Business Research Unit (BRU-IUL)

Team improvised adaptation
Team performance in contexts of uncertainty and time scarcity

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A Thesis presented in partial fulfilment of the Requirements for the Degree of Doctor in Management with specialization in Human Resources and Organizational Behaviour

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Para a Isabella
Para a Paula
Para a Mãe

ABSTRACT

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The main goal of this thesis is to propose, validate, and analyse the team improvised adaptation construct. It comprises one theoretical study and four empirical studies. Team improvised adaptation is the process of team adaptation when design and execution merge. Study 1 deconstructs and recombines team adaptation and team improvisation, proposing the team constructs of purposive improvisation, improvised adaptation and preemptive adaptation. Study 2 validates team improvised- and preemptive adaptation, revealing the moderation role of team learning behaviours on the mediation of improvised adaptation between shared temporal cognitions and team performance. Study 3 suggests that in-action and transitional reflexivity moderate the relationship between shared mental models similarity and improvised adaptive performance, and that transitional reflexivity moderates the relationship between shared mental models similarity and improvised adaptation learning. Study 4 uncovers the mediation effect of team improvised adaptation between future-orientation elevation and team performance. The findings also show that future-orientation diversity has a positive impact on team improvised adaptation learning. However, future-orientation elevation and future-orientation diversity have negative impacts on improvised adaptation learning and team performance, respectively. Finally, study 5 takes an inductive approach revealing two tensions of team improvised adaptation: a deployment tension between routine inertia and improvisation pressures, and a development tension between the need to plan and the need to act immediately. The resolution of these tensions unravels a process that ultimately leads to team learning outcomes. The thesis contributes to the understanding of teamwork, in particular when teams have to adapt to unexpected circumstances under conditions of extreme time scarcity.

Keywords: Team adaptation, team improvisation, team improvised adaptation, team learning.

JEL Classification System: D23 Organizational Behaviour; O15 Human Resources, Human Development.

RESUMO

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O objetivo principal desta tese é propor, validar e analisar o construto de adaptação improvisada em equipa. Compreende um estudo teórico e quatro estudos empíricos. A adaptação improvisada em equipa é o processo de adaptação da equipa quando o plano e a execução são simultâneos. O estudo 1 desconstrói e recombina a adaptação e a improvisação em equipa, propondo os construtos de improvisação premeditada, adaptação improvisada e adaptação preparada. O estudo 2 valida a adaptação improvisada e a preparada, revelando o papel de moderação dos comportamentos de aprendizagem em equipa, na mediação da adaptação improvisada entre as cognições temporais partilhadas e o desempenho da equipa. O estudo 3 sugere que as reflexividades em ação e transicional moderam a relação entre a semelhança dos modelos mentais partilhados e o desempenho adaptativo improvisado, e que a reflexividade transicional modera a relação entre a semelhança dos modelos mentais partilhados e a aprendizagem de adaptação improvisada. O estudo 4 expõe o efeito de mediação da adaptação improvisada em equipa entre a orientação futura da equipa e o seu desempenho. Os resultados também revelam que a diversidade na orientação futura da equipa tem um impacto positivo na aprendizagem de adaptação improvisada. No entanto, o construto de orientação para o futuro, composto para o nível da equipa através da elevação e através da diversidade, têm impactos negativos na aprendizagem de adaptação improvisada e no desempenho da equipa, respetivamente. Finalmente, o estudo 5 faz uma abordagem indutiva que revela duas tensões de adaptação improvisada em equipa: uma tensão inicial entre a inércia de rotina e as pressões de improvisação, e uma tensão de desenvolvimento entre a necessidade de planear e a necessidade de agir imediatamente. A resolução destas tensões despoleta um processo que, em última análise, leva à aprendizagem em equipa. Esta tese contribui para a compreensão do trabalho em equipa, em particular quando as equipas precisam de se adaptar a circunstâncias inesperadas em condições extremas de escassez de tempo.

Palavras-Chave: adaptação em equipa, improvisação em equipa, adaptação improvisada em equipa, aprendizagem em equipa.

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CHAPTER 1.

INTRODUCTION

INTRODUCTION

Mudam-se os tempos, mudam-se as vontades,
muda-se o ser, muda-se a confiança;
todo o mundo é composto de mudança,
tomando sempre novas qualidades.

Time changes, and our desires change.
What we believe – even what we are – is ever-changing.
The world is change,
which forever takes on new qualities.
(Camões, in William Baer ed., 2008, pp. 70–71)

In the sixteenth century the Portuguese poet Luís de Camões recognized the mutable character of the world. During this period, hundreds of caravels departed from Portuguese shores filled with dreams of new worlds and new people, and prepared for the unknown. Five hundred years later, modern organizational teams face similar levels of unpredictability at an ever more accelerated rate of change. Just as ancient sailors were ready to adapt to novel environments and unpredictable incidents, contemporary teams must be prepared to face dynamic organizational contexts and unforeseen disruptions. In such a volatile environment, a team's ability to adapt constitutes a sustainable differentiation factor (Crossan, Lane, White, & Klus, 1996). However, when the dynamic of change bursts into shorter and shorter time frames, teams must adapt so fast that they might not have time to prepare a new plan prior to its implementation; they should, therefore, improvise (Cunha, Miner, & Antonacopoulou, 2016). Yet, while improvising, teams cope with change in an ephemeral way that does not ensure enduring solutions. Improvisation serves local and temporary purposes, which do not always translate into the acquisition of new knowledge (Moorman and Miner, 1998a). In order to understand how teams can adapt to unanticipated disturbances in a time frame that forces them to merge design and execution, we ought to integrate the team adaptation and improvisation literatures.

As the core building blocks of organizations (Kozlowski & Bell, 2013) teams can be defined as complex systems of two or more individuals that share common goals, and socially interact to perform relevant and interdependent tasks (Salas, Dickinson, Converse, & Tannenbaum, 1992). Hackman (1990) refers to organizational work groups as delimited social systems that have one or more tasks to perform, in which interdependent individuals play differentiated roles, and operate in an organizational context. In order to perform those tasks, teams must engage in teamwork, consisting of "the interdependent components of performance required to effectively coordinate the performance of multiple individuals" (Salas, Cooke, & Rosen, 2008, p. 541). Moreover, the ultimate goal of teams is to be effective, which, from Hackman's (1987) perspective, means that they have to perform in a way that exceeds the quality and quantity standards defined by whoever receives, reviews or uses the outcome; they have to be satisfied by the team work experience promoting their overall well-being; and team members must be willing to continue working together ensuring the team´s viability. However, structuring organizational work around teams in changeable environments, dictates the need for adaptation in the pursuit of team effectiveness (Burke, Stagl, Salas, Pierce, & Kendall, 2006).

Team adaptation is a process of adjustment of relevant team processes as a reaction to a disruption that creates the need for adaptation (Maynard, Kennedy, & Sommer, 2015). During the last two decades, several scholars have delved into this phenomenon and tried to understand the process of team adaptation (e.g., Burke, Stagl, Salas, Pierce, & Kendall, 2006), and also what factors or antecedents most favour its adoption (e.g., Randall, Resick, & DeChurch, 2011). Building on Cunha, Miner and Antonacopoulou's (2016) definition of improvisation, team improvisation can be seen as a collective system (Vera & Crossan, 2005) of deliberate and substantive fusion of design and execution implying the production of some sort of novelty. The improvisation literature has mainly focused on explaining the emergence of improvisation (e.g., Hatch, 1999; Moorman & Miner 1998b), its antecedents (e.g., Crossan & Sorrenti, 1997; Magni, Proserpio, Hoegl, & Provera, 2009), and on refining the construct by identifying different improvisation typologies (e.g., Cunha, Clegg, Rego, & Neves, 2014; Hadida, Tarvainen, & Rose, 2015). Although these two literatures have been looking at phenomena that mostly rise from the need to react to unpredictability, they have followed independent courses, somehow overlooking each other's advances. Our work starts from the argument that the conceptual detachment between adaptation and improvisation literatures has prevented them from fully understanding the adaptation process when there are severe time limitations, which we argue, changes the nature of the phenomenon, with strong implications on antecedents, the process, and outcomes.

Given the relevance of the need to rapidly adapt to changing circumstances faced by modern organizations, the present thesis aims to answer the following questions: How can teams adapt when there are severe time constraints by improvising solutions to unpredictable disruptions? What factors most influence a team's capacity to perform such adaptation within such a temporal context? How can a team produce durable knowledge from such episodes, and what kind of knowledge can be produced? As time is of the essence in our conceptualization, addressing these questions entails combining adaptation and improvisation literatures from a temporal perspective.

The contributions of this thesis are threefold. First, by deconstructing and recombining the concepts of team adaptation and team improvisation, it proposes a framework– the team improv-adaptation space – that refines the conceptual resolution of both constructs, thereby expanding current knowledge on how teams can adjust their processes to cope with change and unpredictability. Second, it explores the concept of team improvised adaptation, capturing the essence of adaptation phenomena when time is so scarce that design and execution ought to merge. Time has an ontological character in organizational theory (George & Jones, 2000). To look at adaptation without considering the effect of time is to ignore a constituent ingredient of the team adaptation process, in particular the timing of the trigger giving rise to the need for adaptation, and the scarcity of time available to execute a task. Third, this thesis contributes to the improvisation literature by uncovering fundamental aspects that allow teams to persistently learn and integrate new knowledge into their organizational routines. Without this knowledge, improvisation would have no significant consequences beyond the local episode.

This work is organized as follows: we begin by exploring the theoretical bodies of team adaptation and team improvisation, outlining the relevance of approaching them from an integrated perspective in order to properly grasp team adaptation when there is a severe time scarcity. Second, we delve into the role of time in organizational theory so we can better understand its importance in explaining team process. We then move on to the presentation of a theoretical paper where we establish the conceptual framework of our proposal and define the concept of team improvised adaptation. Next, we present four empirical studies that validate the construct and explore its antecedents, process, and outcomes. Finally, we close the thesis with a general discussion covering the five studies, and offering a comprehensive overview of the main construct, examining theoretical and practical implications, and proposing directions for future research.

TEAM ADAPTATION

Team adaptation is ubiquitous in modern organizations, as they have to deal with uncertainty and time pressure. The concept has been the focus of research for the last two decades, and it has been approached from several perspectives that can be structured, as Maynard et al. (2015) did, according to an input-process-output model. Particular attention has been paid to the understanding of how teams can adapt to uncertain environments, in which change is a constant element of organizational life. Teams adapt because, given a disruption, they want to maintain team performance (Entin & Serfaty, 1999). Entin and Serfaty (1999) propose that, in order to do so, teams change their decision-making strategy, their coordination strategy, and their behaviour and organizational structure to the requirements of the situation. This means that adaptation requires "adjustments to relevant team processes (i.e., action, interpersonal, transition) in response to the disruption or trigger giving rise to the need for adaptation" (Maynard et al., 2015, p. 656). Although thoroughly described by scholars, the input-process-output logic, present in the adaptation literature, has led to some conceptual fuzziness. Some definitions are more input oriented, such as that of Gibson and Birkinshaw (2004) that refers to the capacity to quickly reconfigure activities to meet changing demands of a task; others focus primarily on the process as team-level behavioural changes (DeRue, Hollenbeck, Johnson, Ilgen, & Jundt, 2008); and some authors emphasise the adaptive outcome, for example the extent to which a team modifies its configuration (LePine, 2005).

Maynard and colleagues (2015) felt the need to clarify the conceptual arena of team adaptation and differentiated between team adaptability, team adaptation process, and team adaptive outcomes. The authors defined *team adaptability* as the capacity that a team has to change in response to some kind of disturbance. This ability derives from individual factors but also from collective characteristics. The *team adaptation process* represents the adjustments performed as a reaction to the disruption, and configures a process of change mediating the relationship between the team's adaptability and the adaptive outcomes. Finally, the *team adaptive outcomes* embody the consequences of the adaptation process and may include, for example, different emergent states and team effectiveness. In this section we discuss current knowledge regarding team adaptability, at individual and team levels; we provide a comprehensive overview of the team adaptation process, introducing several models to describe it, and reviewing the different roles of team processes and emergent states; and finally we debate adaptive outcomes, focusing on team performance and decision making, explaining the different perspectives on adaptive performance, and ending with a review of maladaptive adaptation.

Team adaptability

Team adaptability depends on a number of factors or antecedents to the team adaptation process. There are three levels of factors that can be considered as antecedents of team adaptation: individual, team and organizational. However, team adaptation literature has been sparse in terms of identifying organization level antecedents. We will focus our review on individual and team level factors.

Individual antecedents

At an individual level, Burke et al., (2006) distinguishes between knowledge, attitudes, and traits and abilities.

Knowledge characteristics that favour adaptation refer to knowledge about the task, or task expertise; knowledge about the team, or team expertise; and mental models, which are "cognitive representations of reality that team members use to describe, explain, and predict events" (Burke et al., 2006, p.1199). Task expertise concerns the need for team members to know what to do, how, and when to do it. In order to adapt, team members should be familiar with the task and the requisites for its accomplishment (LePine, 2003). Only with this knowledge can they adequately change the task to accommodate the new demands. Team expertise refers to the knowledge that team members have about other team members. According to Burke et al. (2006), this knowledge allows individuals to easily recognize others' cues and more promptly react to eventual behavioural changes. A similar effect results from team members having flexible mental models, favouring an effective identification of pertinent cues that require adaptation.

Regarding *attitudes*, a predisposition to cooperate with fellow team members, or psychological collectivism, is seen to be a positive attitude towards adaptation (Randall et al., 2011). Also, a learning orientation, or a desire to acquire new knowledge, and a performance orientation, or a desire to gain favourable judgments, are relevant aspects of individual attitudes that favour adaptation (LePine, 2005). Another individual attitude that helps team adaptation is member achievement, i.e., the level of effort to achieve goals (Baard, Rench, & Kozlowski, 2014; LePine, 2003; Pulakos, Schmitt, Dorsey, Arad, Borman, & Hedge, 2002), since it will drive individuals to change team processes to maintain team performance.

The third type of individual antecedent identified by Burke and colleagues (2006) was *traits and abilities* and, among them, openness to experience stands out as determinant because adaptation involves the creation of something new (Baard et al., 2014; LePin, 2003, 2005). However, since teams will have to process new information as it emerges, it is also relevant that individuals possess cognitive ability, or the capacity to process new information and learn (Pulakos et al., 2002; Randall et al., 2011). Additionally, and embodying a critical trait, individuals must be able to adapt and cope with change, i.e., they must have individual adaptive capability (Han & Williams, 2008).

Team antecedents

A team's ability to adapt is also influenced by collective factors. Salient as a team antecedent for adaptation is the design and structure of the team, especially decision-making structures. A centralizing decision-making structure creates barriers to adaptation, for example by preventing team members from exploiting time sensitive opportunities that may not have been predicted (Hollenbeck, Ellis, Humphrey, Garza, & Ilgen, 2011). Moreover, a team with a high degree of self-management, meaning that it has freedom to determine how and when to coordinate inputs, will also be more prepared to adapt (Burke et al., 2006). Additionally, the reward structure can set the stage for adaptation. For example, teams can easily adapt from a cooperative reward structure to a competitive reward structure, increasing performance speed (Johnson, Hollenbeck, Humphrey, Ilgen, Jundt, & Meyer, 2006), which benefits adaptive behaviours.

Furthermore, if teams have an elevated collective efficacy, sharing the belief in their capacity to perform certain activities, they will allocate task-related efforts to cope with the demands of disruptions, promoting adaptation (Chen, Thomas, & Wallace, 2005). The same is true for the team mental models, consistent with what was argued about individual antecedents, but now accounted collectively. One aspect of team mental models refers to the quality of team member structural networks, which involves how key decisions relate to each other in achieving a collective goal, which has been seen to favour adaptation. This happens because the better team members understand the key decision alternatives and their implications for achieving the team's goals, the quicker they make decisions and adapt their strategies (Resick, Murase, Bedwell, Sanz, Jiménez, & DeChurch, 2010).

Team adaptation process

As a team process, to fully grasp team adaptation it is critical to understand the dynamics of team processes. To this end we used Marks, Mathieu, and Zaccaro's (2001) model, which views team performance as a series of related input-process-output episodes. The authors argue that the outcomes of a certain episode become the input of the next episode in a sequence of transition and action phases. The *action phases* consist of periods that contribute to the accomplishment of the task, and the *transition phases* are periods where the team evaluates and plans activities. Each phase comprises a number of action, transition and interpersonal processes. Some processes are more likely to occur during the transition phase (transition processes); others are more likely to occur during the action phase (action processes); and the interpersonal processes occur during both phases and contribute to managing interpersonal relationships. Table 1.1 describes the different team processes proposed by Marks et al. (2001). Consistent with this perspective is Kozlowski, Watola, Nowakowski, Kim, and Botero's (2009) framework of team dynamics, entailing four different phases – team formation, task and role development, team development, and team improvement – each of these phases having a preparation and an action component.

Both models acknowledge the need for adaptation. Marks and colleagues' (2001) model considers the process of strategy formulation and planning as integrating three different dimensions: deliberate planning, contingency planning, and reactive strategy adjustment. The deliberate planning dimension refers to the formulation and diffusion of the main strategy; contingency planning consists of the previous preparation of alternative plans and strategy adjustments to anticipated changes in the environment; and reactive strategy adjustments represent changes to the current plans in response to unforeseen disruptions. This last dimension configures adaptive behaviours. Also, the model of Kozlowski et al. (2009) reflects an adaptation process by including a team improvement phase, in which teams focus on developing adaptability, therefore preparing to effectively deal with non-routine situations.

Table 1.1. Typology of team processes (Based on Marks et al., 2001)

Transition processes	**Action processes**	**Interpersonal processes**
Mission analysis Goal specification Strategy formulation and planning	Monitoring progress Systems monitoring Team monitoring and backup responses Coordination activities	Motivation and confidence building Affect management Conflict management

Team adaptation models

Several models have been proposed to explain the team adaptation process. We have mentioned Entin and Serfaty's (1999) model emphasising the type of changes that occur during the adaptation process. According to these authors, in order to maintain performance, teams adapt their decision-making strategy, their coordination strategy, and their behaviour and organizational structure. These adaptations serve as feedback loops that help minimize the perceived stress and altering the team structure. Despite revealing important adjustments, this model fails to acknowledge the different team processes that occur when teams are adapting.

In fact, adaptation implies that after a change, either in the task or in the environment, a series of process mechanisms takes place in order to adapt to those changes (Baard et al., 2014). Burke et al. (2006) focused on those mechanisms (Figure 1.1). According to these authors, the adaptive cycle has four phases: situation assessment, plan formulation, plan execution, and team learning. *Situation assessment* consists of at least one team member searching for cues that the team's goal might be compromised, implying the need for change. These cues can be an unusual situation, a discrepancy, a disruption, or an unexpected failure (Louis & Sutton, 1991). Once the cues are recognized, those who identify them must communicate their meaning to the rest of the team, so the team can be aware of the new situation. This ends the situation assessment and triggers the *plan formulation* phase. In this phase teams decide what to do, set objectives, clarify roles and responsibilities, discuss context elements, prioritize tasks, clarify their expectations, and share information related to the task. Once the plan is set, teams start *implementing* it. This involves several processes that are executed dynamically, simultaneously, and recursively. Team members coordinate their activities by constantly communicating with each other, and by mutually monitoring for when cognitive or physical resources are diminished, they can apply backup behaviours to compensate. The coherence of this phase is ensured by the leader, who helps members structure their actions. The final phase of the adaptive cycle is *team learning*, in which teams openly discuss errors and unforeseen results so they can appropriately revise cognition and behaviour, resulting in team adaptation, comprising some level of innovation and modifications in the team.

Maynard and colleagues (2015) have a different viewpoint of team adaptation. These authors diverge from Burke and colleagues' (2006) perspective in the sense that for Burke et al. (2006) team adaptation is the result of the adaptive cycle, and is revealed in the innovation or modification of existing structures, capacities, or behavioural actions. Maynard and colleagues (2015) see team adaptation as a process implying adjustments to action, as well as interpersonal, and transition team processes. This divergence has relevant impacts since one sees team adaptation as an outcome, and the other sees it as a mediator. In their framework, Burke et al. (2006) argue that, as part of the execution phase, monitoring, communication, backup behaviour and leadership lead to team adaptation. However, Maynard et al. (2015) see similar elements as mediators between the team adaptation process and team adaptive outcomes, and also in a feedback loop as relevant to the adoption of the adaptation process itself. Figure 1.2 portrays this model, clearly illustrating the three fundamental elements of team adaptation: team adaptability, team adaptation process, and team adaptive outcomes.

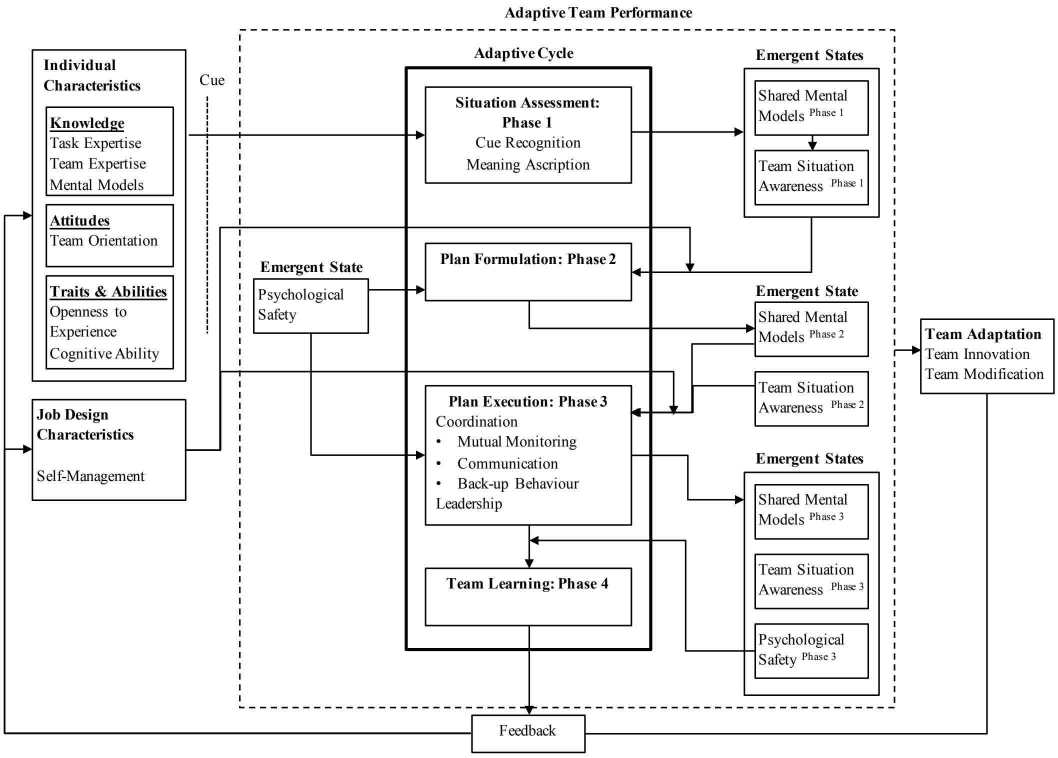

Figure 1.1. Input-throughput-output model of team adaptation
(adapted from Burke et al., 2006)

Maynard and colleagues (2015) also reflected on the content of the team adaptation process. The authors integrate the different team processes introduced by Marks et al. (2001), and argue that there are different types of triggers deploying different types of processes. Task-work triggers relate to changes in what the team is doing involving disruption in tools, machines, or systems; team-work triggers refer to how team members are performing the task, and might involve disturbances in the team's composition, for example. The model proposed states that task-based triggers prompt teams to adjust their action processes, and team-based triggers prompt adjustment to interpersonal processes. Moreover, the severity of the trigger influences the need for transition processes. The authors suggest that if the severity of a trigger increases, a team will focus on the transition processes, and only then will go back to the action or interpersonal processes. In a similar vein, Christian, Christian, Pearsall, and Long (2017) assert that the origin and duration of a stimulus can affect the effectiveness of team adaptation. The authors identify internal stimuli, defined as changes in roles, membership, rewards, or team structure; and external stimuli comprised by changes in the task environment. They also distinguish between temporary stimuli, or those that are transient and short-term; and sustained stimuli as those that are enduring and long-term. They observe that external adaptive stimuli enhance the relationship between some team processes (communication and coordination) and team performance, and also that teams facing temporary stimuli experience an enhanced relationship between communication and performance.

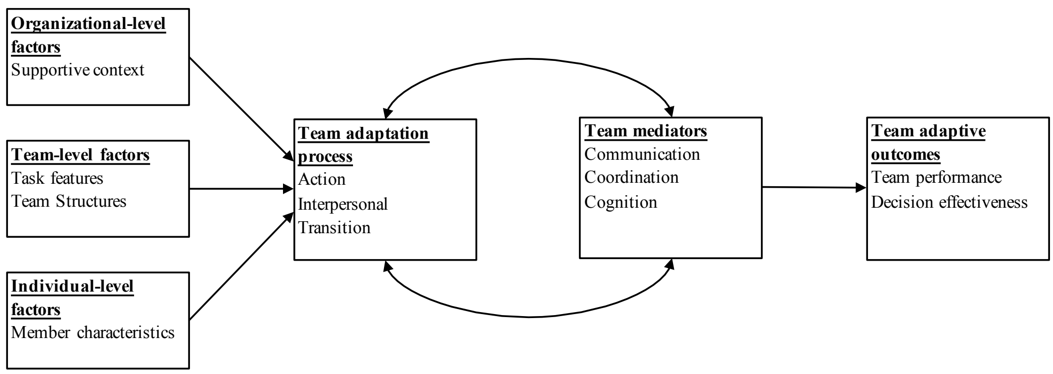

Figure 1.2. Team adaptation nomological network
(adapted from Maynard et al., 2015)

Team processes and emergent states

The distinction between team processes and emergent states is relevant because, as noted by Marks and colleagues (2001), emergent states do not describe the nature of members' interactions, but often are intertwined with team processes, which can lead to construct adulteration. Team processes are "members' interdependent acts that convert inputs to outcomes through cognitive, verbal, and behavioural activities directed toward organizing taskwork to achieve collective goals" (Marks et al., 2001, p. 357). It is through team processes that members work interdependently and use available resources to achieve their collective goals. On the other hand, emergent states are dynamic cognitive, motivational, and affective states of teams, all of which change with team context, inputs, processes, and outcomes, and influence the implementation of team processes (Marks et al., 2001). The difference can be summarized by the condition that emergent states do not imply interaction processes, but represent qualities of a team, and team processes are a means to transform inputs into outputs in the pursuit of group goals.

As we have seen earlier, team processes are critical at different stages of the adaptive cycle. An expanded version of Burke and colleagues' (2006) model advances a number of *team performance processes* within each of the main processes of the adaptive cycle (Rosen, Bedwell, Wildman, Fritzsche, Salas, & Burke, 2011). Defined by Rosen et al., (2011) as cognitive or behavioural goal-directed action, these performance processes consist of a more comprehensive account of what happens during each phase of the adaptive cycle (Table 1.2). Each of these phases is influenced and produces specific emergent states. Burke and colleagues (2006) identified psychological safety, shared mental models, and team situation awareness as three determinant emergent states that serve as proximal outcomes and inputs to diverse phases of the adaptive cycle. Psychological safety is the shared belief that the team is safe for interpersonal risk taking (Edmondson, 1999). This belief favours the plan formulation phase and also influences the team's capacity to adopt learning behaviours (Burke et al., 2006). Shared mental models represent a mutual understanding between team members about task, team, and temporal aspects of their work (Klimoski & Mohammed, 1994; Mohammed, Ferzandi, & Hamilton, 2010); and team situation awareness is a shared understanding of the present situation at a given moment (Salas, Prince, Baker, & Shrestha, 1995).

When teams assess a disruptive situation they develop a shared mental model that helps gain awareness of that situation. Between each phase of the adaptive cycle, teams will develop new shared mental models and new situation awareness, which, coupled with psychological safety, will ultimately positively impact the team's ability to learn. Rosen et al. (2011) also added two emergent states to those proposed by Burke and colleagues (2006). The authors argue that mutual trust and motivation are both products and inputs of team adaptation. Mutual trust is an affective state consisting of a shared belief that team members will do their part to ensure that the interests of the other team members are protected (Salas, Sims, & Burke, 2005). The course of action will determine whether mutual trust increases or diminishes. For example, what happens during plan formulation will define members' willingness to adopt back-up behaviours through plan execution.

Table 1.2. Team performance processes in each phase of the adaptive cycle (Based on Rosen et al., 2011)

Situation assessment	Plan formulation	Plan execution	Team learning
Cue Recognition	Mission Analysis	Coordination	Information Search and Structuring
Meaning Ascription	Goal Specification	Mutual Monitoring	Review events
Team Communication	Deliberate Planning	Back-up Behaviour	Active listening
	Contingency Planning	Systems Monitoring	Convergent Interpretation
	Role Differentiation	Reactive Strategy	Divergent Interpretation
	Preemptive Conflict Management	Reactive Conflict Management	Strength / Weakness Diagnosis
		Affect Management	Summarize Lessons Learned

Team adaptive outcomes

Burke et al. (2006) view team adaptation as an outcome of the adaptive cycle and consisting of team innovation and/or team modification. Maynard et al. (2015) have a different perspective considering team adaptation as the adaptive process itself. This viewpoint allows us to further consider other adaptive outcomes as consequences of the adaptation process. The literature attributes a positive relationship between adaptation processes and a vast number of outcome variables, such as performance, mission effectiveness, decision-making effectiveness, or innovation (Maynard et al., 2015).

Team performance and decision making

In 1999 Mary Waller observed that airline crews, engaged in a flight simulation, that quickly reprioritize and redistribute tasks among group members, when facing non-routine situations, performed better than those crews that did not adapt so rapidly. Other numerous studies related team adaptation with performance. For example, DeChurch and Haas (2008) proposed that reactive adjustments have a higher impact on team effectiveness than contingency planning and deliberate planning. Another study detected that teams more focused on the outcomes than on the process, reveal a higher capacity to identify problems and adapt their work processes, which ultimately results in higher team performance (Woolley, 2009). Moreover, when teams are subject to a disruption, engaging in in-process planning does initially increase adaptiveness, but too much planning after the beginning of work limits this capacity and performance gets affected (Lei, Waller, Hagen, & Kaplan, 2016). This means that teams who quickly adapt after some in-process planning, perform better.

The quality of the decision-making process has also been seen as an important outcome of team adaptation. LePine (2003) assessed that when teams effectively adapted their role structure to face unforeseen changes in the task, their decision-making process would become more effective. This means that the flow of information among team members increases, and the judgments and recommendations on the proper course of action become more adequate. Likewise, Resick et al. (2010) found that teams that were able to adapt their strategies more efficiently were also those that made decisions more quickly and more effectively.

Adaptive performance

The literature on adaptation has conceptualized adaptive performance in different ways, depending on the perspective of adaptation taken by the authors. Baard and colleagues (2014) identified some of those conceptualizations. The authors distinguished adaptive performance from the perspectives of performance construct and performance change. As a performance construct, adaptive performance refers to a process that captures particular aspects of the performance space. From a performance change perspective, it relates to the performance after a change and is closer to an outcome perspective. In line with Baard et al.'s (2014) approach, we identify three different conceptualizations of team adaptive performance: as a *process*, representing the extent to which teams adjust their processes given a disruption; as a *performance outcome*, consisting on the absolute result of the adaptation process; and as a *relative performance outcome*, involving the conception of a relative result of the adaptation process.

There is a large number of scholars defining adaptive performance from a process perspective (e.g. Resick et al., 2010; Sander, van Doorn, van der Pal, & Zijlstra, 2015). One of the first attempt to define the construct was made by Allworth and Hesketh (1999), who defined it as "behaviours demonstrating the ability to cope with change and to transfer learning from one task to another as job demands vary" (p. 98). Adaptive performance is seen as developing new configurations to handle non-routine tasks (Kozlowski & Klein, 2000), particularly the learning and application of new abilities and knowledge to new demands (Han & Williams, 2008). In an attempt to develop the construct and achieve a greater consensus among scholars, Pulakos, Arad, Donovan, and Plamondon (2000) identified eight dimensions of adaptive performance, which they defined as a behaviour modification to manage the requirements of a new situation. The eight dimensions of adaptive performance are: solving problems creatively; dealing with uncertain and unpredictable work situations; learning new tasks, technologies, and procedures; demonstrating interpersonal adaptability; demonstrating cultural adaptability; demonstrating physically oriented adaptability; handling work stress; and handling emergencies or crisis situations. Later, Pulakos et al. (2002) integrated these dimensions into the construct of adaptive performance, stating that its manifestation can configure several forms. This perspective also asserts that the changes in behaviour are directed by the need to achieve final outcomes, configuring goal directed actions (Burke et al., 2006; Rosen et al., 2011).

A different approach is taken by those scholars that see adaptive performance as an outcome. This perspective proposes that team adaptive performance reflects the extent to which teams achieve their goals during adaptive episodes (Chen et al., 2005). As such, it can be seen as the result of the adaptation process and representing the effectiveness with which teams are able to decide (Randall et al., 2011). However, as an outcome, this perspective does not differ from team performance as seen by Hackman (1987). The difference resides only in the context of task execution, as adaptive performance represents task-related outcomes following changes in the task (Christian et al., 2017). Because of this lack of clarity, other scholars felt the need to narrow the concept of adaptive performance, introducing the notion of relative performance. Denrell and March (2001) talk about relative performance to refer to a result of the adaptive process in which performance is measured by comparison to a moment in which teams did not have to adapt. The same is proposed by LePine, Colquitt, and Erez (2000), who consider adaptive performance as the difference between performance prior to any change in the task, and performance given the need for adaptation.

Recent work has attempted to reconcile these perspectives by trying to introduce more clarity in the diverse concepts. Maynard and colleagues (2015) opted to use the terms team adaptation when referring to the process, and team adaptive outcomes when referring to the result of the adaptation process, dropping the use of the word ‘performance’ due to its dual interpretation. Other authors preferred to use the expression adaptive behaviours, as behavioural changes in response to disruptive events, and clearly differentiate them from team performance as a result (DeRue et al., 2008; Marques-Quinteiro, Curral, Passos, & Lewis, 2013). However, the literature has not yet agreed on a common taxonomy leading to some conceptual uncertainty, which leads some authors to be very inclusive in their conceptualizations. For example, Lei et al. (2016) consider adaptive performance from both a process and an outcome perspective stating that it represents the extent to which teams adapt to environmental contingencies, and make effective decisions that ensure good performance. In this work we are closer to the relative performance perspective (see study 3) because it represents the result of the adaptation process independently of the team's ability in the respective task.

