilität und Wandel in Organisationen aus. Die Erforschung solch interdependenter Routinen bietet somit eine hervorragende Gelegenheit Organisationen und deren Dynamiken besser zu verstehen.

Die vorliegende kumulative Dissertation hat es sich zum Ziel gesetzt konzeptionelle, empirische und methodische Erkenntnisse zur oben genannten Debatte beizutragen. Der erste Artikel erarbeitet konzeptionell, wie sich die Koordinationsprozesse zwischen interdependenten Routinen auf die Balance zwischen Stabilität und Wandel in Organisationen auswirken. Der zweite Artikel beleuchtet empirisch die Dynamiken dieser Koordinationsprozesse und zeigt auf, dass die Grenzen von Routinen keineswegs immer stabil sind, sondern sich verändern, verschieben und mitunter sogar auflösen. Der dritte Artikel entwickelt ein stringentes und transparentes methodisches Verfahren, das den empirischen Forschungsprozess für Routineforscher erleichtern und den Fortschritt der Forschungsgemeinschaft fördern soll.

Insgesamt treibt die vorliegende Arbeit die Routineforschung voran und liefert hierbei unmittelbar Erkenntnisse zu zentralen Fragestellungen der Organisationsforschung. Die Dissertation beleuchtet zum Beispiel sehr genau, wie in Organisationen durch die Interaktionen zwischen interdependenten Routinen komplexe Aufgaben erledigt werden. Zudem zeigt sie deutlich auf, wie organisationale Dynamiken durch die Wechselwirkungen zwischen Routinen kreiert und balanciert werden. Und schlussendlich vermag das methodische Verfahren, welches in dieser Arbeit entwickelt wird, nicht nur die Routineforschung, sondern auch die

Prozessforschung im Allgemeinen zu bereichern. Die vorliegende Dissertation leistet somit wichtige Beiträge zur Routineforschung und darüber hinaus.

A3 Statutory Declarations

Erklärung

Hiermit erkläre ich, Jan Hoekzema, dass ich keine kommerzielle Promotionsberatung in Anspruch genommen habe. Die Arbeit wurde nicht schon einmal in einem früheren Promotionsverfahren angenommen oder als ungenügend beurteilt.

_____ _____

Ort/Datum Unterschrift Doktorand/in

****

Eidesstattliche Versicherung:

Ich, Jan Hoekzema, versichere an Eides statt, dass ich die Dissertation mit dem Titel:

„Balancing Organizational Stability and Change: A Practice Perspective on Routine Interdependence" selbst und bei einer Zusammenarbeit mit anderen Wissenschaftlerinnen oder Wissenschaftlern gemäß den beigefügten Darlegungen nach § 6 Abs. 3 der Promotionsordnung der Fakultät für Wirtschafts- und Sozialwissenschaften vom 18. Januar 2017 verfasst habe. Andere als die angegebenen Hilfsmittel habe ich nicht benutzt.

_____ _____

Ort/Datum Unterschrift Doktorand/in

A4 Selbstdeklaration bei kumulativen Promotionen

Gemäß § 6, Absatz 3 der Promotionsordnung vom 18. Januar 2017 möchte ich im Folgenden darlegen, in welchem Umfang ich zu den Artikeln, die in Mehrautorenschaft entstanden sind, beigetragen habe. In Anlehnung an internationale Standards erfolgt die Einschätzung in drei zentralen Dimensionen:

Konzeption / Planung: Formulierung des grundlegenden wissenschaftlichen Problems, basierend auf bisher unbeantworteten theoretischen Fragestellungen inklusive der Zusammenfassung der generellen Fragen, die anhand von Analysen oder Experimenten/Untersuchungen beantwortbar sind. Planung der Experimente/ Analysen und Formulierung der methodischen Vorgehensweise, inklusive Wahl der Methode und unabhängige methodologische Entwicklung.

Durchführung: Grad der Einbindung in die konkreten Untersuchungen bzw. Analysen.

Manuskripterstellung: Präsentation, Interpretation und Diskussion der erzielten Ergebnisse in Form eines wissenschaftlichen Artikels.

Die Einschätzung des geleisteten Anteils erfolgt mittels Punkteinschätzung von 1 – 100 %

Für mindestens einen der vorliegenden Artikel liegt die Eigenleistung bei 100 %.