Team maladaptation

Although team adaptation literature has recurrently identified positive outcomes for team adaptation, it is audacious to consider that this is always the case. Maynard and colleagues (2015) stress this point and consider that more research should be done considering the dark side of adaptation. Denrell and March (2001) have looked at imprecise adaptation related to the fact that adaptive systems might underestimate the effects of risky and new alternatives, due to small samples of experience, which can lead to biases caused by a will to reproduce success, and eventually lead to a short-run inefficient adaptation. Also Rosen et al. (2011) refer to maladaptive performance affirming that it can imply social loafing, meaning that individuals apply less energy to working in a group than they would apply when working individually (Karau & Williams, 1993), or a reduced focus on group objectives. Maladaptation can also be the result of inadequate changes in the reward structure. Johnson and colleagues (2006) observed that teams shifting from a competitive reward structure to a cooperative reward structure, decreased the accuracy of their performance. However, much ground is yet to be covered. What are the boundary conditions for positive adaptation? When does team adaptation lead to poor performance? These questions reveal how little we still know about team adaptation.

Summary

The study of team processes when facing a disruption that makes them adapt has been the focus of numerous studies in the past two decades. These studies have focused on antecedents, on the process itself, on outcomes of adaptation, and although less, also on boundary conditions to the process. Several models have been proposed to try to define and explain the construct, considering both team performance processes and emergent states as relevant aspects of team adaptation. While the literature has focused on positive outcomes of adaptation, scholars are now turning their attention to maladaptation phenomena, in which teams fail to adequately adapt, resulting in poor performance. However, the adaptation academics have overlooked one temporal dimension of team adaptation: the time available for teams to prepare a new plan before its implementation. The central theme of the present thesis, and our main argument, is that this temporal element changes the nature of the adaptation process. The process of adaptation when teams have time to prepare a new plan is inherently different from this process when teams do not have time to plan, and design merges with execution. However, the merger of design and execution has been the focus of improvisation literature. The next section will review this literature.

ORGANIZATIONAL IMPROVISATION

Just as for team adaptation, also improvisation has also been a relevant area of interest for organizational theory, particularly during the last two decades. From research that used theatre and jazz as metaphors (Barrett, 1998; Hatch, 1999; Kamoche & Cunha, 2001; Vera & Crossan, 2004) to work by authors who focused on typifying the construct of improvisation in organizational contexts (Cunha et al., 2014; Miner, Bassoff & Moorman, 2001; Moorman & Miner, 1998a), the subject has been studied through diverse perspectives and has been consolidated as a proper research topic. Cunha et al.'s (2016) definition of improvisation encapsulates three fundamental aspects of improvisation: extemporaneity, or the convergence of design and performance (Baker, Miner, & Eesley, 2003; Cunha, et al., 1999); novelty, which means the production of something new (Miner at al., 2001; Vera & Crossan, 2005); and intentionality as a deliberate act performed by organizational members (Crossan, Cunha, Vera, & Cunha, 2005; Cunha, Kamoche, & Cunha 2003). Also relevant is the consideration that improvisation comprises dealing with the unexpected (Hadida et al., 2015), which is often an event that cannot be addressed with previously established routines and procedures (Moorman & Miner, 1998b). It is historically relevant to start this section with a summary of the literature based on the metaphors mentioned above; then we move to a more structured approach and start by discussing the rationale for improvisation; we move forward by providing an account of different modes and typologies of improvisation; and we finalize by distinguishing improvisation from neighbouring constructs.

Organizational improvisation metaphors – improvisational theatre and jazz

Early authors used improvisational theatre and jazz as metaphors to discuss organizational improvisation, understood as the improvisation that takes place within an organization at any level of analysis, individual, team, or organizational (Hadida et al., 2015). These studies not only aroused interest in the construct, but also identified several competencies that organizational actors should own in order to effectively improvise (Cunha et al., 1999).

Among the first authors to bring improvisation into the organizational arena were Bastien and Hostager (1988), who argued that modern organizations live in turbulent and marginally predictable environments, in which its agents face levels of uncertainty similar to those lived by jazz players while improvising. For the authors, the structural constraints reflected in strict informal norms and codes, allow practitioners to recognize innovation opportunities; and a shared knowledge facilitates social task processes, fundamental for action coordination. A similar perspective can be observed in Eisenberg's (1990) work, who used the concept of jamming, drawn from the musical experience, recognizing its improvisational character which he defined as "making do with minimal communalities and elaborating simple structures in complex ways" (p. 154). For the author, four fundamental conditions were necessary to ensure effective jamming: *Skill*, not only a minimum level, but also that skill levels among group members must be equivalent; *structure*, asserting that jamming requires a fixed structure, translated into a well-defined and simple set of rules and roles, which, paradoxically enables more creativity since all players exactly know the basis of their performance; *setting*, implying that jamming occurs when people get outside normal and routine situations; and *surrender*, meaning that jamming cannot occur at will but is the fruit of an intuitive inspiration in which players 'go with the flow' in some sort of unselfconsciousness that might result in a transcendent experience. In the same vein, Kamoche and Cunha (2001) propose that the success of organizational improvisation depends on a balance between structure and flexibility, which is ensured by minimal structures, allowing the merger of composition with performance. These structures are a set of consensual guidelines and agreements comprising two basic elements: social structures and technical structures. The first consist of behavioural norms and communication codes; and the second refer to performance conventions and the combination of skills and competencies among group members.

Using improvisational theatre as a metaphor, Weick (1993a) proposes that in turbulent environments, continuous improvisation might be the answer to continuous change, asserting that *designing* (as the unceasing act of design) should replace *design* (viewed as a more static element). In this sense, improvisation becomes a mixture of pre-composed and spontaneous, control and innovation, exploitation and exploration, leading towards simultaneity instead of choice, in the management of such organizational dichotomies (Weick, 1998). Organizations pursue multiple goals, are subject to multiple individual interpretations of reality, and suffer frequent reorganizations (March & Olsen, 1976). These movements create organizational ambiguity, allowing organizational members to apply personalized ways relying on creativity and innovation, to ensure coherence, like jazz players do as they improvise (Hatch, 1999). In an attempt to describe ways by which organizations can emulate jazz bands and nurture spontaneity and creativity, Barret (1998) suggested seven practices that organizational actors might apply: boost the processing of information during and after actions are implemented; cultivate provocative competence; ensure that everyone has a chance to solo from time to time; cultivate supporting behaviours, such as mentoring and encouraging; create organizational designs that produce redundant information and overlapping knowledge; create organizational climates that value errors as a source for learning; and cultivate serious play by combining fun with work.

Although the jazz and theatre metaphors served the development of knowledge on organizational improvisation well, they are not free from some hurdles. Kamoche, Cunha, and Cunha (2003) recognize the important role of the metaphors, but warn of their perils, mainly the fact that they might distort the object under investigation, potentially leading to erroneous conclusions. Moving beyond these metaphors implies approaching the construct from a more structured perspective, which we will do in the next sections.

Improvisation rationale

A renowned work by Weick (1993b) studied the Mann Gulch fire disaster in which 13 men died due to a sudden shift in the evolution of a fire caused by unexpected high winds. Only three firefighters survived, and according to Weick, two of the reasons were that they used bricolage and improvisation. As bricoleurs they remained “creative under pressure, precisely because they routinely act in chaotic conditions and put order out of them…thus, when situations unravel [it was natural for them]… to proceed with whatever materials are at hand” (p. 639); also, when organizational order collapsed, the replacement of traditional order with an improvised order avoided paralysis. This perspective sees improvisation as the result of unexpected changes in the environment. The same viewpoint is shared by Hadida et al. (2015), who claim that often improvisation is triggered by unforeseen events requiring immediate action. However, the authors note that unpredictability might not be enough to drive improvisation, and add that previously agreed routines must fail to address sudden disruptions. In fact, improvisation is most likely triggered when planning does not provide adequate solutions to the new setting (Moorman & Miner, 1998b). Cunha et al. (1999, p.314) condense these three elements by saying that an organizational actor improvises when facing “an occurrence it perceives as unexpected, for which it does not possess any kind of preplanned course of action and which is perceived as requiring fast action”. This need for fast action results from temporal gaps reflected in divergences regarding the time to implement established procedures and the time available to implement a solution (Miner et al., 2001). Also, Moorman and Miner (1998a) assert that improvisation can be an effective alternative when change is required within a shorter timeframe than a regular planning cycle.

The unexpected character of improvisation can arise from inside the agent of improvisation or from its outskirts. Environmental disruptions often occur in fast changing business environments (Crossan et al., 1996), which can simply denote changes in the external environment (Cunha et al., 1999), or more drastic market instability (Akgün, Byrne, Lynn, & Keskin, 2007), or even technological turbulence (Pavlou & El Sawy, 2010). Often these changes represent organizational threats, but may also signify opportunities, frequently the result of serendipitous interactions between organizational actors and their stakeholders (Miner et al., 2001). When coming from the inside, the rationale for improvisation can configure the presentation of a new vision that requires emergent changes (Crossan et al., 1996). However, internal aspects can also configure purposive factors, which do not arise from any particular circumstance, but from an individual, team or organizational will, which they believe is beneficial for them or the organization. The need to learn new skills, the need to show proactivity and get higher levels of positive individual feedback, or the need to get the feeling of transcendence given by a positive outcome of an improvisational process, are examples of such factors that might also induce the practice of improvisational processes (Cunha et al., 1999).

The internal rationale is also related to the circumstance that improvisation frequently leads to positive outcomes (Cunha et al., 1999; Hadida et al., 2015). By improvising, organizational actors may overcome flawed mental models that limit their effectiveness, and develop flexibility by adapting to changes in the environment that require high speed responses (Cunha et al., 1999). In this sense improvisation approaches the concept of adaptation, but does not signify the same phenomenon, as we will explain further. A second possible positive outcome of improvisation is learning. Although organizational improvisation does not always result in learning (Moorman & Miner, 1998a), it can be seen as a special type of short-term learning where the change that results from learning occurs at the same time as the related experience (Miner et al., 2001). Nonetheless, it might also lead to longer term learning, particularly through the formalization of improvisations, an increased knowledge about themselves and about the environment, and through developing an actor's ability to improvise (Cunha et al., 1999). Chelariu, Johnston, and Young (2002) noted that improvisational skills can be learned, which results in more effective improvisation. But organizations can even go further, and institutionalize improvisational learning as a form of strategic learning, becoming a normal practice that facilitates adaptation (Cunha, Neves, Clegg, & Rego, 2015).

Another significant benefit is innovation. Several studies have discussed improvisation as a means to innovative solutions, particularly in the case of new product development (Akgün & Lynn, 2002; Kamoche & Cunha, 2001). Bastien and Hostager (1988) describe improvisation as a process of organizational innovation, and De Tienne and Mallette (2012) argue that improvisation creates a culture and momentum for change and innovation, and develops an innovation-oriented culture. Moreover, Pavlou and El Sawy (2010) have shown that, in turbulent markets, improvisational capabilities, defined as "the ability to spontaneously reconfigure existing resources to build new operational capabilities to address urgent, unpredictable, and novel environmental situations" (p. 444), are drivers of competitive advantage by their ability to promote positive change. This competitive advantage can manifest itself in different aspects of organizational life. For example, Valaei, Rezaei, and Ismail (2017) found that improvised ideas, processes, products, and services can lead to innovation and enhance small and medium enterprises' practices. However, there are boundary conditions for the positive impact of improvisation in innovation. Vera and Crossan (2005) saw that improvisation is not inherently good or bad, but under specific moderating factors produces significant innovative results. The authors identified four moderating factors: expertise, teamwork quality, experimental culture, and real-time information and communication. *Expertise* regards task-related skills and implies cognitive abilities, perceptual skills, experience, and formal and informal education; *teamwork quality* relates to a collaborative attitude that is supported by cognitive and affective factors; an *experimental culture* captures the essence of the "yes-and" rule, which means that members accept the contribution of others and build on it; finally, *real-time information and communication* requires that team members are attentive to what is going on around them and permanently communicate with each other.

Framing organizational improvisation

In order to adequately frame organizational improvisation, we must take stock of different classifications attributed to the construct, but also clearly distinguish improvisation from nearby concepts. As we will see, the most significant difference between improvisation and its most similar constructs resides in the temporal simultaneity between design and execution, which is constitutive in improvisation and is extraneous to all other construct definitions.

Improvisation taxonomies

Several taxonomies, according to different criteria, have been proposed for organizational improvisation. One of these criteria is the degree of improvisation. Using the jazz metaphor, Weick (1998) proposes four degrees of improvisation in a progression of creativity: interpretation, embellishment, variation, and improvisation. *Interpretation* is the adoption of minimal changes to a plan that is mostly followed; *embellishment* refers to greater modifications of a plan that it is still recognizable; *variation* occurs when improvised actions are inserted maintaining a link to the original plan; and finally *improvisation* means a drastic departure from what was planned. In a similar vein, Moorman and Miner (1998a) refer to three levels of improvisation: a first level comprising minor adjustments to a pre-existing process; a second level involving stronger differences to original plans and routines, including for example improvised new products, consisting of variations of current products or new production processes; finally, a third and more radical level of improvisation that implies a complete departure from routine, as when teams improvise a new product outside the organization's strategy. This latter perspective puts improvisation in a continuum instead of discrete categories, which is more adequate to represent organizational practice (Cunha et al., 1999). Hadida et al. (2015) talk about minor, bounded and structural improvisation. *Minor improvisation* implies modest adjustments to routine processes; *bounded improvisation* comprises improvising new processes or products framed by existing structures; and *structural improvisation* refers to radical changes to the structure itself.

A different perspective uses actors to categorize improvisation. In this sense, improvisation can be *individual* when it is executed by a single person, or *collective* when it represents the effort of a collection of people, be it a team or an entire organization (Moorman & Miner, 1998a). A more refined categorization considers three levels of improvisation according to its actors. *Individual improvisation* happens due to the action of single employees that alter their work in real-time, developing new solutions as a reaction to the emergence of new information; *interpersonal improvisation* takes place in small teams, representing bilateral or multilateral adjustments; and *organizational improvisation* represents a movement in which the whole organization develops new ideas, new ways of doing, and might imply redefining basic organizational pillars (Hadida et al., 2015). Hadida and colleagues (2015) crossed the degrees and the levels of improvisation, developing what they called the degree/level framework of organizational improvisation (Table 1.3). This framework ranges from *spontaneous practice*, a minor improvisation carried out by one individual, to a structural improvisation performed by a whole organization, or *platform organization*.

Table 1.3. Degree/level framework of organizational improvisation (Adapted from Hadida et al., 2015)

		Level		
		Individual	***Interpersonal***	***Organizational***
Degree	***Minor***	Spontaneous practice	Synchronization	Space for experimenting
	Bounded	Expert leadership	Yes-and	Constrained improvisation
	Structural	Dropping tools	Minimal structuring	Platform organization

Apart from level and degree criteria, other categories have been developed by improvisation scholars. For example, Cunha and colleagues (2016) focused on micro and macro levels of analysis, distinguishing between *local improvisation* (more individual and team oriented) and *strategic improvisation* (more organizational); they crossed this with the presence or absence of a common goal. Their framework comprises micro improvisation as ad-hoc action to accomplish work when there is a common goal; micro improvisation as political ingenuity if improvisational actors do not have a common goal; macro improvisation as strategy in the presence of a common goal; and macro strategy as a struggle for strategic domination in the absence of a common goal. On a different path, Miner and colleagues (2001) used improvisational productions to identify three forms of improvisation: behavioural production, artefactual productions, and new interpretative productions. *Behavioural productions* refer to improvisation that results in changes of processes; *artefactual productions* occur when teams create new physical structures, such as new products; and *interpretative productions* imply the reframing of events and the attribution of new meanings, for example when teams discover unanticipated outcomes from a specific process that might have implications for other stakeholders, such as clients or suppliers.

There are also categorizations that delve into the definitional character of improvisation. Crossan et al. (2005) consider the time pressure (low or high) and level of uncertainty (low or high) to develop a framework, in which a *planning* category represents low level of uncertainty and low time pressure and, therefore, does not imply improvisation. Improvisation is needed when time pressure and/or uncertainty increases. *Ornamented improvisation* occurs when, subject to low uncertainty, organizational agents face high time pressure, and not responding in a timely fashion might result in losing an opportunity or intensifying a problem; *discovery improvisation* happens when urgency is not an issue, but uncertainty is high, leading people to act before planning; and a *full-scale improvisation* materializes when high time pressure combines with high uncertainty scenarios, forcing organizational agents to rapidly react to crisis situations and fast changing environments.

In addition, the purpose of the improvisation has been considered in its portrayal. Cunha and colleagues (2014) propose that improvisation is *ad-hoc* when it is a spontaneous response to unforeseen disruptions that require immediate action; is *covert* when people decide to resist managerial power by developing their own way of performing; is *provocative* when it is an attempt to challenge organizational practices in a subversive but necessary way; and is *managed* when it represents a trained and managed response, in real-time, to unexpected events. This assortment of different typologies has allowed improvisation researchers to develop their empirical studies in a grounded and solid body of knowledge. However, although a sound taxonomy informs us what improvisation is, it is also relevant to explain what improvisation is not. This is what we will do in the next section.

What improvisation is not

There are many closely-linked concepts of improvisation, yet they contain fundamental differences. One of the most referred to in the literature, and also one of the topics of this work is *adaptation*. However, improvisation is distinct from adaptation, since adaptation does not necessarily imply the merger of design and execution (Cunha et al., 1999; Moorman & Miner, 1998a). Adaptation can be attained with previous planning and also by improvising. Another difference is that improvisation can occur independently from the emergence of a disruption (for example the covert improvisation proposed by Cunha et al., 2014), and adaptation is, by definition, always a response to an unexpected event. A second type of constructs often mentioned in the literature are *creativity* and *innovation*. All improvisation, by definition, comprises some level of innovation due to the need to act outside pre-planned routines. Yet, as for adaptation, innovation might also be the product of previous planning (Moorman & Miner, 1998a). The same can be said about creativity, since the implementation of creative production can be delayed to exploit optimal resources (Cunha et al., 1999). A third related construct is *learning*. Although improvisation might imply learning, not all learning derives from improvisation. Previously planned learning can occur without requiring improvisation; inversely, improvisation does not necessarily result in learning (Moorman & Miner, 1998a). *Bricolage* is also very close to the concept of improvisation, as it means to perform a task with whatever resources available (Weick, 1993b). Again, as noted by Crossan and Sorrenti (1997), improvisation assumes that organizational agents act 'in the moment', which might not be the case of bricolage. Finally, *intuition*, or choices made without formal analysis (Crossan & Sorrenti, 1997), while a part of some sorts of improvisation, does not totally overlap this construct, since some types of improvisation do not imply intuitive action, particularly collective improvisation that requires interdependent actions (Miner et al., 2001).

Improvisation antecedents

If organizational actors want to develop new processes as action unfolds, a number of influencing factors must be present (Cunha et al., 1999). These factors manifest at individual, team, and organizational levels, and alter the way improvisation is adopted (Magni, Provera, & Proserpio, 2010).

Individual antecedents

The literature is prolific regarding individual antecedents. Magni et al. (2010) consider two different kinds of individual factors: *personality traits*, which refer to individual characteristics that are relatively stable over time; and *cognitive factors* which differ from the former due to the possibility of being developed as time passes. Among personality traits, an intuitive insight, as a subconscious processing of ideas, is a factor that enhances improvisation, reasoned by the need to act rapidly in the face of an unforeseen situation (Crossan & Sorrenti, 1997). The same is true regarding self-esteem, tolerance for ambiguity, and emotional resilience (Mirvis, 1998). Also, innovativeness and self-efficacy become salient when one must create a novelty that is believed to result in positive outcomes (Magni et al., 2010). On a different note, Cunha and colleagues (1999) argue that the quality and extent of improvisation depends on the will to depart from memory, since one must adopt a practice that differs from previously established routines. Moreover, improvisation is a paradox between action and planning (Clegg, Cunha, & Cunha, 2002), implying a tension between acting and strategizing. According to Smith and Lewis (2011), individuals will more likely accept paradoxical tensions, such as this, and depart from defensive responses, if they possess emotional equanimity and behavioural complexity. The authors define behavioural complexity as the ability to adopt competing behaviours, and emotional equanimity as an emotional calm and evenness.

There are also cognitive factors that impact improvisation. Mirvis (1998) argues that trust and confidence in co-workers is determinant for the right temperament for improvising. From a more technical perspective, field independence, or the capacity to focus on relevant aspects of a given situation (Magni et al., 2010), technical skills and expertise (Crossan & Sorrenti, 1997), and the improvisational skill itself (Cunha et al., 1999), are qualities that impact the capacity to improvise. Finally, although procedural memory, or the memory of action, might be detrimental for improvisation (Moorman & Miner, 1998a), declarative memory, or the knowledge of facts, augments its likelihood (Cunha et al., 1999).

Team antecedents

Within organizations, individuals do not operate in a vacuum; they carry out their activity within a system that represents the combined effort of several individuals (Magni, 2010). Therefore, it is important to understand the team antecedents that favour improvisation. As with individual antecedents, a broad set of skills and expertise will favour improvisation (Crossan et al., 2005; Vera & Crossan, 2004, 2005). However, interrelational aspects play an important role in the capacity to improvise: the level of team cohesion and mutual support (Crossan & Sorrenti, 1997; Magni et al., 2009, 2010), and the quality and fluidity of communication (Crossan et al., 2005; Vera & Crossan, 2005), are fundamental to enhance the probability of improvisational acts. As for any other organizational facet, leadership is a determinant element; Cunha et al. (1999) argue that a rotating leadership and a serving leadership style are influencing factors of improvisation. They also defend that the training of improvisation itself will increase the emergence of improvisational acts. Finally, the capacity that individuals have to identify the different chunks of knowledge within the team, or transactive memory systems (Magni et al., 2010), and team implicit coordination (Marques-Quinteiro et al., 2013), also play an important role in improvisation, as teams must coordinate action if they want to adequately act outside previously established practices.

Organizational antecedents

There are a number of organizational conditions that must be met so improvisation can be adopted (Cunha, et al., 1999). Moreover, the beliefs that individuals have towards the organization can support or discourage improvisational actions (Vera & Crossan, 2004). Whether at a perceptual or a concrete level, organizations must create the right environment so improvisation can more likely occur. Supported by several researchers is the notion of an experimental culture, which means a culture that rewards exploration and creativity, and tolerates mistakes (Crossan et al., 2005; Magni et al., 2010). Similarly, Magni et al. (2010) argue that the employees' perception that the organization cares about their wellbeing i.e., organizational support, will increase the likelihood of departing from the routine. Cunha et al. (1999) also consider that collateral structures constitute an organizational configuration that allows the deployment of improvisational actions. The authors define collateral structures as organizational spaces where members can informally exert less canonical practices, which allow them to explore their creativity and exercise improvisation in a safer environment.

Summary

The improvisation literature has come a long way since it started with the theatre and jazz metaphors. Several taxonomies have been proposed and a solid conceptual body has been developed within the last two decades. The knowledge regarding the factors that most influence improvisation is thorough, and the reasons for the emergence of organizational improvisation have been methodically discussed by scholars. However, little has yet been advanced regarding the improvisational process itself. We still lack the knowledge of what happens when organizational agents are improvising, especially when collective improvisation occurs. This is one of the main goals of the present thesis: to understand what happens when teams improvise. We are particularly interested in discussing the case of improvisation as a response to a disruption or an unforeseen event.

THE TEMPORAL DIMENSION OF ORGANIZATIONS

George and Jones (2000) view the influence of time on organizational theory as having an ontological quality. The authors state that in order "to grasp the essential nature of a phenomenon it is important to understand how its existence at any point in time is a reflection of both the past and the anticipation of the future as they come together at any single moment in time" (p. 660). This thesis is based on this standpoint, affirming that in order to accurately describe the phenomena of team adaptation and team improvisation, a temporal dimension must be acknowledged. Although time can be defined as "a nonspatial continuum in which events occur in apparently irreversible succession from the past through the present to the future" (Ancona, Okhuysen & Perlow, 2001b, p.513), time is neither a simple nor an immutable object of reality, but rather a social construction that varies between and within cultures (Bluedorn & Denhardt, 1988), and between and within individuals (Waller, Conte, Gibson & Carpenter, 2001; Zimbardo & Boyd, 1999). Therefore, it can represent different conceptions, and people relate to time in different ways. Moreover, time lays out a continuum in which change occurs in an unequivocal manner, determinedly impacting organizational processes (Roe, Gockel, & Meyer, 2012).

Conceptions of time

What is time? This question has long occupied scientists and philosophers. Newton believed in absolute time, which was equal in all points in space; Einstein advocated for relative and, therefore, context dependent time (Buonomano, 2017). Buonomano (2017) summarized the two most important philosophical theories regarding the nature of time: presentism and eternalism. *Presentism* argues that the present is the single reality; the past has already happened and no longer exists; and the future is something that does not yet have any sort of manifestation. On the other hand, *eternalism* proposes that past and future are as real as the present; this perspective sees the *now* in relation to time as *here* relates to space. Although philosophically attractive, and even supported by a large scientific community, eternalism does not serve organizational theory well, since it is incompatible with the notion that time is perishable, non-replenishable, and cannot be borrowed, lent, or saved (Blount & Janicik, 2001).

The *clock-time* conception is the most common way to portray time in the Western world (Ancona et al., 2001b), and has been thoroughly used in the organizational literature (e.g., Bluedorn & Denhardt, 1988). This perspective sees time as linear and "infinitely divisible into objective, quantifiable units such that the units are homogeneous, uniform, regular, precise, deterministic and measurable" (Ancona et al., 2001b, p. 514). In contrast with this conception of time is the *event-time* perspective, in which time is perceived around meaningful events that are used as reference points to its passage (Bluedorn & Denhardt, 1988). George and Jones (2000) note that the way people experience time leads them to aggregate their experiences into episodes, which they call time aggregations. These time aggregations are bracket periods of time that people explore and reflect on, in order to extract sense and derive meaning from them. Blount and Janicik (2001) refer to these aggregations as temporal markers or reference points that convey temporal meaning to people. Also noteworthy is the notion that the intensity with which a phenomenon changes through time in a unidirectional trajectory, impacts the way individuals interpret the nature of the phenomenon (George & Jones, 2000). Some phenomena spiral over time in a crescendo of intensity, sometimes over a short period of time. In this sense, improvisation can be seen as an extreme spiral phenomenon where its intensity abruptly ascends due to the time scarcity of the occurrence.

The event-time perspective is useful for organizational management. For example, project management is organized in a way that couples with the notion of event-time, in which projects assume the role of significant events that mark the passage of time (Ancona, Goodman, Lawrence, & Tushman, 2001a). Orlikowski and Yates (2002) consider three different perspectives of time: objective time, subjective time, and practice-based time. *Objective time* is independent of human action, is exogenous and absolute, and represents a strong constraint to human action since it marks an unstoppable and irreversible forward movement; *subjective time* is a culturally relative social construction, whereby experience is subject to human interpretation in the attempt to create meaningful temporal notions around events and cycles; *practice-based time* represents the ongoing human action in which time is realized by the reproduction of temporal structures such as project schedules. As we will see further in this chapter, actors play different roles according to the different perspectives of time.

Two temporal perspectives can also be identified in the study of team performance and effectiveness: developmental models and episodic approaches (Mathieu, Maynard, Rapp, & Gilson, 2008). *Developmental models* look at teams as changing entities that are influenced by diverse factors as they evolve over time. For example, Kozlowski et al. (2009) consider four phases in the development of adaptive teams: team formation, task and role development, team development, and team improvement. The boundaries between the different phases are diffused, representing a continuum. On the other hand, *episodic approaches* see team processes as episodic structures that take place at different times, and evolve in a cyclical manner. Marks and colleagues' (2001) model is a good example of such approaches, as team processes are portrayed as occurring during specific time bounded episodes. Gersick (1988) emphasizes this perspective by affirming that a group's progress over time is mostly triggered by the members' awareness of specific deadlines rather than by an overall perspective of the work developed over a continuous period of time. The reconciliation of these two perspectives was proposed by Mathieu et al. (2008), who assert that developmental processes progress across time as teams evolve, and are subject to cyclical episodes that occur in feedback loops (Figure 1.3). It has also been proposed that effective improvisational processes can surpass this dichotomy through the concept of clock-event-time management (Crossan et al., 2005). Clock-event-time management focuses both on responding to changes in the environment and manipulating the environment. Effective improvisation processes enable individuals to coordinate their actions in a creative manner so they can adapt to unexpected events and manage calendar deadlines at the same time (Crossan et al., 2005).

Actors in time

Time is a conditioning factor to organizational activities. The temporal organizational structures are subject to and, at the same time mark, the unfolding of individual, team, and organizational processes (Blount & Janicik, 2001). In this section we aim to discuss the way individuals relate to time, and the roles played by organizational actors regarding time.

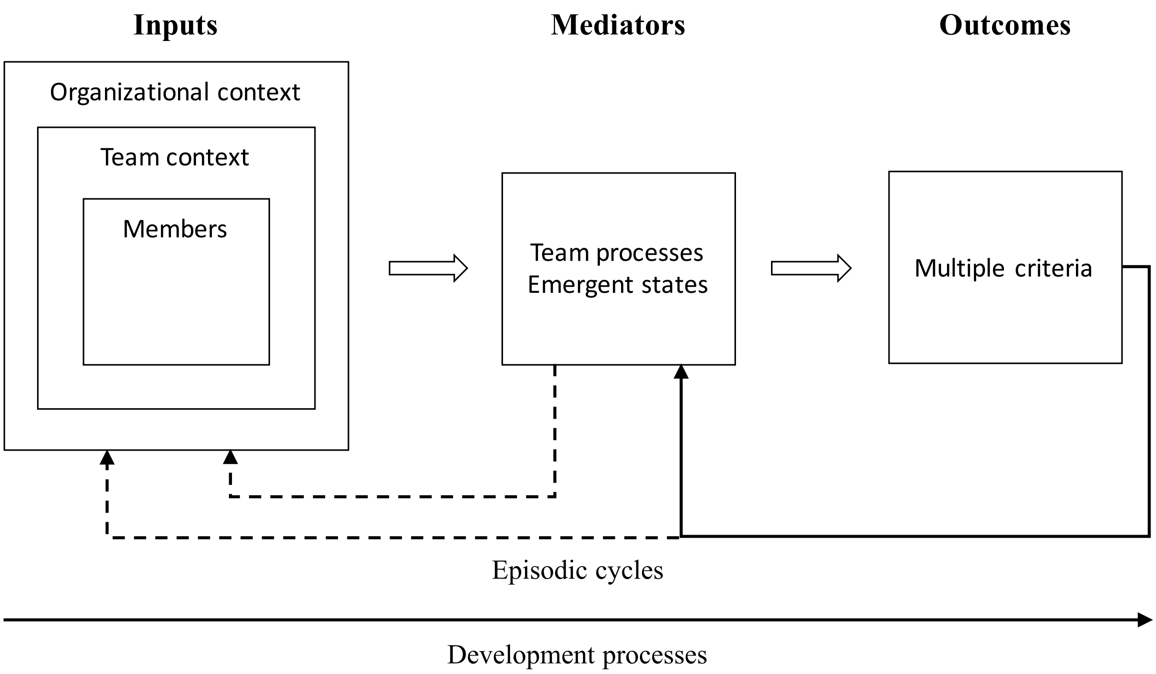

Figure 1.3. Team effectiveness framework representing development processes and episodic cycles (adapted from Mathieu et al., 2008)

How individuals relate to time

Ancona et al. (2001b) argue that people relate to time in two different ways, which they call temporal perceptions and temporal personality. *Temporal perceptions* are the ways people understand and acknowledge time through the senses. This experience of time varies across actors and can be applied to various levels of analysis, particularly individual, team, and organizational levels (Ancona et al., 2001b). For example, groups share some temporal perceptions, which Standifer and Bluedorn (2006) describe as shared temporal mental models, and define as "shared meanings about time and temporal matters among team members" (p. 906). These temporal models refer to the order of the different elements of the task, the pace, and the deadlines for task completion (Santos, Uitdewilligen & Passos, 2015). As the shared temporal models are developed through the interaction among group members, workgroups tend to adopt their own unique pace (Blount & Janicik, 2001). This is a fundamental aspect of team performance since, for example, when teams have similar temporal mental models, team learning processes are beneficial to performance improvement (Santos at al., 2015).

The second aspect, *temporal personality*, refers to the way an actor understands and interacts with time, involving cognitive and behavioural dispositions (Ancona et al., 2001b).

Waller and colleagues (2001) propose four time-perception prototypes for team members that result from combining time perspective and time urgency. *Time perspective* refers to a nonconscious process where social experiences are allocated to time frames, which helps attribute meaning to those events (Zimbardo & Boyd, 1999). A similar approach can be seen in the notion of *temporal focus*, or the extent to which individuals emphasize their perceptions of the past, present, and future (Bluedorn, 2002; Shipp, Edwards & Lambert, 2009). Two of these perspectives are future- and present-orientation. *Time urgency* is related with time behaviours, in which individuals tend to be very aware of the passage of time and perceive it as their enemy (Waller et al., 2001). Waller et al.'s (2001) typology consists of: organizers and crammers who are high in time urgency, the organizers being future-oriented and the crammers present-oriented; and visioners and relators, who are low in time urgency, visioners being future-oriented and relators present-oriented. The authors propose that a temporal match between team time urgency/time perspective configuration and the demands of the task will positively impact team performance.

Actors' roles in time

One interesting perspective regarding the role of actors in time was revealed in Berger and Luckmann's work (1967), who argue that 'cosmic' or absolute time could never fully match its social interpretation. The authors note that society imposes certain sequences that involve waiting. Waiting does not comply with absolute time, as time does not wait and is unstoppable. People wait for meetings, wait for the release of the new product, wait in traffic. This waiting represents a temporal structure that forces organizational actors into temporal synchronizations that contradict the linearity and finitude of absolute time (Berger & Luckmann, 1967). This viewpoint tends to see actors as passive agents of the temporal reality, in which it is the passage of time that marks actors' behaviours. For example, the notion of time constraint as the result of a temporal deadline might result in time pressure induced by the need to cope with the limited time (Ordóñez & Benson, 1997).

However, other time perspectives reveal that actors might play an active role in temporal change. Orlikowski and Yates (2002) propose that different time perspectives imply different roles. According to the objective time perspective, actors cannot change time, but only adapt their actions to its inexorable passage; however, from a subjective time perspective, actors can change their cultural interpretations to give different meanings to the events, for example, by defining "lunch time", or "coffee-break time"; finally, from a practice-based time perspective, actors can modify temporal structures, for example by changing different fiscal years, or defining new intervals for performance appraisal. The conception of the active role of actors in time leads to the concept of temporal capability. *Temporal capability* is the ability to comprehend various temporal conceptions and use them to guide action (Huy, 2001). Temporally capable people display temporal complexity by being able to perform multiple and apparently temporally paradoxical activities. For example, when teams are improvising, it is probable that several temporal conflicts occur. Because of its extraordinary and ambiguous nature (Cunha et al., 1999), members might not know when to play a specific role, they might find different roles to play at the same time, and they also might consider that the time available is not enough to perform all behaviours needed to achieve the team's goals. Moreover, these tensions will be felt differently by different team members. To reconcile these tensions and promote effective performance, team leaders must possess temporal capability (Huy, 2001).

Time and change

The temporal approach to organizational theory sees change as ubiquitous in organizational life (Roe et al., 2012). This is true for individuals, groups and organizations. From this perspective, phenomena should be studied as they progress and change through time. Roe et al. (2012) describe three objectives for temporal research: describing temporal phenomena, analysing the temporal and casual relationships, and uncovering long-term constancy and change. Change occurs over a time continuum; therefore, for a better understanding of the changing phenomenon, it is important to determine the timing of the change, and the temporal context (Sonnentag, 2012).

Timing relates to the question of when things happen. Mitchell and James (2001) argue that although causal relationships are determinant for organizational theory, the timing and duration of those relationships is also important in order to understand the nature of phenomena. Zaheer, Albert and Zaheer (1999) talk about five different time scales or intervals associated with organizational phenomena: existence, validity, observation, recording, and aggregation intervals. The *existence interval* reflects the length of a phenomenon; the *validity interval* is the period in which the phenomenon is meaningful, for example, a soccer season in which each game represents a phenomenon; the *observation interval* represents the period that proximally impacts the phenomenon, for instance, the planning phase of an action phenomenon; the *recording interval* defines the shorter periods within a phenomenon that give meaning to its understanding, as with the length of the different phases of team dynamics described by Kowzlowski et al. (2009); finally, the *aggregation interval* reveals a methodological choice regarding the time scale that defines the aggregation of the information recorded, for theoretical interpretation. The viewpoint of Zaheer et al. (1999) is that the same phenomenon can mean different things when looked at through different time scales.

The *temporal context* is an environmental stimulus "that is present when a behaviour of interest happens and this affects the social and economic relationships around organizational behaviour" (Sonnentag, 2012, p. 363). There are key contextual conditions promoting the effect of time on the unfolding of organizational activities, such as trends, technological movements, or organizational changes (Johns, 2006). In one sense, the temporal context can be seen as a close concept to the notion of validity interval developed by Zaheer et al. (1999), and might reflect a boundary condition of a theory (Sonnentag, 2012). However, it can also be seen as providing depth through contextualization. For example, Bligh, Kohles and Meindl (2004) studied changes in political speech and the emergence of a more charismatic rhetorical language after the crisis of 9/11. Also, economic time, reflecting positive and negative business cycles, has significant impacts on organizational research. In this vein, Andrade and Duarte (2011) verified that the 2007 financial crisis gained volume when it hit Portugal, and one of the consequences was a migration wave of young workers that led to organizational inefficiencies. Finally, individual contextual time is also determinant for organizational research, in the sense that past experiences influence present thoughts, feelings, and actions (Sonnentag, 2012).

Also salient to this matter is the concept of entrainment. McGrath and Rotchford (1983) introduced the term *entrainment* in social and organizational behaviour, and defined it as the "capturing and modification of human activity cycles by various social customs, norms, and institutions" (p. 78). There are shared social cycles at several levels. For example, weekly cycles comprising workdays and weekends, or organizational cycles consisting of periods between results disclosure. The activity of individuals entrains to these cycles. Ancona and Chong (1996) built on MacGrath and Rotchford's (1983) work and propose that entrainment can be obtained through adjustments to the tempo and/or phase of an activity in order to obtain temporal synchronization with other activity. This entrainment can be adopted by individuals, groups or whole organizations. The concepts of tempo and phase become, therefore, salient. *Tempo* is the time a cyclical activity takes to be executed, while *phase* signifies a certain stage in the cycle or a part of an activity cycle (Pérez-

Nordtvedt, Payne, Short, & Kedia, 2008). With strong implications for organizational performance, a misfit between organization and environment activity cycles can occur either by differences in the tempo or in the phase. Pérez-Nordtvedt and colleagues (2008) described the different implications for the organization if the misfit occurs in different combinations of tempo and phase. The authors propose four types of tempo and phase fit: *full entrainment* exists when both tempo and phase are synchronized, which promotes high levels of organizational performance; when there is a misfit in the phase, organizations are *out-of-phase*, and organizational actors must try to align the timing of activities with the environment if they want organizational performance to recover from below normal; when the misfit is in the tempo, the organization has a *tempo misfit*, and managers must accelerate or decelerate organizational activities to increase performance; finally, if both elements are out-of-fit, there is a *full temporal misfit*, and both actions must be implemented.

Summary

As George and Jones (2000) emphasise, not to integrate a temporal dimension into the study of organizational phenomena is to fail to fully understand them. There are different conceptions of time with different impacts on how an organizational phenomenon is interpreted. Different actors have different perceptions of time, and different roles can be performed in relation to time. Moreover, the way phenomena change over time is a fundamental aspect to understanding its nature. This work integrates time in the interpretation of the adaptation phenomenon, bringing the notion of improvisation into its dominion, in an attempt to understand team adaptation within a temporal context of extreme time scarcity. Not only do we provide a temporal context that allows a sounder understanding of the phenomenon, but we also demarcate the timing of changes provoked by unforeseen disruptions.

AIM AND OVERVIEW OF THE THESIS

This thesis aims to understand the team adaptation process under contexts of extreme time scarcity, forcing teams to improvise solutions to unforeseen disruptions. Our purpose is to discuss this phenomenon by looking at team adaptation through a temporal lens, which implies the integration of organizational improvisation and team adaptation literatures. From this integration we developed the construct *team improvised adaptation*, which reflects team improvisational actions in response to unexpected events, as a distinct construct from other forms of adaptation and improvisation, namely *team preemptive adaptation* and *team purposive improvisation*. In particular, we want to understand the role of temporal factors, such as shared temporal cognitions, shared mental model similarity, and team temporal personality, on the way teams simultaneously adapt to unpredictable triggers and improvise solutions to cope with these changes; and also how these factors interact with in-action and transitional reflexivity in promoting team performance and team learning. We delve into the analysis of team improvised adaptation in order to understand the reasons for the adoption of such processes, and how these processes unfold over time. In order to do so, we performed one theoretical and four empirical studies (three quantitative and one qualitative). Figure 1.4 describes the thesis roadmap that started with the field definition in study 1; then, in study 2, moved to the validation of a narrower framework comprising two distinct adaptation processes: team preemptive adaptation and team improvised adaptation; studies 3 and 4 focused on team improvised adaptation, and explored diverse temporal influencing factors leading to team performance and team learning; and study 5 delved into the construct to develop a sounder knowledge of its dynamics.

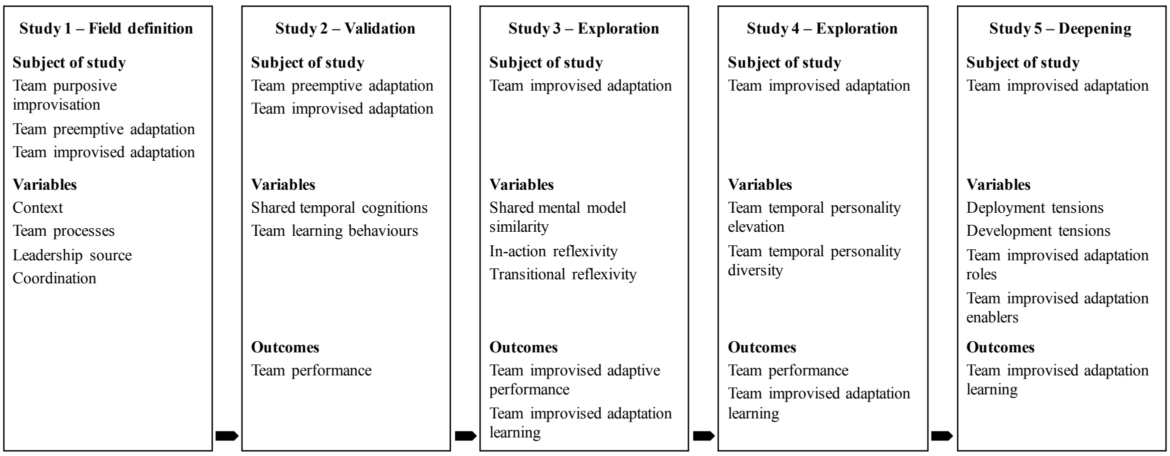

Figure 1.4. Thesis roadmap: subjects of study, variables, and outcomes

In order to develop a comprehensive assessment of team improvised adaptation, and produce solid knowledge of the construct from a temporal perspective, several research questions and diverse methods were used throughout the 5 studies. Table 1.4 describes the research questions and methodologies used in each of the five studies.

Table 1.4. Studies, research questions, and methodologies of the thesis

Study	**Research questions**	**Methodology and data analysis strategy**
Study 1	How can a team effectively manage an adaptive situation in which time is so scarce that design and execution merge and teams have to improvise? How are these team processes different from pure improvisation processes, and from pure adaptation processes? What are the processes, leadership sources, and coordination mechanisms involved in these constructs?	Integrative literature review Theoretical development
Study 2	Depending on the timing of the trigger, does the team adaptation process change? Do these different processes have the same impact on team performance? Under what conditions do they have different impacts?	Scale Validation Exploratory Factor Analysis in SPSS Confirmatory Factor Analysis in R Structural Equation Modelling in R Moderated Mediation in SPSS using PROCESS Macro
Study 3	Do shared mental model similarity and in-action reflexivity interact in predicting team improvised adaptive performance? Do shared mental model similarity and transitional reflexivity interact in predicting team improvised adaptive performance? Do shared mental model similarity and in-action reflexivity interact in predicting team improvised adaptation learning? Do shared mental model similarity and transitional reflexivity interact in predicting team improvised adaptation learning?	Experimental Study with two experiments 2x(2x2) Ordinary Least Square Regression Analysis in SPSS Moderations analysis in SPSS with PROCESS Macro Random Coefficient Modeling in R
Study 4	Does team improvised adaptation mediate the relationships between team present-orientation elevation and team performance? Does team improvised adaptation mediate the relationships between team future-orientation elevation and team performance? Does team present-orientation diversity positively contribute to team improvised adaptation learning? Does team future-orientation diversity positively contribute to team improvised adaptation learning	Experimental Study (2x2) Mediation analysis in SPSS with PROCESS macro Random Coefficient Modeling in R Confirmatory Factor Analysis in R
Study 5	Why do teams improvise? What are the different steps a team must take when engaging in team improvised adaptation? What are the elements ensuring the effectiveness of these steps? What kind of knowledge can be acquired as an outcome of team improvised adaptation processes?	Qualitative study with semi-structured interviews Inductive and abductive inference using the software program ATLAS.ti version 8.1.0 Grounded theory

The *theoretical study* deconstructs and recombines team improvisation and team adaptation, and develops a framework – the *team improv-adaptation space* – which comprises three different constructs: team purposive improvisation, team preemptive adaptation, and team improvised adaptation. *Team purposive improvisation* refers to an improvisational process in which teams improvise in the pursuit of purposive triggers, and not as a reaction to an unforeseen disruption; *team preemptive adaptation* is a pure team adaptation process in which teams react to a disruption by preparing a plan before its execution; finally, *team improvised adaptation* reflects an adaptation process in which teams do not have time to prepare a plan prior to its execution and, therefore, have to merge design and implementation. We then develop a model that describes how the three phenomena unravel over time through different transition and action phases (Marks et al., 2001). We focus on the contextual characteristics of each construct in each phase of the process, the different team performance processes that occur in those phases, the respective leadership sources, and the coordination mechanisms most utilized by teams to ensure an adequate response to the demands of the task. To introduce the new constructs and develop our dynamic model in a broad configuration that points direction to future research, we use a proposition-based style (Cornelissen, 2017), most common within theoretical papers.

In *study 2* we present and empirically validate the *team adaptation temporal framework* encompassing *team preemptive adaptation* and *team improvised adaptation*. We also develop a measurement instrument for each of the constructs and, simultaneously, analyse the combined effects of shared temporal cognitions and team learning behaviours in both facets of the framework, and how they interact to predict team performance. To do so, we performed four different studies with three different samples: two samples of undergraduate students, and one sample of full-time workers. Our results suggest that different types of team adaptation have distinct impacts on team performance, and also that team learning behaviours moderate the mediation that team improvised adaptation establishes between shared temporal cognitions and team performance. The more teams engage in learning behaviours, the more this mediation is evident, contributing to increased team performance.

Study 3 is an experimental study that aims to understand the role of shared mental model similarity and two forms of reflexivity – in-action and transitional reflexivity – on team improvised adaptive performance and on team improvised adaptation learning. We performed two experiments and in each experiment we manipulated two variables. In experiment one we manipulated shared mental model similarity and in-action reflexivity;

and in experiment two we manipulated shared mental model similarity and transitional reflexivity. Experiment one was conducted with a sample of undergraduate students and experiment two was conducted with a sample of full-time workers. Both team improvised adaptive performance and team improvised adaptation learning were objective measures, and in order to measure team improvised adaptation learning we used a longitudinal design with three time points. Our findings indicate that both shared mental model similarity and in-action reflexivity have positive impacts on team improvised adaptive performance. The results also suggest that shared mental model similarity works as a substitute if teams fail to reflect between action phases, and that both positively impact team improvised adaptation learning.

Study 4 is also experimental, and analyses one of the experiments that was also analysed in study 3: the experiment two, which was conducted with a sample of full-time workers. The goal of this study was to analyse the influence of team temporal personality composition, particularly the traits of future-orientation and present-orientation, on team improvised adaptation, and how they interact to predict team performance and team improvised adaptation learning. Both present- and future-orientation were composed at team level through elevation and dispersion methods, resulting in four different constructs: team temporal personality elevation of future-orientation, team temporal personality elevation of present-orientation, team temporal personality diversity of future-orientation, and team temporal personality diversity of present-orientation. The findings reveal that team improvised adaptation mediates the relationship between future-orientation elevation and team performance, and that future orientation diversity positively impacts team improvised adaptation learning. Moreover, the results suggest that future-orientation elevation limits the capacity of a team to learn from improvised adaptation processes, and that future-orientation diversity has a negative effect on team performance. The study did not reveal any relationship between present-orientation and the other variables studied.

Finally*, study 5* is a qualitative study that used inductive and abductive reasoning to perform a grounded theory method, aiming to understand why and how do teams engage in improvised adaptation processes. We conducted fifty semi-structured interviews to mid and top managers in diverse sectors, who had experienced team improvised adaptation situations. The study uncovers two tensions faced by teams subject to contexts of improvised adaptation: one deployment tension between an inertia to maintain pre-established routines, and improvisational pressures, in particular business pressure, time pressures, and unpredictability; and a development tension between the need to plan and the need to start acting immediately. The study also reveals team improvised adaptation roles that must be played if teams want to be effective; and team improvised adaptation enablers that allow the smooth unraveling of improvised adaptation processes. Finally, the study describes three learning outcomes that derive from a post-action reflective process: solutions to prevent future occurrences, solutions to strengthen improvisational performance, and positive improvisation by-products.

The next chapters will present these studies and chapter 7 will present a general discussion of the whole thesis providing theoretical and practical implications, presenting the major limitations of this work, and suggesting future research directions.

CHAPTER 2.

TEAM IMPROV-ADAPTATION SPACE: DECONSTRUCTING AND RECOMBINING TEAM ADAPTATION AND TEAM IMPROVISATION FROM A PROCESS PERSPECTIVE

ABSTRACT[1]

Teams can adapt with time to prepare an action, they can adapt by improvising a solution, but they can also improvise for purposive reasons. The literature has generally neglected the differences between these three processes. Building on team adaptation and team improvisation literatures, we develop a time informed conceptual model that helps to understand how teams can effectively engage in different processes that require team or task adjustments. By acknowledging the defining nature of time in team processes, and exploring the temporal stream of team improvisation and team adaptation, we expand both literatures, increasing construct clarity and extending their nomological network.

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INTRODUCTION

Unpredictability and time scarcity are driving forces in todays' organizational life (Baard, Rench, & Kozlowski, 2014). More than ever, the ability to adapt and exploit an environment that is unpredictable and rapidly changing, can be a differentiation factor (Crossan, Lane, White, & Klus, 1996). In order to be effective in dynamic and mutable environments, teams must adapt (Burke, Stagl, Salas, Pierce, & Kendall, 2006) and, if time is limited, they ought to improvise (Cunha, Miner, & Antonacopoulou, 2016). However, in order for the improvisation process to result in lasting knowledge that can be incorporated into a team's routine, it is fundamental to integrate the improvisation and the adaptation literatures. In the last two decades, both literatures have sought to explain how teams can cope and thrive in such challenging environments (e.g. Lei, Waller, Hagen, & Kaplan, 2016; LePine, 2003; Barrett, 1998; Hadida, Tarvainen, & Rose, 2015; Kamoche & Cunha, 2001), but only a combination of both perspectives can truly delve into these phenomena and reliably reveal the dynamics of team processes facing changeable contexts when there is an extreme time scarcity.

Improvisation is the deliberate and substantive fusion of design and execution of a novel production (Cunha et al., 2016; Miner, Bassoff, & Moorman, 2001), and team adaptation can be defined "as adjustments to relevant team processes (i.e., action, interpersonal, transition) in response to the disruption or trigger giving rise to the need for adaptation" (Maynard, Kennedy, & Sommer, 2015, p. 656). Some authors have established a link between the two constructs, proposing that improvisation can be used to manage in highly mutable business environments, and works as an adaptation process to changing needs and conditions (Crossan et al., 1996). Abrantes, Passos, Cunha, & Santos (2018) proposed that when teams react to a disruption merging design and execution, they are adapting and improvising at the same time, and called this process team improvised adaptation. However, most of the research in one literature has overlooked the advances in the other, except to detach the two from each other as distinct constructs, particularly on the side of improvisation (e.g. Cunha, Cunha & Kamoche, 1999; Miner et al., 2001; Moorman & Miner, 1998a). In line with Abrantes and colleagues' (2018) perspective, our argument is that, because of the conceptual distancing, neither of the literatures has yet thoroughly addressed team adaptation and team improvisation in a conceptual body that fully explores the fine grain that derives from combining both constructs.

We propose a framework, the *team improv-adaptation space*, that combines team adaptation and team improvisation, resulting in three different processes: *team purposive improvisation* (TPI), *team preemptive adaptation* (TPA), and *team improvised adaptation* (TIA). Although the two literatures have been dealing with these phenomena, neither has yet really explored them in depth as separate concepts. The adaptation literature has focused exhaustively on the adaptation process (Burke et al., 2006; Maynard et al., 2015), but has overlooked its temporal dimension, treating the temporal distance between design and execution as irrelevant. It has not considered what happens to the process when time is so scarce that teams have to plan and execute simultaneously. In improvisation, time is a central condition, which augments the accuracy of its description (George & Jones, 2000), but the improvisational process itself has been neglected. The result is that we do not know what happens when teams are improvising as a reaction to a disruption, i.e. we lack knowledge of the process of adaptation as action unfolds, and the extent to which this process is different from purposive improvisation and preemptive adaptation. In this article we expand the team adaptation temporal framework proposed by Abrantes et al. (2018), by integrating the concept of team purposive improvisation into the framework, and develop a time-informed model of the team improv-adaptation space, grounded on Marks, Mathieu, and Zaccaro's (2001) temporal rhythm of team task accomplishment, consisting of alternating phases of transition and action. We start by discussing temporal factors, or antecedents, and how they influence the three constructs, and then we explore different processes, leadership sources, and coordination mechanisms in different phases of the temporal model.

With this article we answer the following questions: How can a team effectively manage an adaptive situation in which time is so scarce that design and execution merge and teams have to improvise? How are these team processes different from pure improvisation processes, and from pure adaptation processes? What are the processes, leadership sources, and coordination mechanisms, involved in these constructs? The main contributions of this article are twofold: first, the development of the conceptual resolution of team adaptation and team improvisation; second, the exploration of a time-informed conceptual model of TPI, TPA, and TIA processes. By combining the adaptation and improvisation perspectives, we contribute to team improvisation literature by augmenting knowledge about the improvisational process, and to team adaptation theory by refining the concept with the integration of the role of time into team adaptation phenomena. We also contribute to solving a practical challenge that contemporaneous teams face in effectively managing highly unstable and high-speed environments, particularly when time is so scarce that planning and acting blend. Autonomously, the adaptation and improvisation literatures have not yet been able to answer this question. Combined, they complement each other and create a more comprehensive theoretical body. Moreover, we build on both theories by helping to determine the processes, the leadership sources, and the coordination mechanisms involved in different temporal phases of the three concepts, aiming to optimize them and increase their efficacy. Grounded on the notion that in a changing environment teams have the need for continuous reflection and contemplation, so that they can apply the best action (Hoegl & Parboteeah, 2006), we propose that in the special case of processes within the team improv-adaptation space, given the occurrence of relevant processes adjustments, the need to pause and reflect becomes paramount if teams wish to produce effective results. This attention is visible in all phases of our model, especially to the action phases.

In the next section we lay out the theoretical background of team adaptation and team improvisation. We then develop a framework that explores the integration of purposive improvisation into the team adaptation temporal framework. We move forward by developing a theoretical model based on a temporal dimension to understand the flow of TPI, TPA, and TIA over time.

ADAPTATION AND IMPROVISATION IN TEAMS

Maynard and colleagues' (2015) definition of the team adaptation process focuses on the defining nature of the reaction to some sort of disruption in relation to the adaptation phenomenon, i.e. team adaptation is always a reaction to a contingency. This perspective is also found in Burke and colleagues' (2006) definition of team adaptation as a response to a salient cue that is external to the team's will. However, these definitions do not include the role of time.

Improvisation incorporates three fundamental features: *extemporaneity* – convergence of design and performance (Baker, Miner, & Eesley, 2003; Cunha et al., 1999; Weick, 1998), in which individuals compose their actions while they execute them (Moorman & Miner, 1998b), usually because they are constrained by time pressures (Crossan, Cunha, Vera, & Cunha, 2005); *novelty* – the production of something new (Miner et al., 2001; Vera & Crossan, 2005); and *intentionality* – a deliberate act performed by organizational members (Crossan et al., 2005; Cunha, Kamoche, & Cunha, 2003), which results from reflecting while acting (Yanow & Tsoukas, 2009), rather than being an intuitive response to surprises or disturbances. Earlier research defends that although sustained by individual improvisation, "team improvisation is more than the sum of individual improvisations because the joint activities of individuals create a collective system of improvisational action" (Vera & Crossan, 2005, p. 204). It is the interaction between individuals when faced with emergent situations that produces collective improvisation (Magni & Maruping, 2013). Building on this perspective and on Cunha et al.'s (2016) definition of improvisation, team improvisation can be defined as a collective system of deliberate and substantive fusion of the design and execution of a novel production.

Why do teams adapt and improvise?

Teams adapt as a response to a trigger or disruption (Maynard et al., 2015). The authors identify two types of adaptation triggers: task-based and team-based triggers. Task-based triggers concern what the team is doing, and team-based triggers concern the means used to undertake a task. If a team member misses an appointed team task, this will prompt the team to adapt, and configures an example of a team-based trigger. Instead, if a team misses a tool that is central for task achievement, then the team faces a task-based trigger. As far as improvisation is concerned, and although researchers have advanced several aspects – both internal and external to organizations – that explain the need for improvisation, it is pertinent to establish the distinction between *purposive* and *contingent* triggers, in order to better address the difference between improvisation and adaptation (Table 2.1).

Contingent triggers

Improvisation often comprises dealing with the unexpected (Hadida et al., 2015; Weick, 1998), which implies an event that cannot be addressed with previously established routines and procedures (Kamoche, Cunha, & Cunha, 2003; Moorman & Miner, 1998a). This configures a contingent trigger, which derives from circumstances external to the will of the team. Weldon (2000) noted that team members often react to problems as they occur in order to improve products or processes. Both task and team triggers represent contingent forms of triggers. Outside the organization, changes in the external environment (Cunha et al., 1999), market turbulence (Akgün, Byrne, Lynn, & Keskin, 2007), and technological turbulence (Pavlou & El Sawy, 2010), are three of the main reasons cited. There are also contingent triggers that are internal to the team, such as the presentation of a new vision requiring emergent changes and, therefore, representing a motive to improvise (Crossan et al., 1996). However, it is still relevant to question why teams improvise in the face of a contingent trigger. They call for action because, at that moment, it matters (Yanow & Tsoukas, 2009), and because “when organizational order collapses, a substitute [must be] invented immediately” (Weick, 1993b, p. 640) in order to avoid paralysis.

Purposive triggers

A perspective that reveals a more defiant improvisation trigger can be found in Cunha, Clegg, Rego, and Neves (2014), who argue that sometimes people improvise as a reminder of their fundamental freedom, as a way to prove to themselves that they can exert their agency. Orr’s (1996) research focused on how machine repair technicians decided to improvise repair solutions outside organizational instructions, as a way to nurture their own self-image as professional technicians or powerful agents (Giustiniano, Cunha, & Clegg, 2016). Organizations may also use improvisation as a form of provocation that challenges organizational assumptions, aiming to unbalance what is usually structured and taken-for-granted (Cunha et al., 2014). These situations mark the presence of purposive triggers that do not arise from any particular circumstance, but only from the team’s will. Nonetheless, teams can also make changes to their structure or to their strategy, before action takes place, for purposive reasons, such as the need to show proactivity. However, these reasons do not constitute disruptions (Maynard et al., 2015) or cues (Burke et al., 2006), and therefore the embedded process is not an adaptation one.

Table 2.1. Rationale for Improvisation

Contingent triggers	Purposive triggers
Changes in the external environment	Need to learn new skills
Market and/or technological turbulence	Need to get positive feedback
Unpredictable environmental shock	Need to get the feeling of transcendence
Unexpected problems and/or opportunities	Resistance and deviation
Temporal gaps	To challenge organizational assumptions
New vision that requires emergent changes	To nurture a self-image of independence

How do teams adapt and improvise?

Either in team adaptation or in team improvisation, members act interdependently through adaptation or improvisation to achieve a collective goal, which is to perform a task under the constraints of the respective trigger. From this perspective, team adaptation and team improvisation are team processes (e.g. Cunha et al., 1999; Maynard et al., 2015) which can be defined “as members' interdependent acts that convert inputs to outcomes through cognitive, verbal, and behavioural activities directed toward organizing taskwork to achieve collective goals” (Marks et al., 2001, p. 357).

The improvisation literature has given little attention to the improvisational *process* itself, but the literature indicates that for adaptation to happen, a series of process mechanisms must take place in order to accommodate the changes that occur either in the task or in the team (Baard et al., 2014). These mechanisms were the focus of Burke and colleagues (2006), who propose the concept of an adaptive cycle that starts with an assessment of the situation, followed by the formulation of a new plan and its execution, resulting in team learning. Maynard et al. (2015) propose a team adaptation model that integrates the different processes introduced by Marks and colleagues (2001), and defend that different types of triggers interact with different types of processes – task-based triggers induce action processes, and team-based triggers induce interpersonal processes. Lei and colleagues (2016) note that in nonroutine situations, teams plan after the beginning of the task, altering their interaction patterns, and that the relationship between planning and team adaptiveness is curvilinear.

Although exhaustive, these models do not truly explore what happens when time scarcity forces the plan to collapse with the execution. What kind of planning happens when teams do not have time to plan? Under the severity of time scarcity, does the severity of the trigger still matter? We argue that those questions can be answered only by integrating a temporal dimension, characteristic of improvisational processes, into adaptation models.

The temporal dimension

The influence of time on organization theory has an ontological quality (George & Jones, 2000), meaning that the temporal dimension should be addressed so more light can be brought into causal processes (Mitchell & James, 2001). Two ways by which time can be conceptualized are *time lags* and *time-related constructs* (Sonnentag, 2012). The first relates to when things happen, and the second relates to constructs such as time perspective (Waller, Conte, Gibson, & Carpenter, 2001), defined as a nonconscious process in which social experiences are allocated to time frames that help to give meaning to those events (Zimbardo & Boyd, 1999), or shared temporal cognitions as “the extent to which group members have congruent mental representations of the temporal aspects of a specific group task" (Gevers, Rutte, & Van Eerde, 2006, p. 54). We base our position on the standpoint that in order to accurately describe the phenomena of team adaptation and team improvisation, a temporal dimension must be incorporated. We focus on the timing of the trigger that unleashes the adaptation process (Abrantes et al., 2018), and on temporal antecedents of team adjustment processes.

TEAM IMPROV-ADAPTATION SPACE

Teams can adapt to a disruption having enough time to prepare a new plan prior to its implementation, or teams do not have time to prepare such plan and they have to design the new strategy and execute it simultaneously. In the first situation teams adopt preemptive adaptation, and in the second teams engage in improvised adaptation (Abrantes et al., 2018) (Figure 2.1). Abrantes and colleagues (2018) propose that the two constructs consist on the team adaptation temporal framework, and argue that have different antecedents and different outcomes. Although this framework refines the concept of team adaptation in a temporal perspective, it does not acknowledge improvisation in its full extent by not considering improvisation as the result of a purposive trigger. We propose a framework that fully integrates team improvisation and team adaptation – *team improv-adaptation space*.

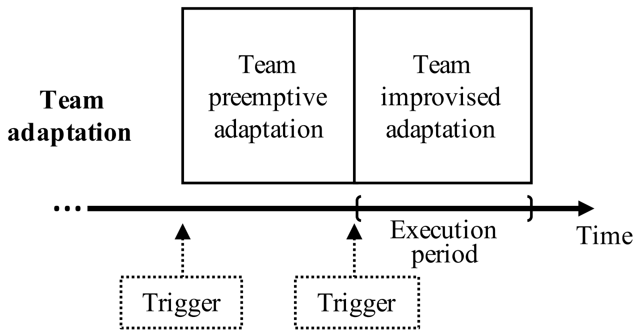

Figure 2.1. Team adaptation temporal framework (adapted from Abrantes, Passos, Cunha, & Santos, 2018)

Team improvisation based on the type of trigger

Team improvisation can be deployed by a purposive trigger or by a contingent trigger (Figure 2.2). The type of trigger leads to two different modes of improvisation that are fundamentally different. A contingent trigger is independent of the team's will and activates a reactive process; a purposive trigger depends only on the team's motives to adopt the improvisational process and does not activate a reactive process. When teams react to contingent triggers their goal is to maintain team's performance under unexpected changes. This process configures what Abrantes et al. (2018) defined as team improvised adaptation. On the other hand, when teams improvise purposively, it may be to the benefit or detriment of the organization and in favour of only the team. We call this process *team purposive improvisation*. The covert improvisation type, which is an agent's reaction to the *status quo* (Cunha et al., 2014) configures this type of improvisation, which involves some level of defiance to the hierarchy, or working "under the radar".

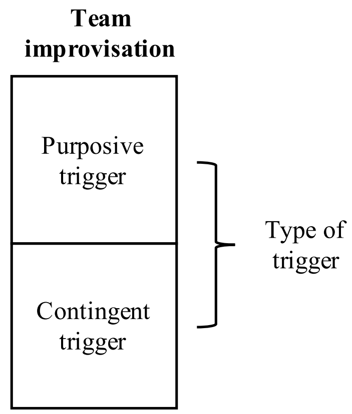

Figure 2.2. Team improvisation deconstructed: Trigger dimension

Defining the team improv- adaptation space

By integrating purposive improvisation into the team adaptation temporal framework (Figure 2.3), we define the *team improv-adaptation space* comprising three phenomena: *team purposive improvisation*, *team preemptive adaptation*, and *team improvised adaptation*. *Team purposive improvisation* (TPI) strictly configures a team improvisational process, and consists on the convergence in time of design and execution, driven by a purposive trigger. Teams improvise *not* as a response to a contingency, but because they will take some advantage from the improvisational action. For example, they believe they will acquire new skills (Cunha et al., 1999) or they show some level of resistance to the present establishment (Cunha et al., 2014).

Team preemptive adaptation (TPA) can be defined as team adaptation when design precedes execution (Abrantes et al., 2018). As long as the design of the new approach precedes the action phase (Marks et al., 2001), these situations do not configure any kind of improvisation, but strictly team adaptation processes. A situation that illustrates this process was also portrayed in Bechky and Okhuysen (2011) study, in which a flood shorted out the electricity on a film set, halting the entire production, requiring the film crews to adapt. Although the sun was setting and time was scarce, they had enough time to rapidly draw up a new plan and execute it immediately. They did not need to merge planning to execution.

Team improvised adaptation (TIA) consists on team adaptation when design and execution merge, or team improvisation as a response to a contingent trigger (Abrantes et al., 2018). This process represents the overlap of improvisation and adaptation. It is an improvisational process because there is a time convergence between design and execution, and it is also an adaptation process since it is a response to a contingent trigger. It is worth mentioning that purposive triggers do not give rise to adaptive processes because they are neither disruptions (Maynard et al., 2015) nor cues (Burke et al., 2006).