Für den Artikel Exploring Routine Interdependence: Fluid Boundaries and Adaptive Patterning liegt die Eigenleistung für

das Konzept / die Planung bei	60%
die Durchführung bei	90%
der Manuskripterstellung bei	70%

Für den Artikel liegt Granularity Matters: Towards a Methodological Framework for Routine Studies die Eigenleistung für

das Konzept / die Planung bei	50%
die Durchführung bei	60%
der Manuskripterstellung bei	60%

Die vorliegende Einschätzung in Prozent über die von mir erbrachte Eigenleistung wurde mit den am Artikel beteiligten Koautoren einvernehmlich abgestimmt.

_____ _____

Ort/Datum Unterschrift Doktorand

A5 List of Publications

Submitted Papers

Hoekzema, J. 'Bridging the Gap between Ecologies and Clusters: Towards an Integrative Framework on Routine Interdependence'. Revise and Resubmit to ***European Management Review***

Hoekzema, J. and Geiger, D. 'Exploring Routine Interdependence: Fluid Boundaries and Adaptive Patterning'. Under review at ***Journal of Management Studies***

Hoekzema, J., Geiger, D. and Kremser, W. 'Granularity Matters! Towards a Methodological Framework for Routine Studies'. Conditionally accepted in ***Organization Theory***

Peer reviewed conference proceedings and presentations

Hoekzema, J., Geiger, D. and Kremser, W. (2019). 'Granularity Matters! Towards a Methodological Framework for Routine Studies'. 35th EGOS Colloquium, Edinburgh.

Hoekzema, J. and Geiger, D. (2019). 'Disentangling Routine Interdependence: Blurry Boundaries and Dynamic Patterning'. 79th Academy of Management Conference, Boston.

Hoekzema, J. (2018). 'It's All About Perspective: Introducing Granularity into Routine Studies'. Annual Meeting of Organizational Researchers, Frankfurt (Oder).

Hoekzema, J. and Geiger, D. (2018). 'Disentangling Routine Interdependence: Blurry Boundaries and Dynamic Patterning'. 34th EGOS Colloquium, Tallinn.

Hoekzema, J. (2017).'Coordinating Novelty: Interdependent Routines in the Face of Ongoing Change'. PhD Pre-Colloquium Workshop at the 33rd EGOS Conference, Copenhagen.

Hoekzema, J. (2016).'Broadening the Horizon: New Perspectives on Routine Interdependence'. Annual Meeting of Organizational Researchers, Hamburg.

A6 Teaching Experience

Semester	Kurs	Studiengang	Anzahl Studierende	Sprache
SoSe 2016	Übung: Grundkurs Organisation	BA SozÖk	40	Deutsch
SoSe 2016	Übung: Qualitative Methods	MIBAS	40	Englisch
WiSe 2016/2017	Übung: Grundkurs BWL	BA SozÖk	80	Deutsch
WiSe 2016/2017	Übung: International Organizations	MIBAS	40	Englisch
SoSe 2017	Übung: Grundkurs Organisation	BA SozÖk	40	Deutsch
SoSe 2017	Übung: Qualitative Methods	MIBAS	50	Englisch
WiSe 2017/2018	Übung: Grundkurs BWL	BA SozÖk	80	Deutsch
WiSe 2017/2018	Übung: International Organizations	MIBAS	40	Englisch
SoSe 2018	Übung: Grundkurs Organisation	BA SozÖk	40	Deutsch
SoSe 2018	Übung: Qualitative Methods	MIBAS	50	Englisch
WiSe 2018/2019	Übung: Grundkurs BWL	BA SozÖk	80	Deutsch
WiSe 2018/2019	Übung: International Organizations	MIBAS	40	Englisch
WiSe 2018/2019	Seminar: The Future of SME‘s	MIBAS	30	Englisch
SoSe 2019	Übung: Grundkurs Organisation	BA SozÖk	40	Deutsch
SoSe 2019	Übung: Qualitative Methods	MIBAS	50	Englisch

A7 Curriculum Vitae

Lebenslauf entfällt aus datenschutzrechtlichen Gründen

Lebenslauf entfällt aus datenschutzrechtlichen Gründen