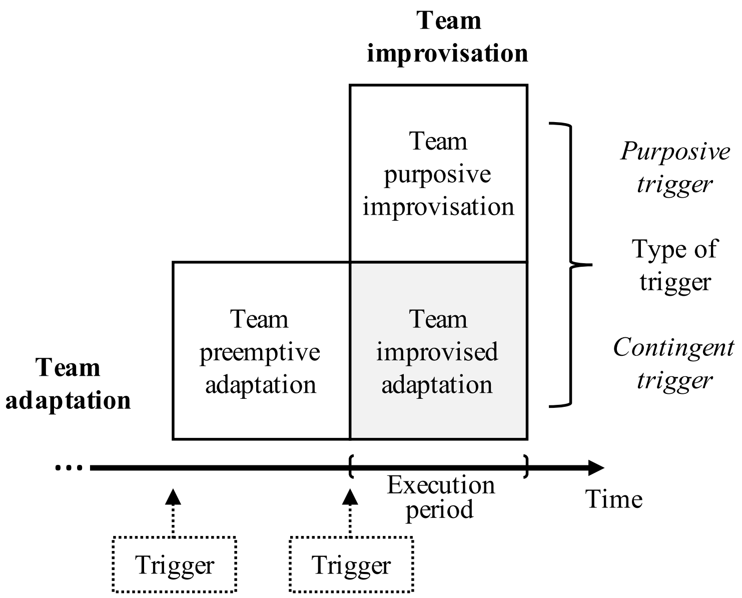

Figure 2.3. Team adaptation and team improvisation recombined: Team improvised adaptation

TEMPORAL STREAM OF TEAM IMPROV-ADAPTATION SPACE

In this section we examine the temporal flow of team improv-adaptation space. We start by analysing the temporal team factors that influence the adoption of the three different processes. We focus on homogeneity and/or heterogeneity among team members regarding specific temporal personality traits, namely time perspective, and also on shared temporal cognitions. Then we explore a temporal flow through Marks et al.'s (2001) transition and action phases, delving into the context, the processes, leadership sources, and coordination mechanisms for each of the phases in the model.

Team processes are intrinsically dynamic, in which team cognitive, motivational, affective, and behavioural processes emerge and change over time and across different contexts (Kozlowski, 2015). The crossing of each phase with each facet of the team improv-adaptation space has its own context implying different processes. At each of these crossings, teams face different challenges that will result in teams adopting different leadership sources (Morgeson, DeRue, & Karam, 2010), being either formal or informal. Formal leadership is exerted by formally assigned leaders that belong to the team, and informal leadership occurs when leaders emerge informally among the team or when leadership responsibilities are shared among team members (Morgenson et al., 2010). Moreover, these different challenges will also result in the use of different coordination mechanisms. Different levels of task routineness imply different coordination mechanisms, either explicit or implicit (Rico, Sánchez-Manzanares, Gil, & Gibson, 2008). Explicit coordination mechanisms, such as planning or communication, are intentionally used by teams to manage interdependencies (Espinosa, Lerch, & Kraut, 2004; Rico et al., 2008), and implicit coordination mechanisms are used when team members dynamically adjust their behaviour as a result of anticipating their colleagues' actions and task demands, without openly communicating their intentions (Rico et al., 2008). Figure 2.4 depicts a summary of the whole model allowing a basic graphic perspective of the temporal stream of the framework.

Temporal antecedents

Although rich in antecedents [for example, a group's collective efficacy or a group's shared belief in its capacity to perform certain activities plays a role as an adaptation antecedent (Chen, Thomas, & Wallace, 2005; Maynard et al., 2015), and team cohesion and mutual support are determinants for improvisation (Crossan et al., 2005; Crossan & Sorrenti, 1997; Magni, Provera, & Proserpio, 2010)], the literatures do not refer to temporal factors. Given the defining nature that time has on the team improv-adaptation space, we consider these aspects determinant to understand the true nature of the constructs. We will use the concepts of temporal personality (Ancona, Okhuysen, & Perlow, 2001b), in particular that of time perspective (Waller et al., 2001), and shared temporal cognitions (Gevers et al.,

2006) to identify the temporal characteristics that most influence the adoption of the different process of our framework. Organizational literature has been mainly attentive to present and future time perspectives (Waller et al., 2001) and because planning and execution are paramount in both improvisation and adaptation, the present work will follow the same orientation.

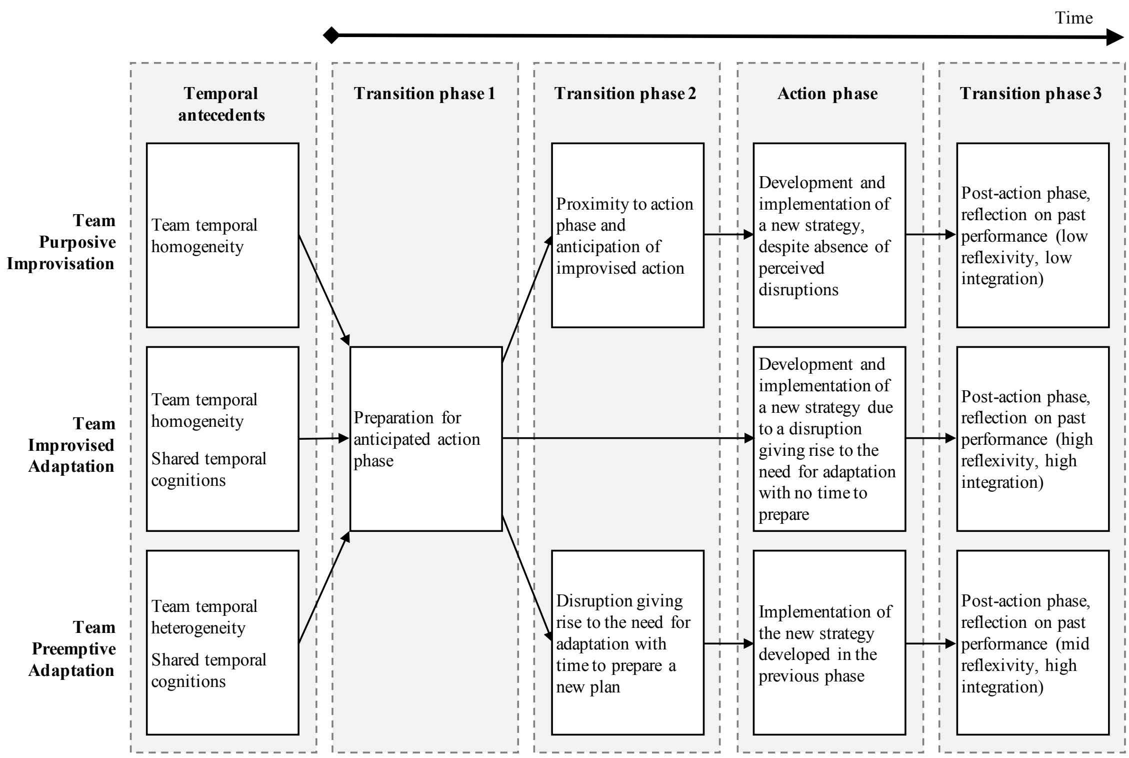

Figure 2.4. Summary of temporal stream of team improvisation/adaptation framework

Shared temporal cognitions

Shared temporal cognitions play a determinant role in team adaptation (e.g. Santos, Passos, & Uitdewilligen, 2016a). When teams have similar views about the temporal demands of a task, they should more likely achieve temporal synchronization (Bartel & Milliken, 2004), which becomes pervasive when time is so scarce that teams have to simultaneously design and execute a new plan. Only a common perception of sequence, duration, pace, and deadlines of a given task will allow a team to effectively engage in a process of team adaptation in the presence of a disruption demanding that adaptation. On the other hand, when teams are purposively improvising, they are not reacting to a disruption but "may be seeking to find and then explore ways of thinking and working that disrupt habitual ways" (Cunha et al., 2014, p. 367); this lack of a significant disruption makes the need for temporal synchronization less important since teams are less constrained by time pressures.

Proposition 1. The more a team shares temporal cognitions, the more successful that team will be when engaging in a) team improvised adaptation processes, and b) team preemptive adaptation processes.

Present and future time perspectives

A person's time perspective establishes the grounds on which his or her goals and expectations are articulated, and defines that person's risk-taking levels (Zimbardo & Boyd, 1999). Bartel & Milliken (2004) refer to time orientations and defined them as "cognitive frames that people use to interpret experienced events, and thus help give order, coherence and meaning to their personal and social experiences" (p. 91). Although present and future time perspectives might seem to stand in opposition, they do not represent the ends of a temporal personality continuum, but autonomous traits of a person's temporal personality (Mohammed & Nadkarni, 2011; Zimbardo, Keough, & Boyd, 1997). In this sense, a person can be simultaneously present and future oriented.

People with a present orientation have a risk-taking attitude toward time and life, and tend to act impulsively (Zimbardo & Boyd, 1999). This characteristic might favour the adoption of improvisation processes. On the contrary, adopting immediate solutions (Harber, Zimbardo, & Boyd, 2003) and taking risks (Zimbardo & Boyd, 1999), are not activities cherished by future oriented people. Nonetheless, achieving goals is one of their fundamental motivations, and they are willing to act now on behalf of future success (Taylor & Wilson, 2016). For these people, immediate satisfaction is less significant than wasting time when pursuing future goals (Boniwell & Zimbardo, 2004). They act now to collect later. Therefore, future oriented teams will be willing to immediately adopt actions if they believe it will bring them future benefits, i.e., they will engage in improvisational process to achieve their future goals.

Team temporal homogeneity and temporal heterogeneity

Although time perspectives are individual personality traits, they can be composed at a team level through an additive model (Chan, 1998), that Neuman, Wagner, and Christiansen (1999) called *elevation*, which can be achieved by summing or averaging lower level scores; and can also be composed through a dispersion model (Chan, 1998), referred to by Neuman et al. (1999) as diversity, consisting of the differences among team members. We refer to these composition models as team temporal homogeneity (additive model or elevation) and team temporal heterogeneity (dispersion model or diversity).

While the literature on team homogeneity and team heterogeneity has been profuse, little has been said regarding team temporal personality. Nonetheless, some assertions have been made. It has been argued that temporally heterogeneous teams are better suited to deal with complex and uncertain environments demanding a set of diverse team skills (Eisenhardt, 2004). However, this temporal diversity might create coordination difficulties (McGrath, 1991). Bartel and Miliken (2004) argue that temporal heterogeneity is positive when teams have to cope with short-term and long-term perspectives simultaneously, but warn that extreme diversity levels might increase conflict and create uncertainty. Also, temporally heterogeneous teams tend to use their time reducing temporal clashes (Mohammed & Nadkerni, 2011), which reduces time available to develop new strategies and execute them. Given these assertions, we propose that the time teams have for preparing a new plan prior to its execution serves as a boundary condition for the benefits of temporal homogeneity or heterogeneity. When teams have time to prepare a new plan before its execution, the time lost solving temporal misalignments is compensated by the positive aspects of temporal diversity. On the other hand, when time is scarce and teams have to plan and execute at the same time, coordination becomes vital and temporal homogeneity surpasses the benefits of heterogeneity (Bartel & Miliken, 2004). Therefore, we propose the following.

Proposition 2. The temporal personality composition of a team influences the three facets of the improv-adaptation space in way that a) the more homogeneous a team is, the more successful that team will be when engaging in improvisation processes, and b) the more heterogeneous a team is, the more successful that team will be when engaging in preemptive adaptation processes.

Transition phase 1

The trajectory of team process enactment runs through a cycle of sequential transition phases in which teams evaluate and plan future activities, and action phases in which teams perform in a way that directly contributes to the task goal (Marks et al., 2001). As for other team processes, prior to the start of any process of the team improv-adaptation space, there is a transition phase in which teams prepare the anticipated task. This transition phase is performed prior to the call for improvisation or adaptation. We explored the different team processes defined for each phase, following the typology presented in Rosen, Bedwell, Wildman, Fritzsche, Salas, and Burke (2011). In transition phase 1, teams are preparing an action phase that has been anticipated, and they do not yet have the call for improvisation or adaptation (Tables 2.2, 2.3, and 2.4). Therefore, they focus on analysing the mission, specifying and clarifying the task objectives, deliberating a strategy to achieve those targets, and assigning different roles for each member of the team. This phase is characterized by a relatively high level of stability and routine, since improvisation and/or adaptation calls have not yet happened. In such circumstances, there is no need for other sources of leadership than formal leadership. Formal leadership can be defined as a role that "describes the relationship between the manager and subordinates that results in the satisfactory execution of subordinates' assignments and, thereby, the attainment of the important goals of the organizational unit for which the leader is responsible" (Muczyk & Adler, 2002, p. 5). At this stage, the task programing activities are purposely used by teams as explicit coordination mechanisms (Espinosa et al., 2004), elicited by the formal leader through the formal communication channels.

Transition phase 2

At a certain point in the trajectory of team process performance, teams that engage in either improvisation or adaptation processes are subject to the call for the respective processes. Transition phase 2 starts when teams autonomously decide that they will improvise a solution for the anticipated task, although they were not subject to a disruption, or there is a trigger that demands some sort of adaptation and there is time to prepare a new solution. These two situations lead to team purposive improvisation and team preemptive adaptation respectively. Teams that engage in team improvised adaptation do not go through this transition phase because they are subject to a disruption only at the start of the action phase.

Table 2.2. Temporal flow of team purposive improvisation

	Transition phase 1	Transition phase 2	Action phase	Transition phase 3
Context	Preparation for anticipated action phase	Proximity to action phase and anticipation of improvised action	Start of action phase with no perceived disruptions	Post-action phase, reflection on past performance
Processes	Mission analysis Goal specification Strategy formulation: deliberate planning Role ascription	Reflection: questioning of current strategy/mission Role re-ascription Definition of new communication channels	Plan reformulation – In-action reflexivity Implementation of improvised strategy	Performance analysis Delineate teamwork changes
Leadership source	Formal leadership	Emergent leadership	Emergent leadership	Emergent leadership
Coordination	Explicit mechanisms - Formal communication channels	Explicit mechanisms - Informal communication channels	Explicit mechanisms - Informal communication channels	Explicit mechanisms - Informal communication channels

Table 2.3. Temporal flow of team improvised adaptation

	Transition phase 1	Transition phase 2	Action phase	Transition phase 3
Context	Preparation for anticipated action phase		Disruption giving rise to the need for adaptation, no time to prepare	Post-action phase, reflection on past performance
Processes	Mission analysis Goal specification Strategy formulation: deliberate planning Role ascription		Situation assessment Plan reformulation – In-action reflexivity Emergent role re-ascription Implementation of improvised strategy	Goal realignment Plan recapping Performance analysis Delineate teamwork changes
Leadership source	Formal leadership		Shared or emergent leadership	Formal leadership
Coordination	Explicit mechanisms - Formal communication channels		Explicit mechanisms - Emergent communication channels Implicit mechanisms - Structures - Team situation models - Minimal structures – critical elements	Explicit mechanisms - Formal communication channels

Table 2.4. Temporal flow of team preemptive adaptation

	Transition phase 1	**Transition phase 2**	**Action phase**	**Transition phase 3**
Context	Preparation for anticipated action phase	Disruption giving rise to the need for adaptation with time to prepare	Start of action phase	Post-action phase, reflection on past performance
Processes	Mission analysis Goal specification Strategy formulation: deliberate planning Role ascription	Situation assessment Goal re-specification Strategy formulation: contingency planning Role re-ascription	New strategy implementation	Performance analysis Delineate teamwork changes
Leadership source	Formal leadership	Formal leadership	Formal leadership	Formal leadership
Coordination	Explicit mechanisms - Formal communication channels	Explicit mechanisms - Formal communication channels	Explicit mechanisms - Formal/informal communication channels Implicit mechanisms - Structures – Team situation models	Explicit mechanisms - Formal communication channels

Team purposive improvisation

With the proximity of the action phase, teams that engage in team purposive improvisation decide to implement a new strategy, even though they were not subject to a disruption or trigger demanding any kind of adaptation (Table 2.2). These teams start questioning the current strategy or mission as not suitable for their own interests. These interests might be related to the overall organizational goal, or may belong the private sphere of the team and represent a private team agenda (Cunha et al., 1999). Teams start ascribing new roles and defining new communication channels that are more suited to their subversive agenda.

At this stage teams have departed from the formal leadership that dominated transition phase 1, either because the team's private goal is divergent from the organizational goal for that team, or because they do not recognize adequate leadership in its formal role to pursue the team's targets. Either way, a new leadership emerges among the team. This emergent leadership establishes the conditions that allow the team to achieve its private goals, increasing team members' level of participation and team cohesion (Kickul & Neuman, 2000). At this stage the need for coordination mechanisms, other than the explicit ones, is not yet felt; however, due to the departure from formal structures, the team starts using informal communication channels. Given these assertions, we propose the following.

Proposition 3. At the transition phase 2, teams that engage in team purposive improvisation, a) at process level, start questioning the current strategy and mission, re-ascribe team members' roles, and define new communication channels; and b) at leadership and coordination level, observe a new leadership emerging among the team, and the team uses explicit coordination mechanisms through informal communication channels.

Team preemptive adaptation

Teams that engage in preemptive adaptation are subject to a disruption that gives rise to the need for adaptation, and still have time to prepare a new plan prior to its execution (Table 2.4). The advent of this disruption marks the start of transition phase 2. At this stage teams must adequately assess the new situation, identifying cues and attributing meaning (Burke et al., 2006; Rosen et al., 2011) to the contextual changes. Because circumstances have changed, it might be possible that the previous goals established for the task are no longer valid. If that is the case, teams must redefine their goals. They must also formulate a contingent plan, i.e., they must develop an alternative plan and make the necessary strategy adjustments in reaction to the contextual changes (Marks et al., 2001). Finally, they have to reassign roles among team members, setting new responsibility borders within the new context, new strategy, and new goals (Kozlowski, Watola, Nowakowski, Kim, & Botero, 2009; Rosen et al., 2011).

Contrary to what happens in purposive improvisation, in preemptive adaptation there is no need to depart from formal structures. Although a disruption motivates new goals, new strategies, and new roles, these are still applied through explicit coordination mechanisms and the leadership source is still formal. Nothing prompts the need for other forms of leadership or coordination. Moreover, unless the disruption affects formal communication channels, they will still be used by teams in this phase. Therefore, our proposition is as follows.

Proposition 4. At the transition phase 2, teams that engage in team preemptive adaptation, a) at process level, assess the new situation, re-specify their goals, formulate a contingent plan, and re-ascribe team members' roles; and b) at leadership and coordination level, utilize formal sources of leadership and use explicit coordination mechanisms through formal communication channels.

Action phase

At a certain point teams need to start conducting activities that directly contribute to the accomplishment of goals. The start of these activities determines the start of the action phase (Marks et al., 2001).

Team purposive improvisation

When the action phase starts, teams engaged in purposive improvisation start improvising (Table 2.2). They do it not because they were subject to a disruption, but because they decided to pursue a private agenda. Therefore, they must plan and execute simultaneously. To do that, teams must engage in some sort of reflexivity, defined "as the extent to which group members overtly reflect upon and communicate about the group's objectives, strategies … and processes" (Schippers, Homan, & Van Knippenberg, 2013, p. 7). However, they must reflect while acting. Although team reflexivity is considered by scholars as a transition phase process (e.g. Schippers, West, & Dawson, 2015) because it most likely occurs during planning (De Jong & Elfring, 2010), in this context teams are planning and acting at once, and must "decide 'on the fly' to reconsider, abandon, or adjust the original plan" (Marks et al., 2001, p. 366). Schmutz and Eppich (2017) refer to this process as in-action team reflexivity, asserting that it happens as a concurrent reflection, when team members reflect and discuss as they act, but can also be operationalized within team reflexivity time-outs, consisting of short periods of time during which teams interrupt the activity to reflect on and discuss the course of action. During this phase teams mostly review if they are still on the right course, and if they are dealing with the problem appropriately (Konradt, Schippers, Garbers, & Steenfatt, 2015). In team purposive improvisation processes teams must exert in-action reflexivity to develop a new plan, and also implement the new improvised strategy.

Because no disruption occurred, the action phase naturally follows transition phase 2, in which an emergent leadership and new communication channels emerged. Therefore, the leadership mode adopted in this phase is the same as in the preceding phase, emergent leadership; and the coordination mechanisms and communication channels are also the same, explicit and informal respectively. Hence, our proposition is as follows.

Proposition 5. At the action phase, teams that engage in team purposive improvisation a) at process level, reformulate the previously developed plan, exerting in-action reflexivity, and implement that plan simultaneously; and b) at leadership and coordination level, utilize emergent sources of leadership, using explicit coordination mechanisms through newly developed informal communication channels.

Team improvised adaptation

At times the disruption that gives rise to the need for adaptation occurs when there is no time to prepare a new plan before its implementation (Table 2.3). When that happens, teams have to engage in team improvised adaptation and develop a new strategy as they implement it. The first process teams must embrace is the proper assessment of the situation. They must also devise a new plan, engaging in in-action reflexivity, and implement that plan. It is likely that the new plan implies the redistribution of roles; however, it is also likely that there is no time to ascribe new roles in an orderly and structured manner. Therefore, the role ascription will plausibly emerge in an implicit manner.

Team improvised adaptation situations configure nonroutine contexts in which uncertainty holds. Under these conditions, the needs of the team change and, as a vehicle for satisfying team needs (Morgeson et al., 2010), so does the source of leadership. Planning and acting at once, in a response to a disruption, requires speed, problem solving, and task expertise, elements that are well spread among team members, and for which an informal source of leadership is suited (Morgeson et al., 2010). An emergent leader can rise among the team, or leadership can be shared as a result of a distribution of leadership functions between different team members (Carson, Tesluk, and Marrone, 2007). This shared leadership will help overcoming limitations of knowledge and perspective (Hannah, Lord, & Pearce, 2011) and avoiding maladaptive responses (Lord, Hannah, & Jennings, 2011).

Another consequence of these particular circumstances is that coordination becomes a challenge, and high levels of explicit coordination, particularly explicit communication, becomes vital if teams want to maintain acceptable levels of performance (Rico et al., 2008). However, due to the scarcity of time, it is expected that new informal communication channels emerge allowing a quicker and more effective information exchange between team members. This is even more imperative since standardized communication protocols fail to cope with unforeseen changes (Sander, van Doorn, van der Pal, & Zijlstra, 2015). On the other hand, explicit coordination mechanisms do not allow the level of rapid response needed in an improvised adaptation scenario. If teams wish to maintain performance and respond in real time to demands of such context, they must also adopt implicit coordination mechanisms. Yet, because it is anticipatory and implies team members dynamically adjusting to others' needs, implicit coordination requires that teams possess emergent team-level knowledge structures, or team situation models, defined as "dynamic, context-driven mental models concerning key areas of the team's work, such as the objectives or roles of colleagues" (Rico e al., 2008, p. 164). These mental models will have a significant impact on a team's ability to develop a course of action to which all members adhere (Zajac, Gregory, Bedwell, Kramer, & Salas, 2014). Without these knowledge structures teams will struggle to coordinate in an implicit manner and, therefore, must maintain high levels of explicit coordination. Nonetheless, there are some organizational structures that teams can adopt to facilitate implicit coordination. Cunha and colleagues (1999) propose that improvisation can be effective if a team operates over minimal structures. These structures consist of three main aspects: control mechanisms that must be invisible, so as not to limit creativity; clearly defined goals as they contribute to team coordination; and short-term milestones that ensure the maintenance of the sense of urgency. We have built on this proposition and enlarge the concept of minimal structures by adding the concept of activity critical elements, and stating that for a team to effectively adopt implicit coordination mechanisms when engaging in improvised adaptation, it must have a restricted number of activity critical elements. We define activity critical elements as those elements that are fundamental parts of the activity, without which the task may not be accomplished.

A situation experienced by one of the authors of this article illustrates activity critical elements. A skydiving team of four plus a cameraman, while performing a practice jump routine, saw one of its members fainting. The team had 20 more seconds to open the parachutes. Immediately, one of the team members grabbed the unconscious individual to stabilize his flight. A second skydiver held his rip cord and prepared to open the parachute. And a third team member went up to warn the cameraman and get him out of the way. This was done without the ability to communicate verbally, and with only 20 seconds to devise and coordinate a solution. One of the reasons why the team was able to accomplish the task was because they all knew the three critical elements involved, i.e. stabilize the unconscious skydiver, open his parachute, and get the cameraman out of the way. The coordination mechanism was implicit, and consisted of a sequenced mechanism. One member took the initiative to assume one of the critical elements and the other two members followed in a sequence to the next critical element and then to the next one. This example illustrates the importance of minimal structures, especially the importance of a small number of activity critical elements, which all team members must know. Given the above, we propose the following.

Proposition 6. At the action phase, teams that engage in team improvised adaptation a) at process level, perform an assessment of the situation, engage in in-action reflexivity to reformulate the initial plan, re-ascribe roles in an emergent manner, and implement the new strategy; and b) at leadership and coordination level, utilize shared or emergent sources of leadership, use explicit coordination mechanisms through emergent communication channels and implicit coordination mechanisms structured on team situation models and minimal structures.

Team preemptive adaptation

In team preemptive scenarios, when the action phase starts, teams have already developed a new plan to face the disruption. At this stage teams must only implement the strategy developed in the previous transition phase (Table 2.4). Although adapting to a new situation, time pressure is less than in improvised adaptation because the plan has already been devised. Therefore, teams maintain the same formal source of leadership. Because team situation models are dynamic and context driven (Rico et al., 2008), and because teams in this context have had time to prepare a new plan before its execution, they have had time to develop team situation models allowing them to coordinate in an implicit manner, with less need for minimal structures. Nonetheless, explicit coordination mechanisms are still fundamental to ensure a smooth coordination (Rico et al., 2008). Even so, the need for adaptation prompts emergent informal communication channels, complementing the formal ones, mainly due to the inadequacy of standardized communication protocols (Sander et al., 2015). We, therefore, propose as follows.

Proposition 7. At the action phase, teams that engage in team preemptive adaptation a) at process level, implement the new strategy; and b) at leadership and coordination level, utilize formal sources of leadership, use explicit coordination mechanisms through formal and informal communication channels, and also use implicit coordination channels structured on team situation models.

Transition phase 3

Having finalized the action phase teams enter a new transition post-action phase. At this stage teams reflect on past performance and try to incorporate lessons learned from the situations experienced that might be useful in the future. They evaluate how well they performed in the previous phase and start preparing the next action phase (Marks et al., 2001).

Team purposive improvisation

Teams involved in purposive improvisation are focused on a private agenda and, therefore, compare their performance against their private goals (Table 2.2). However, some aspects of teamwork, such as coordination issues or potential improvements, must also be discussed if teams wish to improve future performance (Schmutz & Eppich, 2017), even if following a private agenda. Because this scenario implies a subversive action, this phase is still dominated by an informal and emergent source of leadership. For the same reason, the coordination mechanisms are kept explicit through informal communication channels.

Proposition 8. At the transition phase 3, teams that engage in team purposive improvisation a) at process level, analyse their past performance and delineate teamwork changes; and b) at leadership and coordination level, utilize emergent sources of leadership, and use explicit coordination mechanisms through informal communication channels.

Team improvised adaptation

When teams engaged in improvised adaptation finish their task, they must realign their goals against the improvised strategy applied (Table 2.3). This is because they did not have time to do it before. They had to develop a new plan and execute it simultaneously, under extreme time constraints, and all time available was used to plan and execute. It is now time to realign goals. They must also recap the plan executed. The plan was developed with no time for any kind of iteration, teams now have time to make sense of the plan (Rosen et al., 2011), analyse their performance, and also delineate potential teamwork changes. Now that the scarcity of time has gone, teams can go back to formal sources of leadership, and adopt explicit coordination mechanisms through formal communication channels. We propose the following.

Proposition 9. At the transition phase 3, teams that engage in team improvised adaptation a) at process level, realign their goals, recap the plan, analyse past performance, and delineate teamwork changes; and b) at leadership and coordination level, utilize formal sources of leadership and use explicit coordination mechanisms through formal communication channels.

Team preemptive adaptation

For teams operating in preemptive adaptation scenarios, this transition phase allows them to analyse past performance and delineate teamwork changes (Table 2.4). Because they prepared the new plan before they executed it, they had time to redefine their goals during transition phase 2, and they now need to analyse performance. As with a team in improvised adaptation, this phase is also characterized by the returning to dominant explicit coordination mechanisms through formal communication channels, and a formal source of leadership.

Proposition 10. At the transition phase 3, teams that engage in team preemptive adaptation a) at process level, analyse past performance and delineate teamwork changes; and b) at leadership and coordination level, utilize formal sources of leadership and use explicit coordination mechanisms through formal communication channels.

DISCUSSION

We have explored the team improv-adaptation space where teams adjust team processes as a reaction to either purposive or contingent triggers. By distinguishing between these two sorts of triggers, we have deconstructed team improvisation into two different types, which we integrated into the team adaptation temporal framework identifying three different phenomena: one in which teams are solely improvising, one in which teams are solely adapting, and one in which teams are simultaneously adapting and improvising. We have argued that teams are more likely to successfully engage in team improvisation processes when they have temporal personality homogeneity, and, on the contrary, they are more likely to successfully engage in team preemptive adaptation processes when they have temporal personality heterogeneity. We also assert that present and future orientation are relevant time perspectives for all constructs of the team improv-adaptation space, and that shared temporal cognitions play a determinant role in team adaptation processes, either preemptive or improvised.

When teams face different contexts that lead them to adjust processes, they must adjust in ways that best suit the particular context. When teams engage in improvisation, following a private agenda, they relegate their original team goals to a lesser role, and engage in a subversive mode leading them to adopt informal structures of leadership and coordination. When teams pre-emptively react to a disruption, then teams use some time to reflect on a new plan allowing an action phase characterized by an almost purely execution mode. However, when a disruption occurs not giving teams time to prepare a new plan before executing it, they face uncertainty, they do not know if the plan will work, and they do not have time to discuss it properly and to develop alternative plans. They must act immediately, trusting that they will make the best possible decisions. What they can do is to prepare themselves to increase the likelihood that those decisions are the right ones. Therefore, they must optimize the improvised adaptation process so they can maximize its effectiveness.

We have proposed that in order to effectively engage in team improvised adaptation, teams must start the action phase by reflecting while acting, combining concurrent reflection with reflexivity time-outs (Schmutz & Eppich, 2017). Also, the activity must be sustained in minimal structures (Cunha et al., 1999), comprising a small number of activity critical elements, which will facilitate the implementation of implicit coordination mechanisms. All processes of the improv-adaptation space must be followed by a transition phase characterized by post-action reflexivity. However, this reflexivity phase has different contents according to the type of process. In improvised adaptation, team members must realign the activity goals, and share and combine the knowledge acquired, which will result in the enlargement of the team's knowledge repertoire. This will have already been done by teams in preemptive adaptation, and is less relevant for teams in purposive improvisation due to the relevance of their private agenda.

Contributions

This article contributes with a new theory of the temporal stream of team improvisation and adaptation processes, comprising the temporal antecedents, the temporal flow across transition and action phases, and the team processes, leadership sources, and coordination mechanisms by which teams effectively engage in improv-adaptation space practices. It also offers a novel perspective of the improvisational and adaptive phenomena by combining the team adaptation and team improvisation literatures, and developing the conceptual resolution of both constructs. The study of team adaption has focused on trying to explain the adaptation process, independently of the level of time scarcity, therefore overlooking its temporal dimension (e.g. Burke et al., 2006; Maynard et al., 2015). This article contributes to the literature of team adaptation by looking at the team adaptation temporal framework prosed by Abrantes et al., (2018), and asserting that the adaptation processes have different antecedents, different characteristics, and different implications, whether teams have time to plan prior to execution, or have to improvise.

Team improvisation literature has been concentrating on antecedents, on triggers, and on typifying the construct (e.g. Cunha et al., 2014; Hadida et al., 2015), and has given less attention to the process itself. This article offers an insight into the team improvisational process as a response to either purposive or contingent triggers. We suggest that the temporal merger of design and execution is better managed when teams exert in-action reflexivity. We also extend the concept of minimal structures by adding the notion of activity critical elements, as fundamental structures for the establishment of effective implicit coordination mechanisms. Moreover, we suggest that post-action goal realignment will play a fundamental role in ensuring the conditions for teams engaged in improvised adaptation to prepare themselves to face future disruptive episodes.

Future research

While we have proposed homogeneity regarding team members' temporal personality as a factor that increases the likelihood of effectively engaging in team improvisation processes, and heterogeneity when engaging in team preemptive adaptation, other team characteristics might require some level of heterogeneity. Cognitive team diversity might play an important role in team improvised adaptation. Cognitive team diversity consists of the "perceived differences in thinking styles, knowledge, skills, values, and beliefs among individual team members" (Shin, Kim, Lee & Bian, 2012, p. 197). Research has shown that cognitive diversity has a positive effect on team creativity (e.g. Wang, Kim, & Lee, 2016). Research has also proposed that high levels of creativity would favour improvisation (e.g. Cunha et al., 2014). Therefore, it can be inferred that cognitive team diversity would facilitate team improvised adaptation behaviours. Future studies can explore the impact of cognitive team diversity in team improvised adaptation behaviours either directly or mediated by team creativity. Moreover, when engaging in team improvised adaptation processes, team members have to make decisions and to make them quickly. One aspect that future research could also explore is the decision-making style adopted by team members and how it influences the adoption of team improvised adaptation processes. Different individuals express distinct response patterns when confronted with decision situations (Scott & Bruce, 1995). Due to the time scarcity involved in team improvised adaptation processes, it is likely that different patterns will have diverse impacts on the process adoption and on effectiveness.

Future studies can also explore long-term team learning. We have discussed post-action reflexivity as a determinant factor for teams to prepare future disruptive episodes. However, this invites a consideration of the variables that allow teams to retain knowledge over long periods of time. Though we defend that teams must collectively reflect on the task executed, it is a long stretch to infer that the knowledge produced will be retained for a long time. More research should be performed so that more light can be shed on the retention of improvised adaptation learning over time. One way to tackle this problem is to explore the way organizations can use team improvised adaptation processes and inscribe them into organizational routines and practices (Cunha et al., 2014).

Conclusion

To disregard the temporal dimension of adaptation processes is to ignore a fundamental aspect of the phenomenon, which limits its comprehension. Also, to neglect the effect of the type of trigger in improvisation is to disregard a constituent element with implications in the whole process. By combining team adaptation and team improvisation, this paper reveals the distinct processes nested in the two concepts, and advances a time informed overarching model that contributes to a deeper understanding of the phenomena. We hope that our theoretical model serves this purpose by providing the basis for future research and enabling practitioners to effectively manage situations of adaptation and/or improvisation.

CHAPTER 3.

BRINGING TEAM IMPROVISATION TO TEAM ADAPTATION: THE COMBINED ROLE OF SHARED TEMPORAL COGNITIONS AND TEAM LEARNING BEHAVIOURS FOSTERING TEAM PERFORMANCE

ABSTRACT[2]

Change and unpredictability characterize today's business environment. Organizational teams must effectively cope with this reality and ensure that high levels of performance are not compromised. By refining team adaptation with the integration of team improvisation, this study tests a team adaptation temporal framework comprising two processes – team improvised adaptation and team preemptive adaptation. We also investigate the relationships between these constructs and shared temporal cognitions, team learning behaviours, and team performance. We conducted four studies with three different samples, and the results suggest that the two framework constructs are distinct. The results also indicate that team improvised adaptation behaviours mediate the relationship between shared temporal cognitions and team performance, and that team learning behaviours moderate this mediation.

[2] This work has been published as:

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"Adaptation lies at the heart of team effectiveness"

(Burke, Stagl, Salas, Pierce, & Kendall, 2006, p. 1189).

INTRODUCTION

For the last two decades, a growing number of researchers have been focusing on the relevance of adjustments to team processes for team effectiveness, and specifically for team performance. In particular, the team adaptation literature has sought to understand and describe the phenomenon. Team adaptation consists of adjustments to relevant team processes as a response to a disruption (Maynard, Kennedy, & Sommer, 2015). Several researchers have revealed the positive effect of team adaptation on team performance (e.g., Burke et al., 2006; DeChurch & Haas, 2008; Randall, Resick, & DeChurch, 2011; Santos, Passos, & Uitdewilligen, 2016a; Woolley, 2009); however, one particular aspect of the temporal dimension of team adaptation has been overlooked – the timing of the trigger or disruption giving rise to the adaptation process, regarding the start of the action phase (Marks, Mathieu, & Zaccaro, 2001). Considering this temporal aspect, some important questions remain unanswered.

Depending on the timing of the trigger, does the team adaptation process change? If so, do these different processes have the same impact on team performance? Under what conditions do they have different impacts? In this article we investigate whether there are different types of team adaptation within its temporal stream, as a function of the timing of the trigger. By integrating the concept of team improvisation, as a collective, deliberate, and simultaneous planning and execution of a novel production (Miner, Bassoff, & Moorman, 2001), we propose a temporal framework that increases the granularity of team adaptation, by developing two different constructs – *team improvised adaptation* and *team preemptive adaptation*. We also examine the impact of the two constructs on team performance, and whether shared temporal cognitions (i.e., "congruent mental representations of the temporal aspects of a specific group task, such as the importance of meeting the deadline, (sub)task completion times, and the appropriate timing and pacing of task activities"; Gevers, Rutte, & van Eerde, 2006, p. 54) and team learning behaviours (i.e., behaviours that enable teams to acquire, share, and combine knowledge; Edmondson, 1999) also influence these relationships.

The temporal framework of team adaptation has time as an ontological characteristic. The Western world represents time, essentially, through a linear perspective in which it is composed of measurable, regular, and deterministic parts, the clock-time notion (Ancona et al., 2001b). Nonetheless, George and Jones (2000) argue that some occurrences change through time in a spiral trajectory, altering the nature of the occurrence. For adaptation to occur, the temporal dimension between design and execution is irrelevant. Team adaptation can have the design and the execution of the new plan converging in time, or the design can be prior to the implementation. However, when design and execution converge, the scarcity of time might trigger a rise in the intensity of the adaptation process, changing its nature, as suggested by George and Jones (2000). By considering the merger between design and execution within an adaptation process, the team improvisation concept becomes critical since its essence resides in this blend. Based on these assertions, we propose that *team improvised adaptation* is team adaptation when design and execution merge in time, but it can also be seen as team improvisation driven by a disruption. This concept simultaneously configures team adaptation and team improvisation. *Team preemptive adaptation* is team adaptation when design precedes execution.

The distinction between team improvised adaptation and team preemptive adaptation is based on the temporal dimension between design and execution. Therefore, temporal elements of the individuals and the teams become relevant, not only to predict the adoption of either of the two framework processes, but also to predict their impacts on team performance. Shared temporal cognitions are emergent states (Mohammed & Nadkarni, 2014), which are "constructs that characterize properties of the team that are typically dynamic in nature and vary as a function of team context, inputs, processes, and outcomes" (Marks et al., 2001, p. 357). It is known that shared temporal cognitions are positively related to team adaptation (Santos et al., 2016a), and to team performance (Gevers et al., 2006; Mohammed & Nadkarni, 2014). Because temporal aspects are relevant for the framework, it is expected that shared temporal cognitions will affect the two constructs. It is also expected that since both team adaptation and team improvisation are positively related to team performance, both framework processes mediate the relationship between shared temporal cognitions and team performance. Moreover, because the temporal characteristics of the two constructs are different, their mediating role between shared temporal cognitions and team performance might also be different.

Team learning behaviours are a fundamental aspect of team adaptation (e.g., Burke et al., 2006), and are positively related to team performance (e.g., Edmondson, 1999; Santos, Uitdewilligen, & Passos, 2015; Schippers, Homan, & van Knippenberg, 2013). If teams adopt learning behaviours, they increase their likelihood of successfully adapting.

Therefore, we expect the relationships between shared temporal cognitions and the two processes of the team adaptation temporal framework to be moderated by team learning behaviours. Moreover, we predict that the adoption of team learning behaviours will moderate the mediation of team adaptation processes between shared temporal cognitions and team performance. Because the time scarcity that characterizes team improvised adaptation processes creates a hurdle for teams to efficiently share and combine knowledge, the adoption of team learning behaviours becomes even more important. Therefore, our main prediction is that the moderation effect is most important when teams adopt improvised adaptation processes.

This study contributes to team literature, and in particular to team adaptation and team improvisation literatures, in two important ways. To date, team adaptation researchers have neglected the temporal dimension of the adaptation process regarding design and execution. Failure to consider the temporal dimension within the team adaptation process inhibits researchers from refining their findings based on processes that are different, have different antecedents, and different outcomes. By integrating time into our framework, our research contributes to team adaptation and team improvisation literatures, through examining the validity of the team adaptation temporal framework, and developing measurement instruments for the two constructs – team improvised adaptation and team preemptive adaptation. By predicting that the two constructs, while related, are conceptually distinct, and represent different facets of team adaptation, we augment the granularity of the field. Our research also contributes to team research by analysing shared temporal cognitions as antecedents of the two constructs, and by analysing the moderating role of team learning behaviours in the mediation of the two processes between shared temporal cognitions and team performance. Moreover, we examine in detail whether these relationships are different along the different facets of the team adaptation temporal framework.

We conducted four separate studies. In the first we developed a questionnaire and performed an exploratory factor analysis to test the quality of the items. In the second we used the questionnaire improved in study one and performed a second exploratory factor analysis to examine whether the items would indeed fit within two separate constructs. In the third we conducted a confirmatory factor analysis, testing the factorial structure at both the individual and team levels, and tested for convergent, discriminant, and predictive validity. Finally, in the fourth study, we used structural equation modelling and ordinary least square regressions to explore the mediating role of the two processes between shared temporal cognitions and team performance, and the moderating role of team learning behaviours between the framework processes and team performance.

THEORY AND HYPOTHESES

Team adaptation temporal framework

The line of research followed by the team adaptation literature has had an input-process-output approach (e.g., Burke et al., 2006; Maynard et al., 2015), focusing on team adaptability (i.e., the capacity of a team to adapt), on the adaptation process itself, and on the adaptive outcomes. Another relevant aspect within the team adaptation literature relates to the way teams adapt. Some authors suggest that teams adapt by implementing structural changes in response to environmental shifts (e.g., Gorman, Cooke, & Amazeen, 2010), while others propose adaptation through alterations in the strategy for action (e.g., Marks, Zaccaro, & Mathieu, 2000; Randall et al., 2011). Maynard and colleagues (2015) synthetized the different approaches to the way teams adapt by introducing adaptation content areas. They used Marks and colleagues' (2001) taxonomy, stating that teams, when facing a disruption, can make changes in action processes, interpersonal processes, or transition processes. Whatever the approach to the way teams adapt, the temporal dimension along the design and execution of an adaptation process has never been considered as relevant.

Team adaptation and team improvisation are close concepts, to the point that some authors consider that sometimes teams have to improvise in order to adapt (e.g., Crossan, Lane, White, & Klus, 1996). In fact, Cunha, Clegg, Rego, and Neves' (2014) classification of *ad-hoc* improvisation as a spontaneous reaction to unexpected events, and *managed* improvisation as a skilled, trained, and managed response in real time, are also adaptation processes as they are a reaction to a disruption. However, improvisation does not always imply adaptation: it can be deployed either in response to a disruption, or simply by the teams' own will to change, or even as a form of resistance. For example, *covert* improvisation represents an informal reaction to the status quo, and *provocative* improvisation is an attempt to challenge organizational practices (Cunha et al., 2014). These two types of improvisation are not a response to unexpected events and do not necessarily represent adaptation processes. When machine repair technicians decided not to adopt the official recommendations of the company, and explored new improvised ways to conduct their jobs (Orr, 1996), they were improvising but were not adapting. In this sense, team improvised adaptation is a particular form of team improvisation. It is not solely the merger of design and execution, but merger as a response to a disruption. As Cunha and colleagues (2014) put it, "different forms of improvisation raise particular challenges" (p. 367); team improvised adaptation raises the challenge of adapting to disruptions in real time, without previous planning.

The team adaptation temporal framework presented in this study feeds from the team improvisation literature, bridging the two research fields. The framework highlights that sometimes teams are strictly adapting but at other times they are performing both processes simultaneously. The combination of team adaptation and team improvisation is important because the new processes have different characteristics and implications derived from whether teams have time to plan prior to execution. Team adaptation is deployed by a trigger, which can occur at any point in time, either before the action phase, giving time for teams to plan a new implementation before its start, or at the start of the action phase, forcing teams to plan and execute simultaneously. We argue that these are different processes involving different competencies and different underlying forces. Han and Williams (2008) assert that in order to adapt, individuals need to have the capacity to deal with change. However, the simultaneity of design and execution requires improvisation capacity (Cunha et al, 1999). Moreover, when teams adapt they need to assess the situation, plan the execution, execute the new plan, and learn (Burke et al., 2006). These are sequential phases interlinked by emergent states such as shared mental models. But when design and execution merge, planning and execution will not be sequential, and the resultant emergent states will necessarily be different. Learning also becomes affected. For example, Moorman and Miner (1998a) argue that teams do not always learn from improvisational processes.

Although theoretically pertinent, the team adaptation temporal framework lacks empirical validation. Therefore, this study explores the validity of the twofold structure, and whether *team improvised adaptation* and *team preemptive adaptation*, although related, empirically stand as different constructs.

Hypothesis 1. The team adaptation temporal framework consists of two different constructs: team improvised adaptation and team preemptive adaptation.

Team adaptation temporal framework and shared temporal cognitions

Temporal cognitions are shared when group members have similar perspectives on temporal aspects of task implementation (Gevers et al., 2006). Empirical studies show that teams that share an understanding about the temporal aspects of work more easily adopt adaptation processes (e.g., Santos et al., 2016a). In order to engage in team adaptation processes, teams need to have a similar awareness about deadlines and activity pacing. We argue that this effect is even more relevant when teams are improvising. When doing so, time is so scarce that they have to design a new plan and execute it at the same time. The scarcity of time results, in part, from team members' views about deadlines and task duration, which must be shared in order for team improvisation to become an alternative. Through a common experience of the present, team members can use improvisational processes to enable them to coordinate their activities in order to manage deadlines and improve their actions (Crossan, Cunha, Vera, & Cunha, 2005). Therefore, when teams face time restrictions, a common understanding about temporal issues becomes a determinant factor for the teams' engagement in improvisation processes. For the reasons stated above, we expect that shared temporal cognitions positively affect all processes of the team adaptation temporal framework.

Hypotheses 2a and 2b. Shared temporal cognitions are positively related to a) team improvised adaptation, and b) team preemptive adaptation.

The mediating role of the team adaptation temporal framework

A number of studies relate shared temporal cognitions with some manifestation of team performance. Teams with shared temporal cognitions are more able to meet deadlines (Gevers et al., 2006), to achieve temporal synchronization (Bartel & Milliken, 2004), and tend to perform better (Gevers et al., 2006; Mohammed & Nadkarni, 2014; Santos, Passos, Uitdewilligen, & Nübold, 2016b). Failure to understand temporal aspects of work can have strong negative impacts on the final outcome of team work (Mohammed, Hamilton, Tesler, Mancuso, & McNeese, 2015). It is also known that team adaptation has a strong positive impact on team performance. Burke and colleagues (2006) state that in order to be effective, teams must adapt to salient cues. LePine (2003) found that role structure adaptation has a positive impact on the team decision-making performance. When teams face a disruption, those that adapt to the new situation will increase the likelihood of making more effective decisions (Randall et al., 2011). DeChurch et al. (2008) found that teams who utilized on-the-fly planning were able to adapt to changing task demands and performed better and faster. In fact, the process analysed by DeChurch and colleagues constitutes team improvised adaptation, because the on-the-fly planning implies the merger between design and execution.

As we proposed in Hypotheses 2a and 2b, teams in which members share temporal cognitions will more likely engage in any of the processes of the team adaptation temporal framework. This means that when teams face a contingent trigger, if they have shared temporal cognitions they will engage in adaptive processes, which will increase their likelihood for success and for better performance.

Hypotheses 3a and 3b. The relationship between shared temporal cognitions and team performance is mediated by a) team improvised adaptation, and b) team preemptive adaptation.

When teams are engaging in team improvised adaptation processes, they are simultaneously adapting to unexpected events and managing time scarcity induced by calendar deadlines. Not only do they have to manage uncertainty, they also have to manage high time pressure (Crossan et al., 2005). The literature has found different effects of time pressure on team performance. Pearsall, Ellis, and Stein (2009) found that teams under high time pressure attained better performance. Chong, van Eerde, Chai, and Rutte (2011) also asserted that time pressure improves team performance through team coordination. However, several other studies show a negative impact of time pressure on team performance. One example is the study performed by Driskell, Salas, and Johnston (1999) showing the negative effect of time pressure on the team-level perspective, weakening team performance. This discrepancy can be explained with the argument that "time pressure affects performance through its impact on team members' interdependent actions" (Maruping, Venkatesh, Thatcher, & Patel, 2015, p. 1314). Teams that succeed under time pressure employ task management activities enabling the completion of interdependent tasks.

We argue that the time pressure induced by the merger of design and execution of team improvised adaptation processes will allow teams that share temporal aspects of the task to more easily adopt task management activities that promote interdependent tasks and, therefore, improve team performance. This will not be as strong in team preemptive adaptation, due to the lower time pressure present in these processes. For these reasons, we expect the mediating effect of team improvised adaptation between shared temporal cognitions and team performance to be stronger than that of team preemptive adaptation.

Hypothesis 3c. The mediating effect of team improvised adaptation between shared temporal cognitions and team performance is stronger than the mediating effect of team preemptive adaptation.

The mediation moderated by team learning behaviours

A team learning behaviour is "an ongoing process of reflection and action, characterized by asking questions, seeking feedback, experimenting, reflecting on results, and discussing errors or unexpected outcomes of actions" (Edmondson, 1999, p. 353). In a way, the adoption of team learning behaviours represents a team's capacity to engage in learning. Several studies relate team learning behaviours with team performance (e.g., Huang & Li, 2012; Santos et al., 2016a; Savelsbergh, van der Heijden, & Poel, 2009; van der Vegt & Bunderson, 2005; Van Woerkom & Croon, 2009). In the particular case of teams facing change or uncertainty, Edmondson (1999) defends that they must adopt learning behaviours so they can understand the environment and coordinate members' actions effectively. Team learning behaviours also positively affect the capacity of a team to adapt, by allowing them to better examine a situational disruption, and accordingly to adjust their interactions (Rosen et al., 2011; Santos et al., 2016a). LePine (2005) observed that the learning orientation of team members (and, therefore, the likelihood of teams engaging in learning behaviours) was related with the adoption of adaptation processes, and also moderated the relationship between the difficulty of the task and team adaptation. By asking questions, seeking feedback, experimenting, reflecting on results, and discussing errors, teams will improve their ability to adapt and increase team performance.

In addition, shared temporal cognitions allow team members to anticipate other members' actions, and to adjust their own work patterns, enhancing team coordination, which results in better performance (Gevers et al., 2006). However, given a disruption, although sharing temporal aspects of the task favours adaptation, anticipating other members' actions becomes more difficult due to the unforeseen aspect of the situation.

Additionally, while team members share temporal cognitions, they might have different perspectives on other aspects of the task; therefore, not engaging in learning behaviours may prevent teams from harmonizing their working methods and limit their capacity to adapt to unexpected changes (Santos et al., 2016a). By adopting learning behaviours, teams will capitalize on the benefits of sharing temporal cognitions, and facilitate the adoption of adaptive behaviours, either improvised or preemptive.

In line with the previous arguments, we claim that the interaction between shared temporal cognitions and both facets of the team adaptation temporal framework, as well as the impacts of theses cognitions on team performance, are moderated by team learning behaviours. When teams possess shared temporal cognitions, if they adopt team learning behaviours, they will more likely increase their ability to adapt and, therefore, their likelihood of having a higher level of performance.

Hypotheses 4a and 4b. Team learning behaviours moderate the mediated relationships between shared temporal cognitions and team performance via a) team improvised adaptation, and b) team preemptive adaptation, such that the mediated relationship will be stronger the more that teams adopt learning behaviours.

The research model is depicted in Figure 3.1.

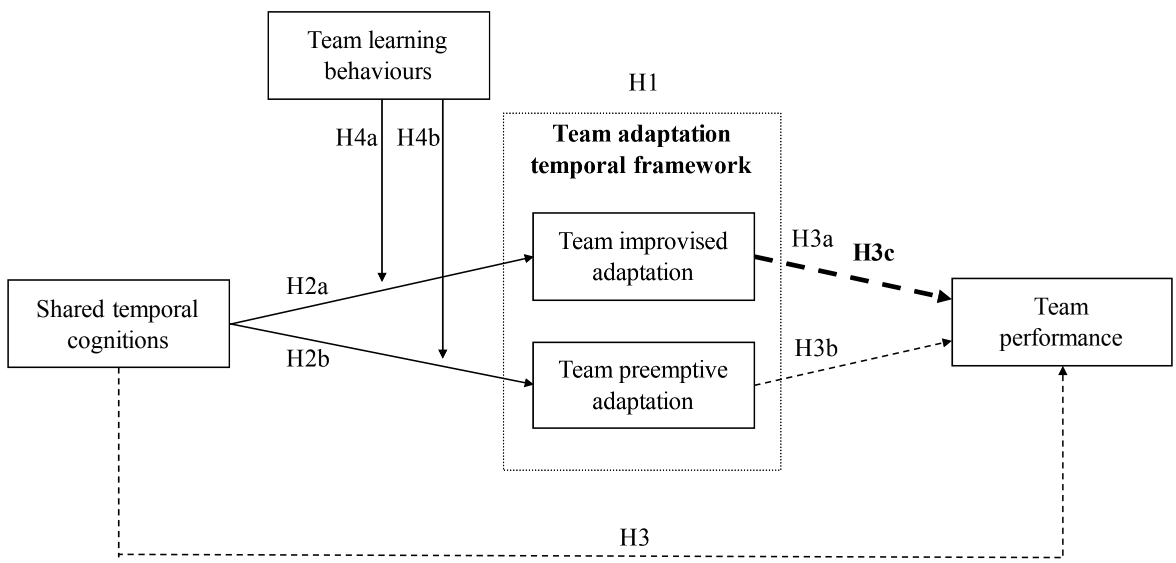

Figure 3.1. Research model and hypotheses. Dashed arrows represent the mediating effect, the thicker arrow represents a stronger relationship and relates to the hypothesis in bold.

SCALE DEVELOPMENT – STUDIES ONE AND TWO

The purpose of these studies is to develop a questionnaire to measure the two constructs of the team adaptation temporal framework. The development of an instrument that measures each construct will allow an increase in the granularity of empirical studies within the field of team adaptation. We start by describing the construction of the scale and then present the process scale improvement for which we performed an exploratory factor analysis.

Study 1 - Pilot

This study was a pilot aimed at improving the initial item pool. We collected data from a convenience sample of 104 undergraduate students, who filled out a questionnaire delivered by hand. The sample was composed of 56% male students, and the average age was 22 years (SD = 2.24). We asked the students to report to a team to which they belonged, to define their role in that team (leader or not a leader), to tell how long they remained in that team, and what was the size of the team. The majority of the participants had been members of the team for less than one year (47%) or between one and three years (38%). The average team size was 6.17 members (SD = 4.04). All respondents completed the questionnaire.

We developed an initial pool of 21 items adapted from two existing scales that measure similar constructs. A team improvisation scale (Vera & Crossan, 2005), and a team adaptive behaviour scale (Marques-Quinteiro, Curral, Passos, & Lewis, 2013). Some items were directly included in the pool since they seemed adequate for the new constructs, other items were rephrased and used in more than one version so they could more accurately describe the constructs, and some other items were combined for this same reason. The items were developed to be scored with a 7-point Likert scale ranging from 1 (totally disagree) to 7 (totally agree). A panel of three expert researchers analysed and classified each item according to a definition of the two constructs to be measured. The experts were asked to identify unclear, ambiguous and irrelevant items. The resulting item pool, after the experts' evaluation, was of 14 items (7 items per construct). This study resulted in restructuring the initial item pool with some items being rephrased to correct the inconsistencies that were revealed.

Study 2: Scale improvement and exploratory test

Study two was an exploratory study that served to test and improve the questionnaire. This study involved 151 undergraduate students, who received a questionnaire delivered by hand. 57% of the students were female with an average age of 21 years (SD = 2.54). As in the first study, the students were asked to report their experience in one team in which they were a member, and answer all questions in relation to that team. As in the prior study, we asked them to define their role in the team (leader or not a leader), for how long they had belonged to the team, and how big the team was. Almost half of the participants had been members of the team for less than one year (48%) and 27% had been on the team between one and three years. The average team size was 8.94 members (SD = 5.07). All respondents completed the questionnaire.

We analysed the adequacy of the items to a two-factor model, using principal component with promax rotation in SPSS. The extraction was based on Eigenvalues greater than 1.00, and we kept items with loads above .60 (Hair, Black, Babin, & Anderson, 2014). Based on these criteria, we deleted two items for each factor. The results revealed two different dimensions that matched the constructs hypothesized for the team adaptation temporal framework. Table 3.1 presents the items, means, and standard deviations, Cronbach's alphas for each factor, and the items' loadings.

The two dimensions that resulted explain 61.94% of the variance. Factor 1, team preemptive adaptation (Eigenvalue = 4.46), explains 44.58% of the variance, and has a reliability of .85. Factor 2, team improvised adaptation (Eigenvalue = 1.74), explains 17.35% of the variance, and has a reliability of .83. These results provide support for the two hypothesized constructs of the team adaptation temporal framework. However, to confirm the two-factor structure of the framework, we conducted a third study with a third sample, and performed a confirmatory factor analysis.

After the final items were established, we asked a panel of three subject experts to freely classify the items by matching them to the two different constructs. Experts were provided with a definition and a practical example of the two constructs. Items were correctly classified 96% of the time, and none of the items was misclassified by more than one expert. We also assessed inter-rater reliability among the three experts using Krippendorff's alpha (Hayes & Krippendorff, 2007), which allows for testing reliability with more than two coders. The analysis showed good reliability (Krippendorff's $\alpha = .87$).

These procedures ensure that the items correspond to the conceptual definition of the respective constructs, certifying the content validity of the scales.

Table 3.1. Items, means, standard deviations, Cronbach's alphas, and factor loadings of team adaptation temporal framework scales (Study 2)

				Factor loadings	
Item wording	*M*	*SD*	α	Fact. 1	Fact. 2
Team preemptive adaptation					
The team prepares in advance how to overcome obstacle that might emerge during task performance.	4.39	1.47	.85	**.88**	-.13
To deal with contextual changes, team members prepare a response before reacting to those changes.	4.39	1.31		**.83**	-.38
Before performing its work in different contexts, the team develops new ideas on its implementation.	4.70	1.28		**.76**	.07
The team devises alternative plans in very short time as a way to cope with new task demands.	4.80	1.30		**.73**	.09
The team discusses, in advance, innovative ways to deal with unexpected events.	4.55	1.37		**.73**	-.01
Team improvised adaptation					
The team deals with unanticipated events on the spot.	4.92	1.14	.83	-.17	**.89**
When unexpected problems appear, the team reacts in the moment.	5.01	1.16		-.32	**.85**
When problems occur, the team immediately tries new approaches.	4.91	1.26		.11	**.73**
The team promptly identifies opportunities for new work processes if an unpredicted situation emerges.	4.82	1.31		.23	**.68**
Team members think on their feet when they have to respond to contextual changes.	4.79	1.15		-.03	**.67**

Note: N = 151

CONFIRMATORY FACTOR ANALYSIS, CONVERGENT AND DISCRIMINANT VALIDITY – STUDY THREE

The purpose of the third study is to conclude testing Hypothesis 1, by confirming if the two-factor structure of the team adaptation temporal framework can be replicated in another sample, and at the team level. We conducted the study using confirmatory factor analysis. The model is expected to fit the data better than a one-factor model. We also analyse convergent and discriminant validity by testing the relationship of the factors in the model with related constructs. The concepts of shared temporal cognitions are used since they relate with team adaptation (e.g., Randall et al., 2011), team learning behaviours that are also related with team adaptation (e.g., Edmondson, 1999), and team performance since it is related with both team adaptation and team improvisation (e.g., Burke et al., 2006; Vera & Crossan, 2005).

Methodology

Sample and procedure

In study three 235 full-time workers participated, belonging to 61 teams. All teams had three or more individuals that socially interact, have common goals, perform organizational tasks, are interdependent regarding workflow, goals, and outcomes, have different roles and responsibilities, and are integrated within a larger organizational system (Kozlowski & Ilgen, 2006). The questionnaires were delivered to the participants by hand or in electronic format, and they were asked to report their experience in the specific work team to which they belong.

The sample was composed of 56.2% female workers, with an average age of 39 years (SD = 8.9). Teams had a reported average size of 7.04 members (SD = 3.66). The average time in the team was between three and five years, with 36.2% of participants being in the team for more than five years, 20.9% between three and five years, and 20.4% between one and three years. Respondents worked in 13 different industries, with the largest groups working in the tourism sector (21.3%), manufacturing (19.7%), and food & beverage (11.5%).

Measures

For the constructs on the team adaptation temporal framework, we used the 10-item scale reported in study two.

Shared temporal cognitions were measured with four items (Gevers et al., 2006) that asked participants to rate the extent to which team members share cognitions concerning temporal aspects of the task execution (e.g., “In my team we have the same opinions about meeting deadlines”). All items were scored on a 7-point Likert scale (1 = totally disagree, 7 = totally agree), and the scale revealed good reliability (Cronbach’s alpha = .88).

Team learning behaviours was measured with seven items from Edmondson (1999; e.g., “We regularly take time to figure out ways to improve our team's work processes”). All items were rated on a 7-point Likert scale ranging from 1 (totally inaccurate) to 7 (totally accurate). Together, the items formed a scale that revealed good reliability (Cronbach's alpha = .71).

Team performance was measured with three items from Aubé and Rousseau (2005) that evaluate team performance regarding team goal achievement, work quality, and productivity (e.g., "The members of this team attain their assigned performance goals"). All items were scored on a 7-point Likert scale that ranged from 1 (not true at all) to 7 (totally true), and the scale revealed good reliability (Cronbach's alpha = .86).

Measurement aggregation

Because our model has to be confirmed at the team level of analysis, we first evaluate whether the individual team members' responses could be aggregated to the team level. We start by evaluating the degree to which ratings from different persons within a group are interchangeable, computing the inter-rater agreement indexes ($r_{wg(j)}$) for each measure (James, Demaree, & Wolf, 1984, 1993; Klein et al., 2000). Then we use interclass correlations [ICC(1) and ICC(2)] to evaluate interrater reliability (Bliese, 2000; Klein et al., 2000). Klein and colleagues (2000) suggest that when using $r_{wg(j)}$, values over .70 justify aggregation, and recommend reporting average $r_{wg(j)}$ values, as well as the percentage of units with values greater than .70. The authors also recommend that when using ICC(1), although values greater than .30 are very unusual (Bliese, 2000), aggregation is justified if the F-test is statistically significant, since it indicates that the between-group variance is significantly greater than the within-group variance of a given measure (Klein et al., 2000). Regarding ICC(2), they need to be higher than the values of ICC(1) for acceptance (Bliese, 2000).

Table 3.2 summarizes the average $r_{wg(j)}$, percentage of units with $r_{wg(j)}$ greater than .70, ICC(1), ICC(2), and the statistical significance tests for all the variables in the study. The average values of $r_{wg(j)}$ are all above .70 with a large percentage of units (all greater than 75%) satisfying the same criteria. Three of the variables have ICC(1) greater that .30; however, the F-tests were statistically significant at the .001 level, with the exception of team learning behaviours, which was statistically significant at the .05 level. All values of ICC(2) were higher than the values of ICC(1). Overall, these results were in line with the levels of reliability and agreement attained in earlier research (e.g. Santos et al., 2016b; Wang, Kim, & Lee, 2016). Therefore, the aggregation of the measures is justified for all variables, which we do by calculating the average value within teams (e.g., DeShon, Kozlowski, Schmidt, Milner, & Wiechmann, 2004).

Table 3.2. Average within group agreement ($r_{wg(j)}$), interclass correlations [ICC(1) and ICC(2)], and F-tests for all the variables (Study 3)

Variables	*Average* $r_{wg(j)}$	% of units with $r_{wg(j)}$ >.70	*ICC(1)*	*ICC(2)*	*F-value*
1. Team improvised adaptation	.89	90%	.41	.73	3.65***
2. Team preemptive adaptation	.83	77%	.35	.67	3.07***
3. Shared temporal cognitions	.80	75%	.31	.64	2.75***
4. Team learning behaviours	.84	87%	.11	.32	1.48*
5. Team performance	.89	93%	.22	.53	2.11***

Note: N = 61 teams. * p < .05. *** p < .001.

Common method bias

Although aggregated to the team level, this study uses cross-sectional self-report data, which are vulnerable to common method bias (CMB). However, several studies point to an overestimated impact of common method variance (CMV) on CMB (Fuller, Simmering, Atinc, Atinc, & Babin, 2016; Lance, Dawson, Birkelbach, & Hoffman, 2010; Spector, 2006). Fuller and colleagues (2016) claim that only for high levels of CMV will relationships between variables be biased in single source data. In order to evaluate the level of CMV we performed a Harman single factor test (Podsakoff & Organ, 1986), which only fails to detect upward CMB for levels of CMV above 70% (Fuller et al., 2016). The results show that the highest covariance explained by one factor is 35.08%, which suggests CMB does not compromise the reliability of the results.

Results

Confirmatory factor analysis

To test whether the two-construct structure of the team adaptation temporal framework fits the data, we analysed the factor structure by performing a confirmatory factor analysis. Analyses were performed in R version 3.2.3 (R Core Team, 2015), using the lavaan package. A complete summary of the results is presented in Table 3.3.

We tested the fit of the hypothesized two-factor model composed of team improvised adaptation and team preemptive adaptation. To evaluate the model fit, we used the χ^2/df ratio, the comparative fit index (CFI), the Tucker–Lewis Index (TLI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR). For the χ^2/df ratio, values below 3 indicate a good model fit, the CFI and TLI indices should be above .95 for acceptance, and RMSEA and SRMR below .08 indicate an acceptable fit (Hair et al., 2014; Schreiber, Nora, Stage, Barlow, & King, 2006).

We started by comparing the two-factor model with a one-factor model to assess whether a two-factor structure shows a better fit than a one-factor structure. The results in Table 3.3 show that the hypothesized two-factor model shows a significantly better fit to the data when compared to a one-factor model. The two-factor model has fit indices within acceptance levels (χ^2/df=2.52, CFI = .959, TLI = .946, RMSEA = .080, and SRMR = .048).

Table 3.3. Results of the confirmatory factor analysis of the team adaptation temporal framework (Study 3)

Model	χ^2	*df*	χ^2/df	CFI	TLI	RMSEA	SRMR
1. One factor model	302.029	35	8.63	.789	.728	.180	.105
2. Two-factor model	85.756	34	2.52	.959	.946	.080	.048

Note: N = 61 teams (235 participants).

Convergent and discriminant validity

To assess convergent validity, we used two different methods. We first examined the estimate loadings, the average variance extracted (AVE), and the construct reliability (which we measured with Cronbach's alphas), as suggested by Hair et al. (2014). We then calculated the correlations between each factor with theoretically related constructs, as displayed in Table 3.4 (shared temporal cognitions, team learning behaviours, and team performance). The estimate loadings of all items showed acceptable values between .62 and .84, the AVE values were all over .50, and the Cronbach's alphas for the two scales were good (.93 for team improvised adaptation, and .94 for team preemptive adaptation), which indicates convergent validity. Regarding the correlations with the theoretical related constructs, both factors of the team adaptation temporal framework correlate significantly with all the constructs included in the study. These results also support the convergent validity of the two scales.

Discriminant validity was examined by conducting a confirmatory factor analysis to establish whether the two constructs of the team adaptation temporal framework were empirically distinct from a theoretically related construct (Hair et al., 2014). Given the statistical significance of the high correlation between the framework constructs and team learning behaviours, we chose this construct to conduct the analysis. Table 3.5 reports the overall fit results. The results indicate that for the two constructs on the team adaptation temporal framework, the two-factor model has a better fit than the one-factor model. Furthermore, the chi-square difference test confirms that the one-factor and two-factor models are significantly different ($\Delta\chi^2 = 77.013$, $p < .001$, for team improvised adaptation, and $\Delta\chi^2 = 68.144$, $p < .001$, for team preemptive adaptation), the two-factor models being a better solution. Therefore, the two constructs on the framework are distinct from the related construct, team learning behaviours.

Table 3.4. Descriptive statistics and Person correlations for all the variables in the study (Study 3)

Correlations

Variables	*Mean*	*SD*	1	2	3	4
1. Team improvised adaptation	5.56	.66				
2. Team preemptive adaptation	5.07	.76	.65**			
3. Shared temporal cognitions	5.22	.80	.55**	.46**		
4. Team learning behaviours	4.75	.48	.42**	.51**	.41**	
5. Team performance	6.09	.50	.65**	.49**	.63**	.29*

Note: N = 61, * $p < .05$, ** $p < .01$.

Table 3.5. Confirmatory factor analysis exploring the independence of team adaptation temporal framework constructs from team learning behaviours (Study 3)

Variables	Model	χ^2	*df*	χ^2/df	$\Delta\chi^2$	CFI	TLI	RMSEA	SRMR
1. Team improvised adaptation and team learning behaviours	One factor	162.290	54	3.01	77.013***	.739	.681	.181	.133
	Two factors	85.276	53	1.61		.922	.903	.100	.073
2. Team preemptive adaptation and team learning behaviours	One factor	140.352	54	2.60	68.144***	.799	.754	.162	.130
	Two factors	72.208	53	1.36		.955	.944	.077	.085

Note: N = 61 teams (235 participants), *** $p < .001$

Conclusion

The main objective of studies one, two, and three was to test Hypothesis 1 by verifying whether the two-factor structure of the team adaptation temporal framework is valid, and whether team improvised adaptation and team preemptive adaptation are related, but different constructs. Studies one and two allowed us to establish the two-factor model, and study three aimed to confirm whether this model could be replicated in a new sample, using confirmatory factor analysis. We concluded that the two-factor model shows a good fit, which is better than the fit of the alternative one-factor model. Moreover, we examined the convergent validity of the team adaptation temporal framework, and we found that the two constructs were positively related to shared temporal cognitions, team learning behaviours, and team performance. We will explore these relationships in study four to test Hypotheses 2, 3, and 4. Additionally, we found the two scales to be distinct from team learning behaviours, which, as we have seen, is a related construct. Therefore, hypothesis 1 was supported.

COMPLETE STRUCTURAL MODEL ANALYSIS – STUDY FOUR

In study four we test hypotheses 2a and 2b, 3a and 3b, and 4a and 4b. We have seen in study three (Table 3.4) the correlations between the two constructs of the team adaptation temporal framework, and shared temporal cognitions, team learning behaviours, and team performance. The purpose of this study is to analyse the nature of such relationships. The sample and procedure were the same as in study three. The measures were also the same as in study three. As in study three, we aggregated the responses to the team level.

Hypotheses testing

Table 3.4 presents the means, standard deviations, and correlations between all the variables of the study. Significant positive correlations were found between all variables.

Direct and mediation effects

The two processes of the team adaptation temporal framework are mutually exclusive in the same time frame, i.e., when a team is performing an improvised adaptation process, it cannot be, at the same time, performing a preemptive adaptation process. Therefore, it is adequate to analyse their relationships with other constructs, one variable at a time, since theoretically there is no influence of either construct on the other.

Hence, the results of the bivariate correlations can be used to test Hypotheses 2a and 2b, which proposes that shared temporal cognitions are positively related to both framework constructs. The results show a statistically significant positive relationship between shared temporal cognitions and both team improvised adaptation, and team preemptive adaptation (r = .55, p <.01, and r = .46, p < .01, respectively), supporting Hypotheses 2a and 2b.

The mediation effect between shared temporal cognitions and team performance of each construct of the team adaptation temporal framework was analysed with the statistical software R version 3.2.3 (R Core Team, 2015), using the lavaan package. In order to ensure statistical power, and as recommended by Preacher and Hayes (2008), we performed a path analysis with 5000 bootstraps and 95% confidence interval (CI). Bootstrapping represents the most powerful method to achieve confidence limits for specific indirect effects (Preacher & Hayes, 2008; Preacher, Rucker, & Hayes 2007). Hypothesis 3a proposes that team improvised adaptation mediates the relationship between shared temporal cognitions and team performance. The model has a good fit: χ^2/df = 1.269, CFI = .980, SRMR = .079. The unstandardized parameter estimate shows that team improvised adaptation mediates the relationship between shared temporal cognitions and team performance (.20 [CI = .06, .42], $p < .05$), which supports Hypothesis 3a.

Hypothesis 3b proposes that team preemptive adaptation mediates the relationship between shared temporal cognitions and team performance. The model also has an adequate fit: χ^2/df = 1.614, CFI = .955, SRMR = .080. However, the unstandardized parameter estimate does not show that team preemptive adaptation mediates the relationship between shared temporal cognitions and team performance (.10 [CI = -.02, .24], $p = .14$), which does not support Hypothesis 3b.

Hypothesis 3c proposes that the mediating effect of team improvised adaptation between shared temporal cognitions and team performance is stronger than the mediating effects of team preemptive adaptation. The mediating effect of team improvised adaptation was verified, but the mediating effect of team preemptive adaptation was not observed, therefore, Hypothesis 3c is supported.

Moderated mediation effects

To test Hypotheses 4a and 4b, we analysed the moderated mediation with the bootstrapping technique (Preacher & Hayes, 2008), using Hayes (2012) PROCESS macro (model 7), with a 95% confidence interval and 5000 bootstrapped samples. The independent variables were centred (Aiken & West, 1991). Hypothesis 4a proposes that team learning behaviours moderate the relationship between shared temporal cognitions and team performance, mediated by team improvised adaptation. The results reveal that both team improvised adaptation and shared temporal cognitions are significantly and positively related to team performance ($B = .32$, $p < .001$ for team improvised adaptation and $B = .24$,

$p < .01$ for shared temporal cognitions). The results also show that both shared temporal cognitions and team learning behaviours are significantly and positively related to team improvised adaptation ($B = .42$, $p < .001$ for shared temporal cognitions, and $B = .34$, $p < .05$ for team learning behaviours). A third indication from the results is that the moderation effect of team learning behaviours between shared temporal cognitions and team improvised adaptation is also significant and positive ($B = .57$, $p <.01$). Also, the results indicate that the moderated mediation effect is stronger for mid- and higher values of team learning behaviours. Finally, the results reveal that the index of moderated mediation is significant and positive (*Index* = .18; *SE* = .104; [CI = .02, .44]). These results are shown in Table 3.6.

Table 3.6. Results for the moderated mediation effect of team improvised adaptation (Study 4)

	Mediator variable model				
Variables	*B*	*SE*	*t*	*p*	R^2
Constant	6.092	.045	136.956	.000	
Team improvised adaptation	.321	.080	3.988	.000	
Shared temporal cognitions (STC)	.242	.067	3.623	.001	.45

	Moderator variable model				
Variables	*B*	*SE*	*t*	*p*	R^2
Constant	-.089	.072	-1.231	.223	
Shared temporal cognitions (STC)	.419	.092	4.543	.000	
Team learning behaviours (TLB)	.342	.152	2.252	.028	
Shared temporal cognitions x Team learning behaviours	.572	.193	2.962	.004	.38

	Conditional indirect effects of STC on TP at values of TLB				
Mediator	*TLB*	*Effect*	*SE*	*Boot LL*	*Boot UL*
Team improvised adaptation	-.482	.046	.062	-.048	.205
Team improvised adaptation	.000	.135	.074	.024	.316
Team improvised adaptation	.482	.223	.111	.045	.462

	Index of moderated mediation			
Mediator	*Index*	*SE*	*Boot LL*	*Boot UL*
Team improvised adaptation	.184	.104	.023	.442

Note: n = 61, bootstrap sample size = 5,000

Figure 3.2 shows the interaction effect, represented by the slopes for the effect of high and low team learning behaviours on team improvised adaptation under high and low shared temporal cognitions (Dawson, 2014). When team learning behaviours are high, the effect of shared temporal cognitions on team improvised adaptation is significantly positive. This means that when teams adopt high levels of team learning behaviours, they will strongly benefit from sharing temporal cognitions on the adoption of team improvised adaptation processes. This benefit does not exist when teams adopt low levels of team learning behaviours. Hence, Hypothesis 4a was supported.

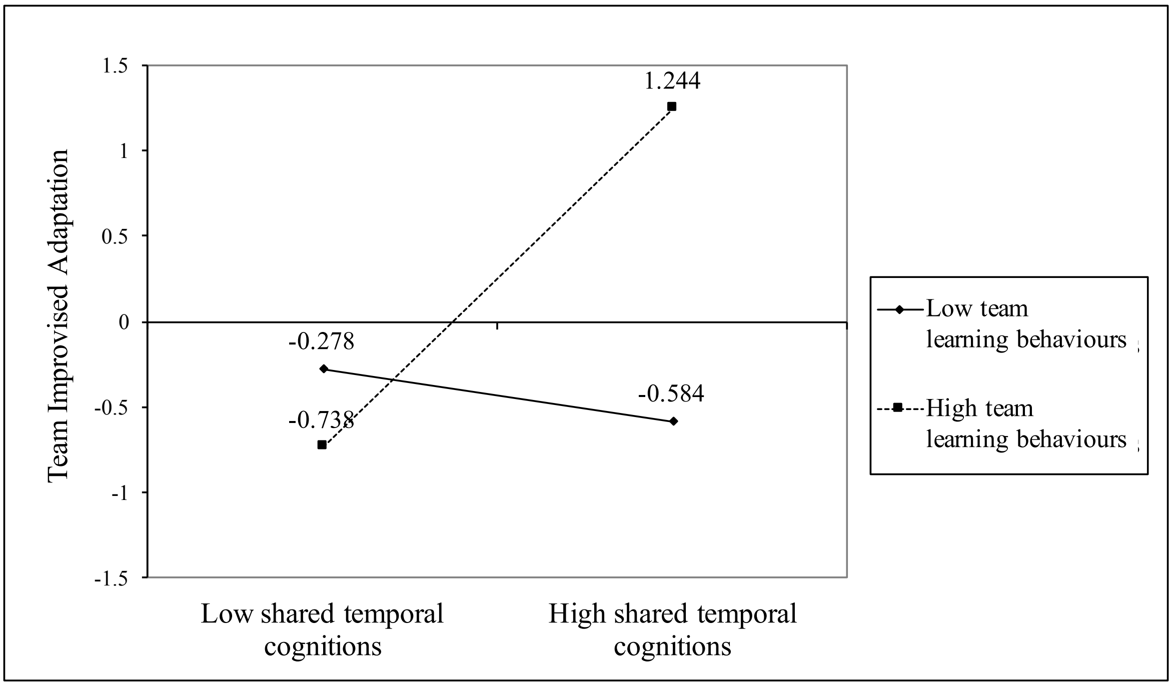

Figure 3.2. The interaction effect between team learning behaviours and shared temporal cognitions on team improvised adaptation.

Hypotheses 4b proposes that team learning behaviours moderate the relationship between shared temporal cognitions and team performance mediated by team preemptive adaptation. The results depicted in Table 3.7 show that, although there are direct effects, team learning behaviours only moderately moderate the relationship between shared temporal cognitions and team performance through team preemptive adaptation (B = .46, p = .52), and the index of moderated mediation barely falls on a positive interval (*Index* = .08; *SE* = .06; [CI = .00, .27]). Therefore, Hypothesis 4b was not fully supported.

Table 3.7. Results for the moderated mediation effect of team preemptive adaptation (Study 4)

	Mediator variable model				
Variables	*B*	*SE*	*t*	*p*	R^2
Constant	6.092	.048	126.867	.000	
Team preemptive adaptation	.167	.072	2.327	.024	
Shared temporal cognitions (STC)	.314	.068	4.600	.000	.45

	Moderator variable model				
Variables	*B*	*SE*	*t*	*p*	R^2
Constant	-.071	.087	-0.825	.413	
Shared temporal cognitions (STC)	.326	.110	2.955	.005	
Team learning behaviours (TLB)	.637	.181	3.515	.001	
Shared temporal cognitions x Team learning behaviours	.457	.230	1.985	.052	.38

	Conditional indirect effects of STC on TP at values of TLB				
Mediator	*TLB*	*Effect*	*SE*	*Boot LL*	*Boot UL*
Team preemptive adaptation	-.482	.018	.031	-.028	.114
Team preemptive adaptation	.000	.054	.040	.002	.178
Team preemptive adaptation	.482	.091	.064	.004	.265

	Index of moderated mediation			
Mediator	*Index*	*SE*	*Boot LL*	*Boot UL*
Team preemptive adaptation	.076	.061	.000	.273

Note: n = 61, bootstrap sample size = 5,000

DISCUSSION

In organizations, time is an ever scarcer commodity. This, combined with the systematic need to react to unpredictable events, creates an added burden that forces teams to accommodate rapid change into their organizational routines. The purpose of our study was to examine whether the timing of the disruption, giving rise to the need for adaptation, has a significant impact on the nature and consequences of the adaptation process, and if the different natures have different effects on the relationship between shared temporal cognitions and team performance. We were also interested in exploring boundary conditions for the effect of shared temporal cognitions on adaptive processes and, consequently, on team performance. More specifically, we examined the influence of team learning behaviours on the relationship between shared temporal cognitions and team performance through team improvised and team preemptive adaptation processes.

Contribution

Our study provides four major process contributions regarding how organizational teams can handle contingencies and time scarcity in a way that promotes performance. First, it expands team adaptation theory by augmenting the granularity of the construct, unravelling team improvised adaptation and team preemptive adaptation, and bridging team adaptation and team improvisation theories. Second, our findings suggest that shared temporal cognitions allow teams to increase performance through the adoption of team improvised adaptation processes, by identifying temporal antecedents for adaptation when design and execution merge, and explaining how the adoption of these processes can increase a team's performance under extreme time scarcity situations. Third, the study shows that different types of team adaptation have differential impacts on team performance, providing a sounder understanding of the adaptation process and of how teams can handle time scarcity. Finally, it provides a deeper insight into the role of team learning behaviours, strengthening the relationship between shared temporal cognitions and team performance, through team improvised adaptation.

The literature of team adaptation has, so far, overlooked the temporal element embedded in the adaptation process concerning the timing of design and execution. The lack of acknowledgement of this element prevents researchers from deepening their findings and better understanding processes that have different causes, different mechanisms, and different consequences. Additionally, within the team improvisation literature, little has been advanced regarding the improvisation process itself. Moreover, although several typologies have been proposed, few empirical studies have approached these different taxonomies and the respective consequences within team performance. The team adaptation temporal framework addresses these gaps. Based on the temporal distance between design and execution, this framework comprises two different constructs that result from the deconstruction of team adaptation and incorporation of team improvisation into the concept of team adaptation. Our findings empirically validate this framework, refining the concept of team adaptation, and presenting a measurement tool that allows researchers to delve deeper into the team adaptation phenomenon.

George and Jones (2000) developed an ontological perspective on the role of time in organization theory. Although time represents a vital element of the team phenomena, it has been neglected in many areas of team research (Kozlowski & Bell, 2013; Santos et al., 2016b). The team adaptation temporal framework adopts an ontological approach to time within team adaptation processes, looking at them through a temporal lens. This study contributes to the integration of time in the team literature, suggesting that shared temporal cognitions increase the likelihood of teams adopting both constructs of the framework. Earlier research has enhanced the important role of shared temporal cognitions on team adaptation (e.g., Randall et al., 2011; Santos et al., 2016a) and its positive impact on team performance (e.g., Gevers et al., 2006; Santos et al., 2016b); our findings support these assertions and move one step further by revealing the mediating role of team improvised adaptation between shared temporal cognitions and team performance. It is known that when team members have similar perspectives on temporal aspects of task implementation they will, more likely, engage in adaptation processes (Santos et al., 2016a). It is also known that shared temporal cognitions promote temporal synchronization (Bartel & Milliken, 2004), allowing teams to meet deadlines and perform better (Gevers et al., 2006). However, our research indicates that teams with shared temporal cognitions will improve performance through team improvised adaptation processes. This may suggest, for example, that when team members have similar temporal perspectives about the task, they will react to a disruption by improvising a new solution, which enhances the probability of meeting deadlines and, therefore, achieving better performance.

Team adaptation was only mediating the relationship between shared temporal cognitions and team performance when design and execution merged, i.e. team improvised adaptation. We did not find evidence that shared temporal cognitions would improve performance through team preemptive adaptation. Two possible explanations can be given, which advance our knowledge of teams and improvisation. One is that the time available was not enough for teams to plan and then execute and, therefore, they spent time planning that could have been used to act, jeopardizing timely performance; another is that when teams react to a disruption and have time to plan before acting, time pressure becomes less severe, which dilutes the positive implicit coordination effects of sharing temporal cognitions on team performance. For example, time to plan might give a false sense of non-urgency, leading teams to lower their concern with deadlines.

Many studies have asserted that team adaptation improves performance. Actually, at the heart of team adaptation is the quest for increased performance. Teams adapt to a multitude of contingencies that endanger their performance, so that they can maintain or increase performance (Burke et al., 2006; LePine, 2003; Maynard et al., 2015). However, different impacts on team performance have been found. Research has shown that team adaptation affects the quality and the accuracy of team performance (Jonhson et al., 2006, Maynard et al., 2015; Waller, Gupta, & Giambatista, 2004), the effectiveness of decisions (LePine, 2003; Randal et al., 2011; Santos et al., 2016a), and the execution speed (Johnson et al., 2006; DeChurch & Haas, 2008). However, as pointed out by Maynard and colleagues (2015), creativity and innovation are aspects of team performance that still need further research. On the other hand, the improvisation literature has found evidence that team improvisation promotes innovation (De Tienne & Mallette, 2012; Vera & Crossan, 2005), the acquisition of new knowledge (Akgün & Lynn, 2002; Chelariu, Johnston, & Young, 2002), flexibility (Cunha et al., 1999), and longer-term benefits driven by the break from flawed mental models (Cunha et al., 1999; Hadida, Tarvainen, & Rose, 2015). By observing different impacts on performance driven by different facets of the team adaptation temporal framework, we allow researchers to investigate the nature of these different impacts. We suggest that one of these differences relates to innovation, the acquisition of new knowledge, and longer-term benefits. The time-pressure imposed by team improvised adaptation processes leads teams to explore more radical alternatives, compelling them to go further away from pre-established routines (Cunha et al., 1999; Moormon & Miner, 1998b). This flexibility, in turn, will enlarge the range of possibilities for the acquisition of new relevant knowledge and longer-term benefits.

As with team adaptation and team improvisation, researchers have postulated that the adoption of team learning behaviours improves team performance (e.g., Savelsbergh et al., 2009; van Woerkom & Croon, 2009), and that this is more imperative when teams face change and uncertainty (Edmondson, 1999). The combined effect of these processes has been less thoroughly investigated. Schippers, Den Hartog, Koopman, and Wienk (2003) argue that teams facing novel tasks need to embrace some reflexivity, which is one form of learning behaviour (Edmondson, 1999), instead of strictly focusing on habitual routines, that is, they must reflect on how to adapt. We found that when teams share temporal cognitions, they improve performance through team improvised adaptation, and that, if they also adopt team learning behaviours, they will foster team improvised adaptation and, therefore, team performance. One explanation is that when teams have to design a plan and implement it at the same time, asking questions, seeking feedback, and experimenting will augment communication and coordination, which will potentially enhance adaptation and increase performance.

However, we did not find any indication that team learning behaviours have any impact on the relationship between shared temporal cognitions and team performance through team preemptive adaptation. When teams, given a disruption, have time to prepare a new plan, the urgency of adopting learning behaviours might be diminished by the extra time available. It does not mean that these kinds of behaviours are not relevant; however, they might become less critical. Summing up, when teams have to improvise solutions to unpredictable disruptions, the adoption of team learning behaviours will significantly improve team performance.

Implications for practice

Our findings hold important implications for organizations, in particular for teams. This study reveals the importance of team members having a common understanding of the temporal aspects of a given task so they can more easily adopt adaptation processes. In an increasingly fast and unpredictable business environment, the adoption of these processes, in particular team improvised adaptation, becomes an emergency if teams aim to cope with change and maintain, or even increase, performance. Team members can improve shared temporal cognitions by openly discussing the temporal aspects of the task, such as deadlines or the time that each activity will take. By so doing, they will create the conditions to formulate new approaches rapidly, when disruptions to the regular flow of team activities force them to simultaneously plan and execute.

The results of the study also show that when teams face this type of disruption, if they are able to plan and execute simultaneously, they will enhance the likelihood of achieving greater performance levels. The ability to plan and execute simultaneously, i.e., the ability to improvise, can be learned and trained (Chelariu et al., 2002; Cunha et al., 1999; Cunha, Neves, Clegg, & Rego, 2015; Moorman & Miner, 1998b) if teams want to be prepared for unpredictability in dynamic environments. Teams whose members share temporal cognitions should engage in team improvised adaptation, leading them to increased performance.

Finally, our findings suggest that learning behaviours will help teams that share temporal cognitions to engage in improvised adaptation processes and achieve better performance. Even in the presence of extreme time scarcity, and even *due to* the scarcity of time, spending a brief moment discussing the present new circumstances, and potential major mistakes that should be avoided, might save valuable time and increase the likelihood of good performance. Moreover, to better prepare for the future, team members should discuss past improvised adaptation episodes, exploring the best ways to adapt and improvise so they can effectively engage in such processes, promoting high levels of performance.

Limitations and directions for future research

One of the limitations of the study is the fact that it uses cross-sectional self-report data. This data collection method is susceptible to common method bias (CMB). However, Fuller and colleagues (2016) argue that for common method variance to bias the results of data from a single source, its levels would have to be very high. The results of Harman's single-factor test suggest that CMB does not compromise the integrity of our findings. Nevertheless, future research should address similar hypotheses using design methods that prevent exposure to CMB. In particular, we recommend the use of a different source to measure the dependent variable, which in our case was team performance.

We addressed time-related constructs. Although our findings are valuable for team adaptation and team improvisation literatures, in future studies researchers should consider adopting longitudinal methods in order to gain a sounder comprehension of the role of time in improvised adaptation phenomena. Future studies could analyse whether the adoption of team learning behaviours between team improvised adaptation episodes will increase team performance from one episode to the next. It would also be valuable to analyse how team learning behaviours can be operationalized during improvised adaptation processes in the face of time scarcity. Future research could explore questions regarding the way teams can handle time pressure and still have the discernment to reflect and avoid major mistakes. It could also be valuable to investigate individual and team temporal characteristics, beyond shared temporal cognitions, which allow teams to better engage in team improvised adaptation processes.

The different impacts of the two facets of the team adaptation temporal framework on team performance is another aspect that should be covered by future research. Researchers should focus their attention on elements of team performance such as the quality, accuracy, and speed of execution. In addition, the enlargement of the knowledge repertoire of teams and the long-term impact of the benefits created by the different types of team adaptation will reveal fundamental properties of the temporal framework and help to consolidate our knowledge about team adaptation processes.

Teams do not operate in isolation. They are integrated within larger organizational settings and they articulate with other organizational teams. Future research could address the team improvised adaptation process considering its relationship with the organization as a whole, and its relationship with other teams in the organization. One interesting question relates to the organizational characteristics that better accommodate team improvised adaptation. Within large organizations, both highly improvisational teams that systematically need to adopt improvised adaptation processes due to the specific characteristics of their task, for example new product development teams (Akgün, Byrne, Lynn, & Keskin, 2007), and low improvisational teams that rely less on this kind of processes, live together. Future studies could tackle the interaction between these two kinds of teams and how they can articulate in a way that benefits both the teams and the organization as a whole.

CONCLUSION

The ability to adequately respond to dynamic and unpredictable business environments represents a determinant factor that will lead teams not only to maintain, but to increase their performance levels. To do so, teams must adapt. Our study contributes to the expansion of the conceptual granularity of such mechanisms by showing that there are different types of team adaptation, that their impact on team performance is unequal, and that this impact can be amplified under specific conditions. When team members share temporal cognitions, their team will more easily promote team performance when engaging in team improvised adaptation. Moreover, when teams that share temporal cognitions adapt through improvisation, they will benefit from also adopting team learning behaviours. In summary, shared temporal cognitions, team improvised adaptation, and team learning behaviours complement each other to foster team performance.

CHAPTER 4.

IF YOUR TEAM HAS TO ADAPT IMPROVISING, YOU BETTER LEARN HOW TO DO IT: THE CONTRIBUTIONS OF SHARED MENTAL MODEL SIMILARITY AND TEAM REFLEXIVITY

ABSTRACT

This work investigates the effects of shared mental model similarity and two types of team reflexivity – in-action and transitional reflexivity – on team improvised adaptive performance and on team improvised adaptation learning. Two experiments were conducted to determine whether these variables predict both outcomes, and whether they interact on that prediction. We manipulated team reflexivity and shared mental model similarity and used a longitudinal design to measure team improvised adaptation learning, which we conceptualized on a learning curve perspective. Our findings indicate that the three variables have a direct effect on team improvised adaptive performance, but shared mental model similarity and transitional team reflexivity do not have a direct impact on team improvised adaptation learning. Our findings add to the literatures of team adaptation, team improvisation, and team learning by revealing the interaction between shared mental model similarity and transitional team reflexivity predicting team improvised adaptation learning.

INTRODUCTION

Unpredictability and dynamic contexts are two characteristics that well describe most of today's business environments (e.g. Maynard, Kennedy, & Sommer, 2015; Vera, Crossan, Rerup, & Werner, 2014). To thrive in such circumstances, teams must be able to adapt (e.g., Burke, Stagl, Salas, Pierce, & Kendall, 2006; Christian, Christian, Pearsall, & Long, 2017) and, in extreme time constraints, to improvise (e.g., Barret, 1998; Crossan, Lane, White, & Klus, 1996; Hadida, Tarvainen, & Rose, 2015; Kamoche & Cunha, 2001), which means that they have to design and execute a new plan simultaneously, as a response to a disruption (Abrantes, Passos, Cunha, & Santos, 2018; Miner, Bassof, & Moorman, 2001). This background led scholars on the quest to capture the fundamental aspects that help teams in adapting to dynamic and unpredictable situations. To understand this phenomenon, we must grasp the articulation of different team processes and different emergent states and their effects on team effectiveness (Christian et al., 2017) under adaptive conditions (Burke et al., 2006).

Christian and colleagues (2017) argue that the origin and the duration of the stimulus, that gives rise to need for adaptation play fundamental roles in moderating the relationship between team processes and emergent states, and team adaptive performance. Although this approach reveals a temporal dimension of the trigger, its duration and its timing in relation to the start of the action phase have yet to be explored further. Based on Maynard and colleagues' (2015) definition of team adaptation, Abrantes et al. (2018), defined team improvised adaptation as the process of simultaneously adjusting and executing relevant team processes in a response to a disruption. For the authors, the timing of the trigger changes the nature of the adaptation process with implications in the way it is implemented and in the respective adaptive outcomes. The effects of specific team processes and emergent states on team adaptive performance are contingent on the timing of the trigger (Abrantes et al., 2018). We are particularly interested in these effects when design and execution merge due to conditions of extreme time scarcity.

In this paper we investigate the effects of a team process, team reflexivity, and an emergent state [shared mental model (SMM) similarity], on two different team adaptation outcomes, team improvised adaptive performance and team improvised adaptation learning. Because the nature of the adaptation process changes when plan and execution merge, we studied the effects of two different kinds of reflexivity, in-action reflexivity or reflection during the execution phase, and transitional reflexivity or reflection during the transition phase (Konradt, Schippers, Garbers, & Steenfatt, 2015; Schmutz & Eppich, 2017). Action phases are periods in which teams engage in activities that lead directly to goal achievement, and transition phases are periods in which teams dedicate to past performance evaluation and future planning (Marks, Mathieu, & Zaccaro, 2001). We suggest that SMM similarity, in-action reflexivity, and transitional reflexivity, have a positive impact on the team's improvised adaptive performance. We also propose that the effect of sharing mental models on team improvised adaptive performance is more salient when teams reflect while acting. On the other hand, we argue that SMM similarity and transitional reflexivity also have a direct positive impact on the team's performance when there is a scarcity of time. However, we assert that these two elements have a negative interaction influencing both team improvised adaptive performance and team improvised adaptation learning. When teams reflect between tasks, the effect of SMM similarity, either on their adaptive performance or their learning potential, is less important, than when they do not reflect. When teams do not reflect in transition phases, if they also have dissimilar SMM, their performance and their ability to learn will be jeopardized. By contrast, when teams do not reflect between tasks, having similar SMM will help both the adaptive performance and the learning potential from improvised adaptive situations.

We explore these assertions by performing two experiments in which we manipulated SMM similarity and the two dimensions of team reflexivity, and objectively measured the two team adaptive outcomes. With this research we extend current knowledge about team adaptation phenomena, in particular when this adaptation is performed under severe time constraints, requiring teams to plan and execute simultaneously. We delve into the team processes and emergent states by which teams can improve team adaptive outcomes, specifically, team improvised adaptive performance and team improvised adaptation learning.

Team improvised adaptive performance

Maynard and colleagues (2015) draw a clear distinction between the team adaptation process (i.e., adjustments to relevant team processes as a response to a disruption) and the consequence of this process, team adaptive outcomes. For the authors, these outcomes can include constructs such as different emergent states, team effectiveness, or team performance. Another important differentiation must be established between team routine performance and team adaptive performance. The first refers to a team effort to complete the same or similar tasks, and the latter reflects the effectiveness of behavioural changes after or during a disruption (Christian et al., 2017). This perspective encapsulates the view of team adaptive performance as a team adaptive outcome, hence, a consequence of the adaptation process. A particular case of team adaptive performance has to do with when teams must adapt and improvise simultaneously (Abrantes et al., 2018). We conceptualize team improvised adaptive performance as an adaptive outcome, characterized by the degree to which teams maintain or improve team performance when they have to enact team improvised adaptation processes.

The effects of shared mental models on team improvised adaptive performance

Shared mental models are emergent states (Marks et al., 2001) that represent a common understanding among team members about task, team, and temporal aspects of their work (Klimoski & Mohammed, 1994; Mohammed, Ferzandi, & Hamilton, 2010). Marks, Zaccaro, and Mathieu (2000) refer to two dimensions of SMM: the precision of the knowledge structures upheld by team members – SMM accuracy; and the extent to which the mental models shared among team members are similar to each other – SMM similarity. Several studies relate SMM similarity with team performance (e.g., Cannon-Bowers, Salas, & Converse, 1993; Kozlowski & Ilgen, 2006, Santos, Uitdewilligen, & Passos, 2015). The similarity of mental models allows teams to efficiently perform tasks, overcoming the need for explicit coordination and communication (DeChurch & Mesmer-Magnus, 2010b), which in turn promotes strategy implementation and group performance (Gurtner, Tschan, Semmer, & Nägele, 2007). However, Mathieu et al. (2000) did not find a direct relationship between shared mental models similarity and performance. Lim and Klein (2006) suggest that a boundary condition for this relationship would be a context of intense time pressure. These authors found a direct link between SMM similarity and team performance within extreme time pressure conditions. They argue that such conditions give little room for explicit coordination and communication, and that team members must share an understanding of the emerging situation and of the actions needed. The authors go further and suggest that it is in this type of setting that SMM better predict team performance.

SMM are also critical for team adaptive performance. Mental models predict performance in novel situations, contributing to team adaptation (Marks et al., 2000). Moreover, by sharing mental models, teams promote a positive impact on team adaptive outcomes (Maynard et al., 2015). Christian and colleagues (2017, p. 65) argue that “more developed cognitive structures facilitate integration of new knowledge or the use of existing knowledge in a new way", fostering team adaptive performance. In team improvisation, SMM also have a relevant role. Vera and Crossan (2005) defend that the collaboration needed for team improvisation is based on cognitive factors. When teams share a mental model, coordination improves, facilitating the emergence of new solutions. When a team is improvising, its members make decisions based on their assumptions of what other members are trying to undertake, turning an implicit shared understanding into an instrumental element (Fuller & Magerko, 2010). Thus, the authors argue that the similarity of SMM is a key aspect of the improvisational process. Taken together, we predict that when teams have a high level of SMM similarity, they improve their ability to adapt to changing circumstances in extreme time constraints, expanding the performance outcomes of team improvised adaptation processes. Therefore, we hypothesize:

Hypothesis 1. Shared mental model similarity has a positive effect on team improvised adaptive performance.

The effects of team reflexivity on team improvised adaptive performance

Team reflexivity has been defined as "the extent to which group members overtly reflect upon, and communicate about the group's objectives, strategies, and processes, and adapt them to current or anticipated circumstances" (West, Garrod, & Carletta, 1997, p. 296). This definition incorporates the notions of team reflection and team adaptation, which is also supported by the definition of Konradt et al. (2016), who describes team reflexivity as the extent to which teams reflect on their strategies and behaviours, and adapt their functioning. However, as these authors assert, team reflexivity has been approached by research mainly from the reflection perspective, leaving team adaptation relatively neglected. We focus on this perspective, so we can clearly investigate the relationship between team reflexivity and team adaptive outcomes, as a result of team adaptation processes.

By referring to current or anticipated circumstances, West and colleagues (1997) overlook unanticipated occurrences, which were integrated in Konradt et al.'s (2016) view of reflexivity, as a process that occurs particularly when teams face complex and unpredictable environments. This perspective is also revealed in the conceptualization of team reflexivity as an explicit information-processing activity preceding adaptation in particularly dynamic settings, by Schippers, Edmondson, and West (2014). For these authors, the chances of teams engaging in adaptive processes are increased by the adoption of team reflexivity. However, neither perspective delves into the temporal dimension of team reflexivity, i.e. the difference between action reflexivity during an action phase, and reflexivity during a transition phase. Schmutz and Eppich (2017) consider three types of reflexivity: pre-, in-, and post-action reflexivity; and define them as a briefing before the action phase, deliberations during the action phase, and reflection after the action phase, respectively. Pre- and post-action reflexivity occur during transition phases, and in-action reflexivity occurs during action phases. Konradt et al. (2015) also differentiate between reflection during the transition phase, and during the execution of the team task, or action phase. During the transition phase teams focus on processes, goals, and strategies, and in the action phase teams review whether they are on the right track, or whether the current situation is being properly handled. For the purposes of our research this distinction is instrumental since, as a result of the temporal merger between design and execution, we aim to investigate the effects of team reflexivity during the action phase, which we refer to as *in-action reflexivity*, and also between improvised adaptive episodes, i.e., during the transition phase, which we call *transitional reflexivity*.

The effects of team reflexivity on team performance have been thoroughly investigated (e.g. Konradt et al., 2015; Konradt, Otte, Schippers, & Steenfatt, 2016; Pieterse, Van Knippenberg, & van Ginkel, 2011; Schippers, Den Hartog, Koopman, & Wienk, 2003; Schippers, Homan, & van Knippenberg, 2013). However, its effects on team adaptive performance have been less examined. Team reflexivity and team adaptation have a strong positive relationship (Wiedow & Konradt, 2011). Wiedow and Konradt (2011) propose that adaptation follows reflection as a step subsequent to the ideas, objectives, and strategies developed during the reflection phase. Nevertheless, the effect of team reflexivity on the team adaptation process does not imply a positive impact on the outcomes of that process. As Maynard and colleagues (2015) emphasize, “adaptation does not universally result in positive outcomes” (p. 663). Our argument is that team reflexivity is a way to enhance the likelihood of positive adaptive outcomes. Hence, we propose that teams that adopt both in-action reflexivity and transitional reflexivity will increase team improvised adaptive performance.

By reflecting, during task completion, on whether the team is handling the problem adequately, and on ways to improve task execution, teams will create conditions for adaptive performance improvement within the current task. On the other hand, by focusing on processes, goals, and strategies, between adaptive situations, teams leverage the likelihood of improving performance from one episode to the next. Thus, we hypothesize:

Hypotheses 2a and 2b. a) In-action team reflexivity and b) transitional team reflexivity have a positive effect on team improvised adaptive performance.

The interaction effects of shared mental models and team reflexivity on team improvised adaptive performance

We discussed above the positive and direct effects of SMM similarity and team reflexivity on team improvised adaptive performance. We will now explore the potential interaction between SMM similarity and the two dimensions of team reflexivity (in-action and transitional reflexivity), and their effects on team improvised adaptive performance. The presence of highly similar mental models indicates that team members share a vision about the way the team plays and "will easily coordinate their actions and be 'in sync,' whereas differences in team mental models would likely result in greater process loss and ineffective team processes" (Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000, p. 275). Moreover, Schmutz and Eppich (2017) defend that teams can exert in-action reflexivity by reflecting while executing the task, or by making small reflective time-outs within task completion. They argue that this reflection is present-oriented and aims to optimize the immediate task, and that, given a changing situation, the processes and/or goals will be adapted to the new condition. Taken together, the adaptive output of teams that have highly similar SMM and adopt in-action reflexivity processes, will be stronger than that of teams that, although having similar SMM, do not reflect while acting. Hence, we predict that in-action team reflexivity positively moderates the relationship between SMM similarity and team improvised adaptive performance.

Hypothesis 3a. In-action team reflexivity moderates the relationship between shared mental model similarity and team improvised adaptive performance, such that this relationship will be stronger the more teams reflect during action phases.

Transitional reflexivity occurs in transition phases and is both past and future-oriented, resulting in both implicit and explicit learning (Schmutz & Eppich, 2017). By adopting transitional reflexivity teams will increase the similarity of the mental models shared by team members (Gurtner et al., 2007). In fact, by actively reflecting on new strategies and processes, teams develop a shared understanding about fundamental aspects of the task, enhancing the similarity of the SMM. This means that when teams reflect during transition phases, the effect of SMM similarity on team improvised adaptive performance will be less important, because teams develop similar SMM via reflection. On the other hand, if teams do not adopt transitional reflexivity, then the effect of SMM similarity on the teams' capacity to adequately adapt to unpredictable disruptions and obtain positive adaptive outcomes will be stronger, because teams will not be able to develop SMM similarity between transition phases. This relationship configures a negative interaction; therefore, we propose that transitional reflexivity negatively moderates the relationship between SMM similarity and team improvised adaptive performance.

Hypothesis 3b. Transitional reflexivity moderates the relationship between shared mental model similarity and team improvised adaptive performance, such that this relationship will be weaker the more teams reflect between action phases.

Team improvised adaptation learning

Burke et al. (2006) see team learning as the final phase of the adaptive cycle, being an outcome of the plan execution phase. Team learning can be conceptualized as an outcome, task mastering, and a group process (Edmondson, Dillon, & Roloff, 2007). For the authors, team learning as an outcome, relates with learning curves in operational settings and consists of performance improvement; as task mastery, it refers to whether team members coordinate to acquire task knowledge; and as a team process entails sharing information and reflecting on experience. The assumption behind the learning curve perspective is that teams improve with practice. Several scholars have defended that improvisation can be learned by practice (e.g., Chelariu et al., 2002; Cunha, Neves, Clegg, & Rego, 2015; Moorman & Miner, 1998). Likewise, the ability to adapt, or adaptability, can also be improved (Maynard et al., 2015; Marks et al., 2000). Our perspective is in line with the learning curve perspective, and we conceptualize team improvised adaptation learning as a team improvised adaptation outcome, characterized by improvements in team performance, under conditions of extreme time scarcity, forcing teams to plan and execute simultaneously, as a response to a disruption.

Although close-related constructs, team improvised adaptive performance and team improvised adaptation learning are separate and independent concepts. Team improvised adaptive performance implies a team's capacity to maintain or improve performance from a situation that does not need adaptation, due to the lack of disruptions, to a situation in which a disruption occurs and the team has to adapt. So, it is an outcome of the adaptation process that reveals the capacity of a team to adapt. On the other hand, team improvised adaptation learning denotes the capacity of a team to improve performance, from one adaptive situation to another adaptive situation, revealing a learning curve that reflects that team's ability to learn how to adapt and, thereby, improve adaptive performance.

The effects of shared mental models similarity on team improvised adaptation learning

Team members who share mental models understand that sharing knowledge within the team is appropriate and beneficial for the success of the team (Xiang, Lu, & Gupta, 2013). When teams acknowledge that effective teamwork requires learning and idea sharing, they engage in team activities that enhance learning and progress (Druskat & Pescosolido, 2002). Considerable research also relates SMM with team learning. Cannon and Edmondson (2001) proposed that sharing mental models improves learning from mistakes. The same is suggested by Tjosvold, Yu and Hui (2004), affirming that SMM helps team members to minimize the obstacles to learning from mistakes, and improving problem-solving. When the teams are subject to unpredictable situations and under great time pressure, the possibility of making mistakes increases, and thus the need to learn from them becomes instrumental for future performance under similar circumstances. By sharing mental models, team members will be willing to engage in learning behaviours and, therefore, will increase their potential to learn from improvised adaptive situations. Given these arguments, we hypothesize:

Hypothesis 4. Shared mental model similarity has a positive effect on team improvised adaptation learning.

The effects of transitional team reflexivity on team improvised adaptation learning

When teams discuss their goals, strategies, and processes, and try to anticipate future problems preparing possible solutions, they are exerting team reflexivity and also learning from a process perspective. Therefore, team reflexivity is a relevant aspect of team learning, viewed as a process (Santos et al., 2015; Schippers et al., 2013). When teams improve performance over time, as a result of evaluating past performance and strategies and discussing future alternatives, they are also learning from an output perspective. Hence, team reflexivity also contributes to team learning, viewed as an output, improving performance over time (e.g., De Dreu, 2007; Schippers et al., 2013; Schmutz & Eppich, 2017). For these reasons, we expect that team reflexivity will positively contribute to team improvised adaptation learning. Because in-action reflexivity is present-oriented and aims to optimize the immediate task, and transitional reflexivity is past- and future-oriented, and it intends to optimize future tasks (Schmutz & Eppich, 2017), we suggest that transitional reflexivity will play an important role in team improvised adaptation learning, since this concept resides in the team's capacity to learn from one adaptive episode to another. Thus, we hypothesize:

Hypothesis 5. Transitional reflexivity has a positive effect on team improvised adaptation learning.

The interaction effects of shared mental models and transitional team reflexivity on team improvised adaptation learning

We have seen that early research has linked SMM similarity with team learning (e.g., Cannon & Edmondson, 2001). Similar to what was hypothesized for team improvised adaptive performance, when teams reflect between action phases they develop SMM similarity (Gurtner et al., 2007), thereby reducing the effect of already possessing this emergent state on their ability to learn, and improve performance in future tasks. Therefore, we expect that under conditions of transitional reflexivity, the impact of SMM similarity on the team improvised adaptation learning will not be great. On the other hand, high shared cognitions play the role of implicit coordination mechanisms, which work as substitutes for more explicit forms of coordination (Santos, Passos, Uitdewilligen, & Nübold, 2016b). Thus, the impact of SMM similarity on a team's ability to learn, substitutes the need for reflexivity, implying that even if teams do not reflect between tasks, the impact of SMM similarity on team improvised adaptation learning is positive. This means that when teams do not reflect in transition phases, the effect of SMM similarity on team improvised adaptation learning will be positive, not only because teams are not developing similar mental models by means of reflexivity, but also because SMM similarity will substitute for explicit forms of coordination.

Hypothesis 6. Transitional reflexivity moderates the relationship between shared mental model similarity and team improvised adaptation learning, such that this relationship will be weaker the more teams reflect between action phases.

The conceptual model is depicted in Figure 4.1.

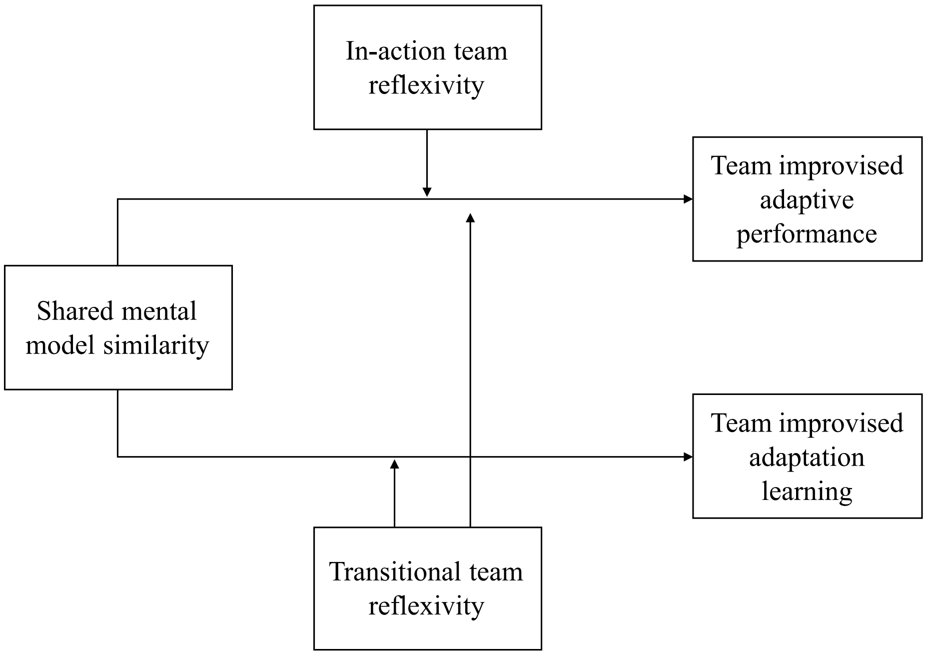

Figure 4.1. Research model

OVERVIEW OF THE RESEARCH

We performed two experiments that tested the effect of SMM similarity, in-action team reflexivity, and transitional team reflexivity, on team improvised adaptive performance and team improvised adaptation learning. In experiment 1 we investigated whether SMM similarity and in-action team reflexivity have a positive impact on team improvised adaptive performance, and whether they interact to increase this performance potential. In experiment 2 we tested the effects of SMM similarity and transitional team reflexivity in both team improvised adaptive performance and team improvised adaptation learning, as well as their interaction effect on these two outcomes. In experiment 1, SMM similarity and in-action team reflexivity were manipulated, and in experiment 2, the manipulations were on SMM similarity and on transitional team reflexivity. Both outcomes were assessed with objective measures.

EXPERIMENT 1

Experiment 1 examined our hypotheses that SMM similarity and in-action team reflexivity have positive direct effects on team improvised adaptive performance (H1 and

H2a), and that they positively interact enhancing the same outcome (H3a). To accomplish these goals, we manipulated SMM similarity and in-action team reflexivity.

Method

Participants and design

In this experiment 183 undergraduate students participated (68% women) with an average age of 21.66 years (SD = 4.23). The participants were randomly assigned to 61 teams of three members each. Each team of three was randomly assigned to one of four conditions. The design of the experiment was a 2X2, in which we manipulated in-action reflexivity (no reflexivity vs. with reflexivity) and shared mental model similarity (low similarity vs. high similarity). Because some participants knew each other, we controlled for experience working together.

Task and procedure

Groups worked on a brick building task, which is adequate for this sort of experiment (e.g. Daniels, Neale, & Greer, 2017), purposely developed for this project. The experiment was purposely developed to prompt team improvised adaptation tasks, and consists of a series of four exercises, comprising two sets of two exercises. In each set there is a control exercise with no need for improvised adaptation, and a similar exercise but requiring teams to adapt to a changing task circumstance. The first set of two tasks consisted of building a structure similar to a pre-designed structure. Teams were given an instruction sheet that included a picture of the structure to be built. Teams had to build the structure in the least possible time with the fewest possible mistakes. All mistakes were translated into added construction time. In the second task of this set teams faced a change in the task, two minutes after start, that required them to adapt during construction time. The change resided in a new model structure that was given to the teams, containing ten differences in relation to the structure they were previously building. In the second set of two tasks, teams had to build the most profitable tower possible. The revenue was attributed to the size of the tower, and costs were gathered by the number of bricks used and building time. The time limit for the construction of the tower was 5 minutes. Teams were given a written set of rules, and an oral explanation of the task. Again, in the second task of this set, two minutes after starting, a task change was introduced forcing the teams to adapt during action. Teams were given a new set of rules in which some building characteristics were mandatory (e.g. the tower had to have two columns on the base separated by a specific distance and with a specific height). The whole experiment took about 75 minutes. After the experiment participants completed a questionnaire with some demographic information.

Manipulation and measures

Shared mental model similarity

Research on SMM similarity has largely used measurement techniques based on three characteristics that allow the measurement of the degree of convergence among team members (DeChurch & Mesmer-Magnus, 2010a; Mohammed et al., 2010): elicitation method, structure representation, and representation of emergence. To our knowledge no attempt has been made to manipulate SMM for experimental purposes. Therefore, we developed a manipulation procedure in order to give team members a common understanding about relevant features of the task such as the particular activities they had to execute and the duration and timing of those activities (Mohammed et al., 2010). In the manipulated condition, in the beginning of each set of two tasks we asked team members to develop, among the team, a detailed workflow of each set of tasks, including the expected duration of each sub-task within the task. The different sub-tasks within each task were suggested by giving team members a set of different cards corresponding to different possible sub-tasks. In the non-manipulation condition, team members received the same information but were requested to develop the workflow individually. In this way, team members in the manipulated condition created a shared understanding about significant elements of the task, and team members in the non-manipulated condition diverged in the assessment of these elements.

In-action team reflexivity manipulation

In-action team reflexivity was manipulated with oral and written instructions (e.g. Gurtner et al., 2007; Pieterse et al., 2011). In the in-action team reflexivity condition, the team must take a moment to reflect about the exercise. Teams receive instructions encouraging them to discuss whether they are using the right approach to the exercise, what are the alternatives for that task, and about the best way to perform it. They are also encouraged to continue to reflect during the exercise. In the "no reflexivity" condition groups did not receive such instructions.

Manipulation checks

The manipulation of the SMM similarity was checked by asking team members to draw, individually, a detailed workflow of each set of tasks, including the expected duration of each sub-task (in the manipulation condition this request was made after drawing the workflow in group). Then, SMM similarity was evaluated according to the workflow similarity among team members, which was measured as follows: for each workflow (one workflow for each set of two tasks), the researchers rated its similarity among team members by attributing one point if any difference in the sub-tasks was found, and one point if any difference was found in the duration of those sub-tasks. The results were then reversed to translate an increase in value with similarity. Given that the experiment consisted of two sets of two tasks, the ratings ranged from “1” (no similarity) to “5” (total similarity). The in-action reflexivity manipulation was checked by asking participants “was your team expressly asked to reflect, during task execution, on the best way to execute it?” (possible answers were “yes” or “no”).

Team improvised adaptive performance

We conceptualize team improvised adaptive performance as the degree to which teams maintain or improve team performance when they have to adopt team improvised adaptation processes. Therefore, we measured this outcome as the difference in performance from a task in which teams do not have to adapt to a similar task in which teams have to adapt. In creating a performance measure, we followed these steps: step 1 – we measured the absolute performance for each of the four tasks; step 2 – for interpretation simplification and in order to facilitate comparability, we rescaled the results to a 0-100 scale, using a min/max transformation, where 100 corresponds to the highest result and 0 corresponds to the lowest result; step 3 – we computed the differences between task 2 and task 1, and task 4 and task 3 (from a non-adaptive situation to an adaptive situation, in similar tasks); step 4 – in order to add consistency to the measure, we computed the mean of the two differences. This mean was the measure used to assess the team improvised adaptive performance.

Experience working together

The experience working together was measured by asking participants the following question: “have you ever done group work with another member of your team?” Responses were rated with a 5 point Likert scale that ranged from “Never” to “Frequently”.

Results

Means, standard deviations, and correlations among the variables of experiment 1 are reported in Table 4.1. We controlled for experience working together having no effects nor interacting with other variables.

Table 4.1. Means, standard deviations, and correlations (Experiment 1)

Variable	M	SD	1	2	3
1. Shared mental model similarity					
2. In-action team reflexivity					
3. Team improvised adaptive performance	11.72	16.13	.30*	.27*	
4. Experience working together	2.33	1.18	-.11	-.19	-.14

Note, N = 61 teams. For shared mental model similarity, high similarity was coded 1 and low similarity was coded 0. For in-action team reflexivity, explicit reflexivity was coded 1 and no explicit reflexivity was coded 0.

* $p < 0.05$ (two-tailed)

Preliminary analysis – manipulation checks

Two one-way ANOVAs were conducted to compare the differences between the manipulated groups and the non-manipulated groups for the in-action team reflexivity and the SMM similarity manipulations. The SMM similarity groups revealed a much higher similarity in the workflow executed by its members (M = 4.51, SD = 0.56) than the groups in the non-manipulation condition (M = 1.00, SD = 0.00), $F(1,59) = 1{,}225.06$, $p < 0.001$. The results also revealed that team members in the groups of the in-action team reflexivity condition indicated a much higher perception of having been subject to team reflexivity (M = 1.00, SD = 0.00) than the team members in the groups not manipulated (M = 0.36, SD = 0.27), $F(1,59) = 169.58$, $p < 0.001$.

Main analysis

To test direct effects we conducted an ordinary least square (OLS) regression analysis. To test the moderation effect we conducted a moderation analysis using 10,000 bootstrap samples for bias corrected bootstrap confidence intervals, with a level of confidence for all confidence intervals of 95% (Preacher & Hayes, 2008), using Hayes (2012) PROCESS macro (model 1). The independent variables were centred (Aiken & West, 1991).

Direct effects

We started by testing the direct effects of SMM similarity and in-action team reflexivity on team improvised adaptive performance (Hypotheses 1 and 2a). Consistent with our hypotheses, the results of the OLS regression analysis (Table 4.2) reveal a positive effect of both SMM similarity (B = 9.23, SE = 3.90, p < 0.05) and in-action team reflexivity (B = 8.21, SE = 3.95, p < 0.05) on team improvised adaptive performance.

Table 4.2. OLS regression of team improvised adaptive performance on shared mental model similarity and in-action team reflexivity (Experiment 1)

Variable	Team improvised adaptive performance	*SE*	*t*
Intercept	4.96	5.60	.88
Experience working together	-.78	1.70	-.46
Shared mental model similarity	9.23*	3.90	2.37
In-action team reflexivity	8.21*	3.95	2.08

Note, N = 61 teams. For shared mental model similarity, high similarity was coded 1 and low similarity was coded 0. For in-action team reflexivity, explicit reflexivity was coded 1 and no explicit reflexivity was coded 0.

* p < 0.05

Interaction effects

Hypothesis 3a predicted that the relationship between SMM similarity and team improvised adaptive performance was moderated by in-action team reflexivity in such a way that the more teams adopt in-action reflexivity, the stronger the effect of SMM similarity on team improvised adaptive performance. To examine this hypothesis we tested the interaction between the two variables, but the results did not show any significant interaction between SMM similarity and in-action team reflexivity predicting team improvised adaptive performance (B = -1.84, SE = 8.97, p = 0.82). Hence, Hypothesis 3a was not supported.

Discussion

Experiment 1 revealed that teams can improve improvised adaptive performance by augmenting the similarity of SMM, and by adopting in-action team reflexivity activities. These results are in line with earlier research on the effects of team reflexivity on team performance (e.g., Pieterse et al., 2011). However, they expand team reflexivity theory by augmenting the granularity of the analysis on team reflexivity to in-action team reflexivity, and by analysing its effects on team improvised adaptive performance, also fine-tuning the research on team adaptation. A simple comparison of the means in Figure 4.2 illustrates that when teams face extreme time scarcity forcing them to plan and execute simultaneously, those teams that have similar SMM, and take a few moments, even in the midst of great time pressure, to reflect on their task and on better ways to adapt it to the changing conditions, will increase their adaptation potential and improve team adaptive performance. These results help to resolve the disagreement regarding the impact of SMM similarity on team performance. Mathieu et al. (2000) did not find a direct effect of SMM similarity on team performance; however, this effect was found by Lim and Klein (2006), who argued that intense time pressure creates the ideal conditions in which SMM similarity better promotes team performance. Our findings support this latter argument, unveiling boundary conditions for the effect of SMM similarity on team performance, i.e., under extreme time constraints, when design and execution blend in a response to a disruption.

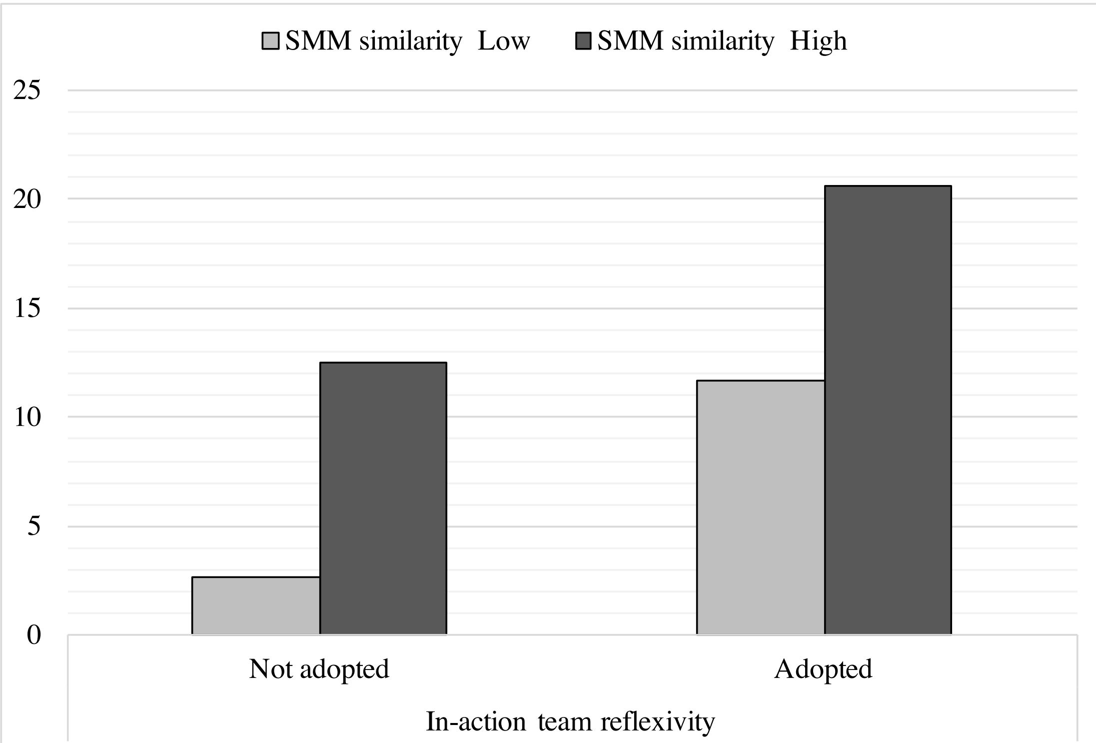

Figure 4.2. Comparison of the means of team improvised adaptive performance as a function of SMM similarity and in-action team reflexivity

In turn, contrary to our predictions, our results did not support any interaction between SMM similarity and in-action reflexivity. Although both the emergent state and the team process contribute to team improvised adaptive performance, the adoption of in-action team reflexivity did not benefit the effect of SMM similarity on team improvised adaptive performance. Our prediction was based on the argument that because highly similar mental models facilitate coordination (Mathieu, et al., 2000), this mechanism would be enhanced by exerting in-action reflexivity, optimizing the current task (Schmutz & Eppich, 2017) and promoting team improvised adaptive performance. The fact that we did not observe this effect might suggest that explicit and implicit coordination mechanisms do not work together to promote adaptive performance. In experiment 2 we complement the research conducted in experiment 1 by analysing the effects of post-action team reflexivity on team improvised adaptive performance, and also on team improvised adaptation learning.

EXPERIMENT 2

In experiment 2 we examined the effects of SMM similarity and transitional reflexivity on team improvised adaptive performance and on team improvised adaptation learning. As in experiment 1, we also tested the interaction effects of both independent variables on both dependent variables. To test our hypotheses we manipulated SMM similarity and transitional team reflexivity.

Method

Participants and design

In this experiment 180 full-time workers participated (53% women) with an average age of 40.64 years (SD = 6.34). The participants, employees of a banking company, were participating in an executive training program. All participants were informed that the experiment was for research purposes, and all agreed to participate. Team members were randomly assigned to 60 teams of three members each. Each team of three was randomly assigned to one of four conditions. The design of the experiment was a 2X2, in which we manipulated transitional reflexivity (no reflexivity vs. with reflexivity) and shared mental model similarity (low similarity vs. high similarity). Because some participants worked for the same company, although in different regions and departments, we controlled for experience working together.

Task and procedure

The experiment was similar to that of experiment 1, but we added two tasks so we could adopt a longitudinal design in order to analyse team performance trajectories and measure team improvised adaptation learning. Tasks 1 through 4 were exactly the same as in experiment 1. Groups had to build a structure similar to a given model in tasks 1 and 2, and had to build the most profitable tower in tasks 3 and 4. The added tasks in this experiment were tasks 5 and 6. Both of these consisted of building the most profitable tower, but as in task 4, in both tasks, two minutes into action teams were given a new set of rules that forced them to adapt. In both tasks the changes relate to the task (e.g. new tower characteristics), but also some changes in team dynamics. In task 5 team members could not talk to each other during task completion (could communicate but not orally), and in task 6 only one member at a time could handle the bricks, with the “handler” changed every 30 seconds. The whole experiment took about 90 minutes. After the experiment participants completed a questionnaire that included some demographic information.

Manipulation and measures

Shared mental model similarity

SMM similarity was manipulated exactly the same way as in experiment 1.

Transitional team reflexivity manipulation

As in experiment 1, transitional team reflexivity was manipulated with oral and written instructions (e.g. Gurtner et al., 2007; Pieterse et al., 2011). In the transitional team reflexivity condition, teams were driven to reflect about the exercise between tasks. Teams received instructions encouraging them to discuss whether they were using the right approach to the exercise, what the alternatives were for the future, and about the best way to perform in the future. Teams were given 3 minutes to reflect between each task. In the “no reflexivity” condition groups did not receive such instructions. These teams were also given 3 minutes, but team members were asked to perform neutral exercises individually, such as soup-letters or cross-words puzzles. Because these exercises were performed individually and were not related with the main tasks, there was interference on neither the task nor any team processes.

Manipulation checks

SMM manipulations were checked as in experiment 1. Also similar to experiment 1, post-action reflexivity manipulation was checked by asking participants "was your team expressly asked to reflect, between tasks, on the best way to execute them?" (possible answers were "yes" or "no").

Team improvised adaptive performance

Team improvised adaptive performance was measured as in experiment 1.

Team improvised adaptation learning

We conceptualize team improvised adaptation learning as improvements on team performance, under conditions of extreme time scarcity, forcing teams to simultaneously plan and execute, as a response to a disruption. This conceptualization reflects an outcome perspective of team learning, encompassing team learning curves, expressed by the trajectories of change in team performance over time (Edmondson et al., 2007). To examine learning curves, we analysed team performance trajectories over the last three consecutive tasks (tasks 4 through 6). As for team improvised adaptive performance, we translated the absolute performance to a scale of zero to 100 (using the same methodology). The trajectory of this measure was used to assess the team improvised adaptation learning.

Results

Preliminary analysis – manipulation checks

We conducted two one-way ANOVAs to compare the differences between the manipulated groups and the non-manipulated groups, for the SMM similarity and the transitional team reflexivity manipulations. The results revealed that the SMM similarity groups had a greater similarity in the workflow performed by its members (M = 4.69, SD = 0.37) than the groups in the non-manipulation condition (M = 1.02, SD = 0.12), $F(1,58) = 2{,}649.41$, $p < 0.001$. Similar results were observed for team members in the groups of the transitional team reflexivity condition, indicating a higher perception of having been subject to team reflexivity (M = 0.96, SD = 0.12) than the team members in the groups not manipulated (M = 0.03, SD = 0.10), $F(1,58) = 1079.90$, $p < 0.001$.

Main analysis

Means, standard deviations, and correlations among the variables of experiment 2 are presented in Table 4.3. We controlled for experience working together, which had no effects nor interacted with other variables. The results show a significant correlation between SMM similarity ($r = 0.42$, $p < 0.001$) and team improvised adaptive performance, and between transitional team reflexivity ($r = 0.37$, $p < 0.01$) and team improvised adaptive performance. The results did not reveal a correlation between SMM similarity and team performance at time 0 – team performance 1; but transitional team reflexivity correlates with team performance at times 0 and 1 – team performance 1 and 2, respectively ($r = 0.40$, $p < 0.01$; $r = 0.31$, $p < 0.05$, respectively).

An ordinary least squares (OLS) regression analysis was performed to test direct effects of SMM similarity and transitional team reflexivity on team improvised adaptive performance. In order to test our interaction hypothesis we examined the longitudinal data conducting a random coefficient modelling (RCM) analysis as suggested by Bliese and Ployhart (2002). RCM considers the nonindependence of observations and its heteroscedasticity. Moreover, it tests intrateam and interteam changes, allowing the analyses of team performance trajectories (Bliese & Ployhart, 2002). To perform this analysis we used the statistical software R (version 3.2.3). The growth models were estimated with the Nonlinear and Linear Mixed Effects package (Pinheiro & Bates, 2000). Time was coded 0, 1, and 2, standing for tasks 4, 5, and 6, respectively. These three tasks were considered for the longitudinal analysis because the exercise involved is similar (the construction of the most profitable tower), representing the teams' performance progression. Tasks 4 through 6 each imply adaptive situations, acting as "team performance 1 through 3". By coding "team performance 1" as 0, the intercept indicates the value of team performance at task 4 (Bliese & Ployhart, 2002).

Direct effects on team improvised adaptive performance

To start our analysis we tested the direct effects of SMM similarity and transitional team reflexivity on team improvised adaptive performance (Hypotheses 1 and 2b). Supporting our hypotheses, the results of the OLS regression analysis (Table 4.4) show a positive effect of SMM similarity ($B = 13.88$, $SE = 3.55$, $p < 0.001$) and transitional team reflexivity ($B = 12.90$, $SE = 3.64$, $p < 0.001$) on team improvised adaptive performance. These results are also aligned with the results of experiment 1.

Table 4.3. Means, standard deviations, and correlations (Experiment 2)

Variable	M	SD	1	2	3	4	5	6
1. Shared mental model similarity								
2. Transitional team reflexivity								
3. Team improvised adaptive performance	6.27	16.30	.42**	.37**				
4. Team performance 1	59.87	24.16	.01	.39**	.39**			
5. Team performance 2	58.35	25.77	.14	.31*	.34**	.64***		
6. Team performance 3	53.01	24.80	.21	.22	.30*	.53***	.69***	
7. Experience working together	1.43	.83	.07	.23†	.01	.12	-.07	-.16

Note, N = 60 teams. For shared mental model similarity, high similarity was coded 1 and low similarity was coded 0. For in-action team reflexivity, explicit reflexivity was coded 1 and no explicit reflexivity was coded 0.

† $p < 0.10$ (two-tailed)

* $p < 0.05$ (two-tailed)

** $p < 0.01$ (two-tailed)

*** $p < 0.001$ (two-tailed)

Table 4.4. OLS regression of team improvised adaptive performance on shared mental model similarity and post-action team reflexivity (Experiment 2)

Variable	Team improvised adaptive performance	*SE*	*t*
Intercept	-3.88	4.04	-0.96
Experience working together	-2.26	2.21	-1.02
Shared mental model similarity	13.88***	3.55	3.91
Transitional team reflexivity	12.9***	3.64	3.55

Note, N = 60 teams. For shared mental model similarity, high similarity was coded 1 and low similarity was coded 0. For transitional team reflexivity, explicit reflexivity was coded 1 and no explicit reflexivity was coded 0.

*** $p < 0.001$

Longitudinal analysis of team improvised adaptation learning

To execute the longitudinal analysis we conducted the steps prescribed by Bliese and Ployhart (2002), in two different levels. In level 1 we defined the fixed basic model for time, and in level 2 we estimated our model integrating the predictors of intercept and slope variation.

Level 1 analysis: estimation of the basic model

We started by investigating the ICC(1) to evaluate the strength of the nonindependence of the data collected from the teams over time (Bliese, 2000; Bliese, 2006). The ICC(1) estimate was 0.61 revealing that between-team effects are likely to be present. Therefore, we can assume nonindependence implying the need to use a random intercept model (Bliese & Ployhart, 2002).

Next we tested whether the relationship between team performance and time was linear or more complex. We started by testing a linear relationship but the results were not significant ($t = -1.51$, $p = .13$). We then tested a quadratic function and the result was also not significant, revealing an increase of the Type I error rate to about 63% ($t = -0.49$, $p = .63$). These results are not surprising since team performance was measured as a relative valued among all teams and, therefore, its evolution does not represent an absolute performance progression over time. The relevance will be revealed by the comparison among different conditions. However, this analysis helps to indicate that a linear trajectory is a more significant time function than other more complex functions. Therefore, it is the model that we use for the rest of the analysis.

The following step was to analyse if there were differences between the teams in the intercept and slope of performance over time. This was done by comparing the growth model with no variance in the intercept and in growth parameters, to models in which these parameters are allowed to vary. The comparison was conducted using the chi-square difference (i.e., −2 log-likelihood ratios (−2LL)), as suggested by Bliese and Ployhart (2002). Table 4.5 shows the results for models 1 to 3, corresponding to a baseline fixed model, a model with random intercept, and a model with random intercept and slopes, respectively. The comparison of the random intercept model (−2LL = -795.89) with the baseline fixed model (−2LL = -829.56) significantly improved the model fit (Δ2LL = 67.33, $p < 0.0001$). The comparison of the random intercept and slopes model (−2LL = -794.46) with the random intercept model, although not statistically significant, still revealed a better fit (Δ2LL = 2.86, $p = 0.24$). There is a generalized agreement among scholars that this test is very conservative (e.g. Bliese & Ployhart, 2002), and that theoretical arguments would support the use of random slopes. We decided to use a model with variable intercepts and slopes, since the assumption that teams have different performance trajectories over time and, therefore, different learning curves, is theoretically reasonable (e.g., Edmondson et al., 2007). For these reasons, the model used in this study considers differences in team performance, between teams, at time 0 (team performance 1), and also considers differences in the growth rate of team performance across teams in adaptive situations.

The final step of level 1 analysis was to evaluate the error structure of the model. The goal of this step is to determine whether a model fit improves by incorporating autocorrelation and heteroscedasticity. Neither test revealed a better fit controlling for autocorrelation (Δ2LL = 0.99, $p = 0.32$), and for heteroscedasticity (Δ2LL = 1.17, $p = 0.56$). Therefore, we did not control for autocorrelation and heteroscedasticity in subsequent analyses.

<u>Level 2 analysis: predictors of team improvised adaptation learning</u>

In level 1 analysis we evaluated the relationship between team performance and time, and defined the basic model for further analysis. In this level 2 analysis we estimate a model that includes SMM similarity and transitional team reflexivity to predict variance in the trajectory parameters. In all level 2 models we control for experience working together.

Table 4.5. Results of fixed function for time – model 1, and of fitting random coefficient models to team performance – models 2 and 3 (Experiment 2)

Parameter	*Model 1: linear function for time*			*Model 2: random intercept*			*Model 3: random intercept and slopes*		
Fixed Effects	*Estimate*	*SE*	*t*	*Estimate*	*SE*	*t*	*Estimate*	*SE*	*t*
Intercept	60.51***	2.93	20.65	60.51***	3.11	19.44	60.51***	3.12	19.42
Time	-3.43	2.27	-1.51	-3.43*	1.40	-2.45	-3.43*	1.54	-2.23
Goodness of fit									
-2 log-likelihood	-829.56			-795.89			-794.46		
AIC	1,665.11			1,599.78			1,600.92		
BIC	1,674.66			1,612.51			1,620.01		

Note, N = 60 teams

* $p < 0.05$

*** $p < 0.001$

In Hypotheses 4 and 5 we predicted that SMM similarity and transitional team reflexivity are positively related to team improvised adaptation learning. These hypotheses were tested by integrating SMM similarity and transitional team reflexivity in the longitudinal basic model. Then the interactions with time were analysed to determine the impact of SMM similarity (Table 4.6) and transitional team reflexivity (Table 4.7) on team improvised adaptation learning. The interaction between time and SMM similarity was only moderately significantly related to team improvised adaptation learning ($y = 4.82$, $t = 1.74$, $p < 0.10$). The interaction between time and transitional team reflexivity was not significantly related to team improvised adaptation learning ($y = -4.06$, $t = -1.46$, $p = 0.15$). However, transitional reflexivity is correlated with team performance at time 0 ($y = 20.67$, $t = 3.42$, $p < 0.01$). Thus, SMM similarity and transitional team reflexivity do not have a direct effect on performance over time, under extreme time constraints, i.e. on team improvised adaptation learning. Hypotheses 4 and 5 are not supported. Nevertheless, we identified a direct effect of transitional reflexivity on team performance at time 0.

Table 4.6. Results of shared mental model similarity predicting team improvised adaptation learning – model 4 (Experiment 2)

Predictor	*Model 4*		
Fixed effects	*Estimate*	*SE*	*t*
Intercept	56.74***	6.26	9.06
Time	-5.84**	1.96	-2.98
Experience working together	-3.74	3.26	-1.15
Transitional reflexivity	16.62**	5.35	3.10
Shared mental models	1.64	5.92	0.28
Time x Shared mental models	4.82†	2.77	1.74
Goodness of fit			
-2 log-likelihood	-779.88		
AIC	1,575.76		
BIC	1,601.04		

Note, N = 60 teams

† $p < 0.1$

** $p < 0.01$

*** $p < 0.001$

Hypothesis 6 predicts that the relationship between SMM similarity and team improvised adaptation learning is moderated by transitional team reflexivity in such a way that the relationship will be weaker the more that teams adopt transitional reflexivity. This hypothesis was tested by adding the interaction terms of SMM model similarity, transitional team reflexivity, and time to the model (results in Table 4.8). The results show that the interaction between SMM similarity and transitional team reflexivity predicting team improvised adaptation learning is significant and negative ($y = -14.59$, $t = -2.71$, $p < 0.01$). The results also show that this interaction increases the effect of shared mental model similarity on team improvised adaptation learning ($y = 12.12$, $t = 3.19$, $p < 0.01$).

Table 4.7. Results of transitional team reflexivity predicting team improvised adaptation learning – model 5 (Experiment 2)

Predictor	*Model 5*		
Fixed effects	*Estimate*	*SE*	*t*
Intercept	52.30***	6.26	8.35
Time	-1.41	1.97	-0.71
Experience working together	-3.74	3.26	-1.15
Shared mental model similarity	6.47	5.22	1.24
Transitional reflexivity	20.67**	6.04	3.42
Time x Transitional reflexivity	-4.06	2.78	-1.46
Goodness of fit			
-2 log-likelihood	-780.32		
AIC	1,576.64		
BIC	1,601.92		

Note, N = 60 teams
** $p < 0.01$
*** $p < 0.001$

Table 4.8. Results of interaction effects of shared mental model similarity and transitional team reflexivity predicting team improvised adaptation learning – model 6 (Experiment 2)

Predictor	*Model 6*		
Fixed effects	*Estimate*	*SE*	*t*
Intercept	48.42***	6.97	6.94
Time	-7.46**	2.69	-2.78
Experience working together	-1.76	3.11	-0.57
Transitional reflexivity	27.82***	7.86	3.54
Shared mental model similarity	9.32	7.89	1.18
Time x Transitional reflexivity	3.24	3.80	0.85
Time x Shared mental model similarity	12.12**	3.80	3.19
Transitional reflexivity x Shared mental model similarity	-15.79	11.30	-1.40
Time x Transitional reflexivity x Shared mental model similarity	-14.59**	5.38	-2.71
Goodness of fit			
-2 log-likelihood	-763.07		
AIC	1,548.14		
BIC	1,582.70		

Note, N = 60 teams
** $p < 0.01$
*** $p < 0.001$

This interaction is visible in Figure 4.3. For teams that adopt transitional reflexivity, the effect of SMM similarity on team improvised adaptation learning is not significant. However, if teams do not reflect between action phases, the impact of having similar SMM on team improvised adaptive performance over time is high and significant. Moreover, when teams do not reflect between tasks and do not share mental models, their ability to learn from improvised adaptive episodes is considerably weaker. These results support Hypothesis 6.

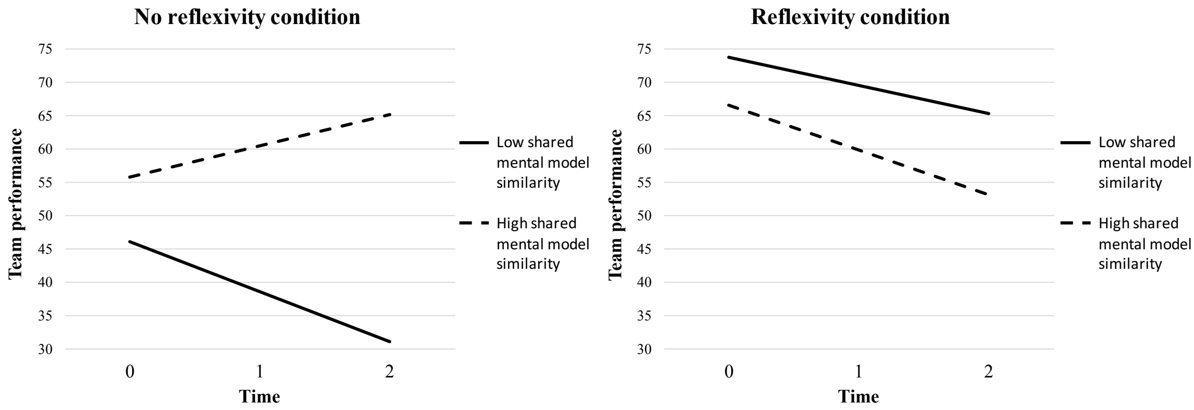

Figure 4.3. The interaction effect between post-action team reflexivity and shared mental model similarity on team performance

Discussion

In experiment 2 the analysis is two-fold. First we investigated the effects of SMM similarity and transitional team reflexivity on team improvised adaptive performance, and second we investigated the effect of these variables on team improvised adaptation learning. We also analysed the interaction between the two variables predicting both outcomes. The results of the first analysis provided additional support for the relevance of SMM similarity predicting team improvised adaptive performance. In addition, the results revealed that teams can improve improvised adaptive performance by exercising team reflexivity between action phases. As in experiment 1 and by analysing Figure 4.4, we can observe that when teams face great time constraints, sharing mental models and reflecting between tasks will reinforce the teams' capacity to deal with unpredictability and perform well. The results in Figure 4.4 show, in a more dramatic way, the consequences of not sharing mental models and not reflecting between tasks, with significant negative consequences for adaptive performance. However, also in line with what was observed in experiment 1, SMM similarity and transitional team reflexivity did not interact to produce effects on team improvised adaptive performance. This supports our previous suggestion that extreme temporal pressure does not allow for explicit and implicit coordination mechanisms to cooperate, promoting improvised adaptive performance.

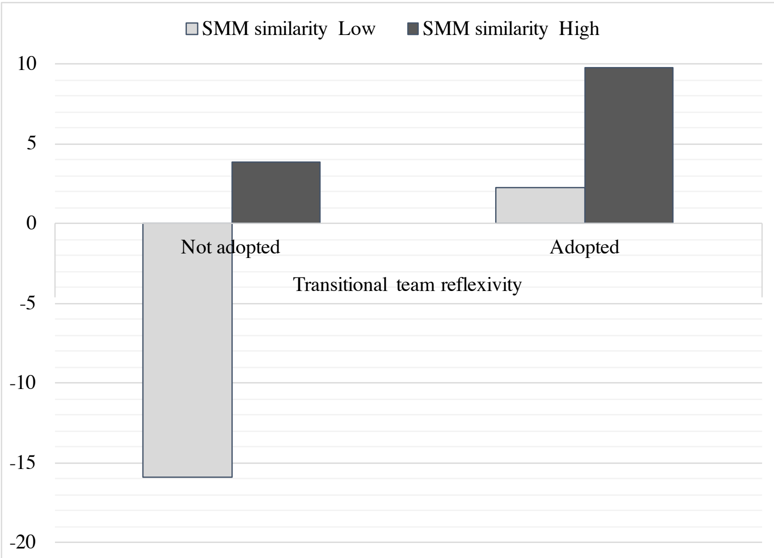

Figure 4.4. Comparison of the means of team improvised adaptive performance as a function of SMM similarity and transitional team reflexivity

The second analysis of experiment 2 was on team improvised adaptation learning. Here the results showed a different relationship between the two independent variables, SMM similarity and transitional team reflexivity, and team improvised adaptation learning. Neither SMM similarity nor transitional team reflexivity revealed a direct effect on the teams' capacity to learn from the improvised adaptive situations. However, by the analysis of the right-hand graph in Figure 4.3, we can observe that for teams that reflect between action phases, their performance trajectory is not significant, and the impact of having similar SMM on team improvised adaptation learning is also not significant. Nonetheless, the lack of significant changes is a meaningful result that indicates that by exerting transitional team reflexivity, teams are able to reduce the impact on performance of unpredictable situations that force them to adapt in an improvisational manner.

Further, the results reveal that, combined, SMM similarity and transitional team reflexivity show a negative interaction predicting team improvised learning. This is best seen in the left-hand graph in Figure 4.3. The graph shows that when teams do not reflect between tasks, if they also do not share mental models, then their capacity to learn from improvised adaptive situations is seriously jeopardized. However, if they have a highly similar SMM they will learn from these situations and improve performance over time. This means that the intensity of the impact of SMM similarity on team improvised adaptation learning depends on whether teams adopt, or do not adopt, transitional team reflexivity. If teams do not adopt reflexive behaviours between tasks, then they must share mental models if they wish to learn and improve improvised adaptive performance over time. One of the most significant conclusions regarding team improvised adaptive performance is that not reflecting and not sharing mental models are highly detrimental for a team's capacity to learn.

GENERAL DISCUSSION

The role of shared mental models on team adaptation has been thoroughly studied in the last few years (e.g., Cannon-Bowers et al., 1993; Mathieu et al., 2000). However, the adaptation process has always been seen, regardless of the temporal dimension of the trigger, in relation to its timing relative to the start of the action phase. By distinguishing between team preemptive adaptation and team improvised adaptation, Abrantes et al. (2018) opened the possibility to fine-tune the analysis on adaptation processes. For example, for Burke and colleagues (2006), SMM are an outcome of diverse phases in the adaptive cycle. After plan formulation, teams develop shared mental models that will help them in the plan execution phase, in which coordination mechanisms play a fundamental role. However, in team improvised adaptation processes teams cannot plan prior to execution and, therefore, develop SMM to support them in the execution phase. Moreover, although Tjosvold et al. (2004) argue that SMM will help teams to learn, which is also a consequence of team adaptation (Burke et al., 2006), improvisational processes do not always result in learning (Cunha, Cunha, & Kamoche, 1999; Moorman & Miner, 1998a). Our research adds a new insight into team adaptation processes by analysing some boundary conditions that promote team adaptive performance under extreme temporal restrictions. Further, our results expand team adaptation, team improvisation, and team learning theories by delving into mechanisms that lead teams to learn from improvised adaptation situations.

Theoretical implications

Emergent states and team processes "are importantly related to team adaptive performance" (Christian et al., 2017, p. 77). Our results indicate that one of the emergent states is SMM similarity and one of the team processes is team reflexivity. Our findings also shed light on the way these constructs interact to affect team learning when design and execution merge as a necessity to adapt to changing and unpredictable circumstances. This study adds a deeper understanding of the role of different types of team reflexivity, in particular in-action reflexivity and transitional reflexivity, on a team's capacity to adopt improvised adaptation processes and improve performance. Further, our results add knowledge on the way transitional reflexivity impacts a team's ability to learn from adaptive situations of design and execution merger, and improve performance over time.

We found that in the particular adaptation situation in which planning and acting occur simultaneously, teams that have similar SMM and reflect while they act, improve improvised adaptive performance. Schmutz and Eppich (2017) have theorized that if teams briefly stop and reflect during the execution of a task, risking to lose valuable execution time, they will optimize the immediate task, adapt, and achieve better performance. We have found that, in fact, under time pressure situations, when teams have to adapt and do not have time to plan prior to execution, the adoption of in-action reflexivity has positive impacts on team improvised adaptive performance. Also, our research suggests that SMM similarity contributes to team improvised adaptive performance. This happens because SMM similarity will work as an underlying mechanism, enabling implicit coordination (Rico, Sánchez-Manzanares, Gil, & Gibson, 2008) and promoting adaptive performance (Christian et al., 2017). As mentioned above, this finding adds to the debate about the effect of SMM similarity on team performance by supporting Lim and Klein's (2006) argument that, under intense time restrictions in which teams do not have much time for explicit coordination, SMM similarity play a fundamental role in team performance, i.e. team improvised adaptive performance.

The present work also contributes to a sounder comprehension of the effects of transitional reflexivity on team improvised adaptive performance. In this type of reflexivity teams evaluate past performance and delineate future alternative strategies, seeking to optimize future tasks (Schmutz & Eppich, 2017). In this study we have shown that teams that reflect between tasks will improve their performance when faced with unpredictable and time stressful situations. Our results suggest that through reflection teams will improve the similarity of SMM (Gurtner et al., 2007) and, therefore, improve the likelihood of good performance in future team improvised adaptation episodes.

Our empirical evidence also covered the effect of SMM similarity and transitional team reflexivity on team improvised adaptation learning. While improvising, teams do not always learn (Moorman & Miner, 1998a). Nevertheless, they can learn how to improvise, they can learn about the task, and they can learn about themselves and the environment (Cunha et al., 1999). One fundamental question is how teams can learn from improvisational processes. Our findings reveal that when teams are involved in improvised adaptation events, if they want to ensure that they learn from one episode to the next, and do not decrease performance over time as unpredictability and time pressure occur, they must have high levels of SMM similarity or adopt transitional reflexivity. This work shows the interaction effect of these constructs and its effect on team improvised adaptive performance trajectory over time. More implicit forms of coordination may function as substitutes for more explicit ones (Santos, et al., 2016a). Our results have shown that SMM similarity (an implicit form of coordination) works as a substitute for the lack of transitional team reflexivity (an explicit form of coordination). The evidence suggests that the lack of both forms of coordination dramatically damages a team's capacity to learn from improvised adaptation situations. Similar to what we have stated above for team improvised adaptive performance, when teams reflect, they develop mental models similarity. Therefore, as the results have shown, the effect of SMM similarity on team improvised adaptation learning is less important when teams reflect between tasks. SMM works as an important mechanism to identify the causes of particular mistakes, and learn from those mistakes (Cannon & Edmondson, 2001). Our study extends this work by showing that if teams do not reflect during transition phases, either because they lack the will or the time to do it, then SMM similarity will play the role of a facilitator mechanism for learning, and allow teams to learn from the errors that typically occur during improvised adaptive situations.

Practical implications

For organizational teams, our work has several implications. The first is that teams that operate in fast and unpredictable environments, and that must be able to adapt under severe time constraints, must develop similar shared mental models. One of the ways to develop mental model similarity is precisely by exercising team reflexivity and discussing fundamental aspects of the task. Moreover, under extreme time pressure, and facing adaptive episodes, team members must not immediately engage in blind execution, even if that means jeopardizing implementation time. Briefly adopting in-action reflective behaviours, such as evaluation of ongoing performance or explore alternative paths, will pay and will save valuable time, avoiding engaging in wrong or less optimal activities.

Another relevant implication relates to the teams' ability to learn from improvised adaptation processes. Organizational teams often have little time to exert transitional reflexivity. Teams jump from action episode to action episode without giving much thought to the previous experience. Our research has shown that although this is not recommended, teams can overcome this challenges by promoting SMM similarity. Of course, we have stated that SMM similarity can be obtained via reflexivity, which makes this implication work in circles; i.e. teams that do not reflect can substitute this limitation by developing SMM similarity, which can be achieved via reflexivity. However, teams have other alternatives to develop SMM similarity, since there are other mechanisms that help to increase SMM similarity. Some relate to team composition, such as the tenure and experience of team members, others with team level interventions, such as planning or leadership (Mohammed et al., 2010). Nonetheless, the main implication of our research for practical purposes resides in the importance of exerting reflexivity, during the task and between tasks, so that teams can have the triple benefit of improving the likelihood of immediate improvised adaptation performance improvement, enjoying this same improvement over time and consecutives adaptive episodes, and also developing similar SMM that contribute for both outcomes.

Limitations and future research

Despite our contributions, this study has three major limitations. The first is the fact that it did not analyse the effect of in-action reflexivity on a team's ability to learn from improvised adaptation processes. We assumed that transitional reflexivity would play a major role in this construct, and opted not to manipulate in-action reflexivity on the experiment in which we measured team improvised adaptation learning. Although we argue that the effect of in-action reflexivity is less important on team learning than the effect of transitional reflexivity, this effect is not totally absent. Schmutz and Eppich (2017) argue that teams that reflect while acting will learn via trial-and-error, which will be a by-product of the reflexivity activity. It would be interesting to evaluate the extent to which teams learn from in-action reflexivity and the impact of that learning on future improvised adaptation episodes.

A second limitation is that we did not explore the relationship between in-action team reflexivity and transitional team reflexivity. The two constructs were never manipulated in the same experiment. In-action reflexivity was manipulated in experiment 1 and transitional reflexivity was manipulated in experiment 2. In line with earlier research, we have seen that transitional reflexivity allows teams to prepare for future actions, and in-action reflexivity favours adaptation (Konradt et al., 2015). The extent to which teams that exert in-action reflexivity need less, the same, or more transitional reflexivity to obtain similar results would be a promising line of investigation: does in-action reflexivity substitute, in any degree, for transitional reflexivity? Or does it impact the quality of the content of transitional reflexivity? These are questions that deserve further attention.

The third limitation of our work has to do with the content of learning. We have measured team learning from an outcome perspective, i.e. by evaluating performance trajectories over time (Edmondson et al., 2007). This perspective sheds little light on the content of learning. As proposed by Cunha et al. (1999), teams can learn how to improvise, can learn about the task, or about themselves and the context. Burke and colleagues (2006) argue that, out of adaptation episodes, teams uncover the results of previous actions, the way to prevent unintended negative consequences, and how to revise the course of action for future episodes. Our research does not delve into content dimensions, and only advances boundary conditions that allow teams to learn from improvised adaptation processes. Future research should investigate what kind of differential learning contents are produced when teams engage in improvised adaptive situations, and the impact of different contents on future situations in which teams must design and execute at the same time.

CONCLUSION

Rampant competition, globalization, rapid technological changes, and prevailing cultural movements lead to frenetic business environments, (Christian et al., 2017; Koslowski & Bell, 2013) in which teams must adapt in shorter and shorter time frames, sometimes by merging design and execution (Abrantes et al., 2018). In order to thrive in such environments, teams must adapt and learn. Team members must try to develop similar understandings about relevant aspects of the task, and they must also engage in team reflexivity both during and between tasks. Time is not an unlimited resource. Modern management demands do not cope with the loss of time by not investing time on reflection.

CHAPTER 5.

DAMNED IF YOU DO AND DAMNED IF YOU DON'T: HOW TEMPORAL PERSONALITY AND TEAM IMPROVISED ADAPTATION CAN FOSTER TEAM PERFORMANCE AND TEAM IMPROVISED ADAPTATION LEARNING

ABSTRACT

Turbulent business environments require adaptable teams that can rapidly react to unpredictable change in order to maintain or improve performance. Adaptable teams demand specific team characteristics. This study investigates the role of team temporal personality, in particular team present- and future-orientation, in a team's ability to adapt to disruptions, when time is so scarce that planning and execution have to be simultaneous. The study analyses the effects of two different aspects of team temporal personality composition – *team temporal personality elevation*, or the mean among team members of a specific temporal personality trait; and *team temporal personality diversity*, or the variability of that trait within the team – on two different outcomes, team performance and team improvised adaptation learning. In a laboratory context, 60 full-time worker teams in the banking sector were assessed on present- and future-orientation personality traits, and evaluated regarding their ability to adapt under, and learn from, disruptive and time constrained situations. The results show that the adoption of team improvised adaptation processes mediates the relationship between team future-orientation elevation and team performance. However, these teams struggle to learn. On the other hand, the findings reveal that team future-orientation diversity facilitates team improvised adaptation learning, but limit a team's ability to perform well when changes mandate that teams plan and execute at the same time. This work contributes to our understanding of the roles of team temporal personality traits on a team's capacity to deal with unpredictability and temporal scarcity.

"The race to predict the future was won by our hominin ancestors when they developed the ability to understand the concept of time and mentally project themselves backward into the past and forward into the future"

(Buonomano, 2017, p.22).

INTRODUCTION

Time is a central element in the way organizations operate and are managed (Bluedorn & Denhardt, 1988; Roe, Waller, & Clegg, 2008; Sonnentag, 2012), and at a team level, it is a particularly crucial aspect to the definition and understanding of team processes (Roe, Gockel, & Meyer, 2012). In unstable and unpredictable environments, such as those that characterize many contemporary business contexts (Maynard, Kennedy, & Sommer, 2015; Vera, Crossan, Rerup, & Werner, 2014), in which teams must often rapidly adapt to unpredicted situations (Lei, Waller, Hagen, & Kaplan, 2016), time becomes ontological to the team process concept.

"Because time directly impacts the what, how, and why elements of a theory" (George & Jones, 2000, p. 658), some lines of research have sought to integrate time into the study of teams (e.g., Blount, Mannix, & Neale, 2004). Two particular literatures in which time reveals its centrality are team adaptation (e.g., Burke, Stagl, Salas, Pierce, & Kendall, 2006) and team improvisation (e.g., Crossan, Cunha, Vera, & Cunha, 2005). Abrantes, Passos, Cunha, and Santos (2018) developed the concept of team improvised adaptation, by integrating team improvisation into team adaptation literature. The authors added a temporal element to the team adaptation construct, considering that when teams are adapting as a response to a trigger that immediately initiates an action process, teams do not have time to plan prior to execution and, therefore, have to plan and execute simultaneously. This was also addressed by Lei and colleagues (2016) who argue that in nonroutine situations, team planning activities occur after the beginning of the task.

The merger of planning and execution configure an extreme temporal context in which several dimensions become critical. For example, effective teams alter their interaction patterns when facing nonroutine situations (Lei et al., 2016); when decision-making is delegated so teams can be locally responsive to unpredictable situations and improvise, performance improves (Magni & Maruping, 2013); also, teams that become stable over time, maintaining their members, tend to improvise better and achieve better results (Akgün & Lynn, 2002). However, although research has revealed the importance of individual characteristics to team effectiveness (Hackman, 1990), and in particular personality (Neuman, Wagner, & Christiansen, 1999), little is yet known regarding team composition and its adequacy for unpredictable and time scarce situations. This study analyses the effects of team composition on team performance under unpredictable and time constraint conditions, and also on the team's capacity to learn under such conditions, i.e. on team improvised adaptation learning. In particular, we investigate whether team temporal personality elevation (TTPE) and team temporal personality diversity (TTPD) play different roles in team performance and team learning under extreme time constraints, defined as critical time limitations that impede planning before acting.

Team personality elevation refers to the team's mean level of a specific personality attribute, and team personality diversity reflects the variance or disparities between team members on a given attribute (Neuman et al., 1999). In this paper we focus on temporal attributes of personality, namely on time perspective (Zimbardo & Boyd, 1999). We suggest that for different reasons, teams composed of present-oriented members, as well as teams composed of future-oriented members, will achieve higher performance levels than those of teams composed of members low on present-orientation and low on future-orientation. Although apparently paradoxical, our suggestions contemplate the fact that present and future time perspectives are not extremities of the same scale, but conceptually independent characteristics of a person's temporal personality (Mohammed & Nadkarni, 2011; Zimbardo, Keough, & Boyd, 1997). We also predict that the relationship between these team personality features and team performance is mediated by the adoption of team improvised adaptation processes. Moreover, we propose that heterogeneous teams, both in terms of present-orientation and future-orientation, i.e. teams that have members high and members low in future-orientation, and teams that have members high and members low in present-orientation, are better equipped to learn from improvised adaptation processes.

The literature on team adaptation suggests that some personality traits, i.e. "relatively consistent patterns of emotion, cognition, and behaviour in which individuals differ from one another" (Mõttus, Kandler, Bleidorn, Riemann, & McCrae, 2017, p. 474) are related to team adaptation (Maynard, Kennedy, & Sommer, 2015). However, many of these assertions derive from individual adaptability (Pulakos, Schmitt, Dorsey, Arad, Borman, & Hedge, 2002), and do not consider temporal characteristics. Our research adds to current knowledge in two fundamental ways. First, it extends team adaptation literature by examining specific aspects of the way a team interprets and interacts with time, or team temporal personality (Ancona et al., 2001), and its effects on team performance and team learning, under extreme time scarcity situations. Second, it expands existing research on team temporal personality by exploring the different impacts of distinct aspects of team personality composition – elevation and diversity.

We start by addressing existing knowledge on team adaptation and team improvised adaptation. We then review literature on team temporal personality, and move forward by reflecting on a potential outcome of team improvised adaptation processes, team performance. We finalize by exploring the way different aspects of team temporal personality composition impact team performance under conditions of unpredictability and extreme time pressure, and also how they impact on a team's capacity to learn under such conditions, i.e. on team improvised adaptation learning. The conceptual model is depicted in Figure 5.1.

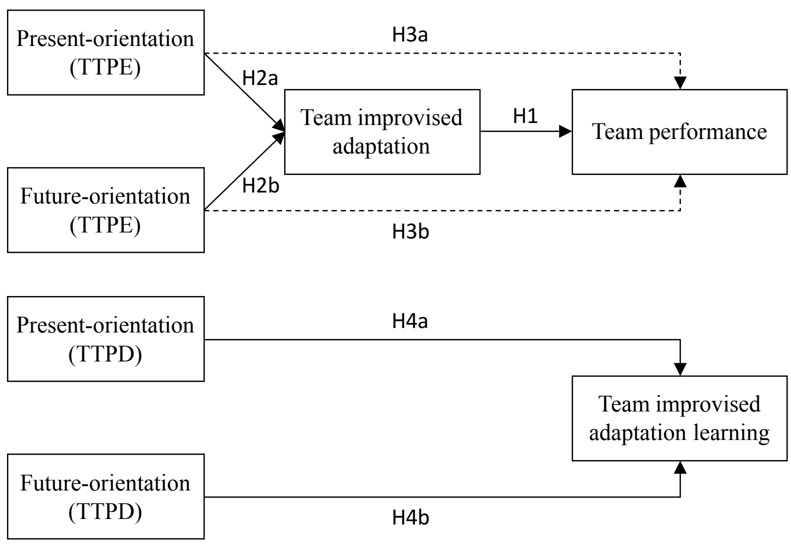

Figure 5.1. Research model and hypotheses. Solid arrows represent direct effects. Dashed arrows represent mediation effects. TTPE – Team temporal personality elevation. TTPD – Team temporal personality diversity.

THEORY AND HYPOTHESIS DEVELOPMENT

Team Improvised Adaptation

Teams adapt by adjusting relevant team processes in a response to a disruption that gives rise to the need for adaptation (Maynard et al., 2015). They do it by going through an adaptive cycle that starts with the new situation assessment, then moves to planning a new execution, implementing it, ending up with a team learning process in which the team analyses the results of their actions in order to better prepare for future adaptive situations (Burke et al., 2006). The consequences of the adaptation process are team adaptive outcomes that can configure emergent states (such as team cognitions) or team performance (Maynard et al., 2015).

Teams improvise when they deliberately merge design and execution of a novel production (Cunha, Miner, & Antonacopoulou, 2016; Miner, Bassoff, & Moorman, 2001). This can be triggered solely by the will of the team (Cunha, Cunha, & Kamoche, 1999) or as a response to unexpected events (Crossan & Sorrenti, 1997; Magni & Maruping, 2013). When teams improvise as a response to an unexpected event, they are also adapting, i.e., they are performing team improvised adaptation (Abrantes et al., 2018). According to Abrantes and colleagues (2018), this process is distinct from team preemptive adaptation (when teams have time to prepare a new plan prior to its execution, as a response to a disruption), and under extreme time constraints, teams that have the ability to plan and execute simultaneously will achieve better performance. The argument that team adaptation predicts team performance has been vastly analysed. Santos, Passos, and Uitdewilligen (2016a) state that team adaptation mediates the relationship between team learning and team performance. It has also been found that team adaptive behaviours mediate the relationship between implicit coordination and team performance (Marques-Quinteiro, Curral, Passos, & Lewis, 2013). Several other studies report that when teams face unpredictability and disruptions, those that adapt achieve better performance (e.g., Han & Williams, 2008; Johnson, Hollenbeck, Humphrey, Ilgen, Jundt, & Meyer, 2006; Maynard et al., 2015). Taking these findings, we assert that teams that adopt team improvised adaptation processes achieve higher levels of performance. We hypothesize the following.

Hypothesis 1: Team improvised adaptation is positively related to team performance.

Scholars have been looking at team adaptive processes for several decades, but the fine-tuning of the construct between team improvised adaptation and team preemptive adaptation is recent. Moreover, although antecedents for team adaptation to nonroutine situations have been thoroughly analysed, the leverage of individual characteristics to a team level analysis, either by aggregation or through other forms of composition, is still a research arena where more work needs to be developed (Maynard et al., 2015).

Team Temporal Personality

Team personality composition is "a team-level index of the personality traits within the team, reflecting the strength (or elevation) of a given trait within the team and/or the heterogeneity of a trait within a team" (Prewett, Brown, Goswami, & Christiansen, 2016, p. 3). Neuman et al. (1999) highlight that the composition can be performed through the mean of a particular trait in the members' personality, representing team personality elevation; or through the variance or differences between team members regarding a specific personality characteristic, representing team personality diversity. These two composition methods correspond to Chan's (1998) additive and dispersion composition models, respectively. For Neuman and colleagues (1999), both aspects of team personality composition will affect team performance, however the effect is different for the different aspects. For example, for traits such as openness to experience and agreeableness, team personality elevation predicted team performance; however, for extraversion and emotional stability, performance was predicted by team personality diversity (Neuman et al., 1999).

One aspect of team personality composition is team temporal personality. Temporal personality "is the characteristic way in which an actor perceives, interprets, uses, allocates, or otherwise interacts with time" (Ancona et al., 2001, p. 519). Ancona and colleagues (2001) clarify that "actors" consist of individuals, groups, organizations, and even society. The authors argue that temporal personality represents the way a person or a team understands and acts in relation to a temporal continuum, and contains variables such as time perspective. Initially defined by Lewin (1951) as "the totality of the individual's views of his or her psychological future and psychological present existing at a given time" (p. 75), this aspect of temporal personality has been labeled in many different ways (Mohammed & Nadkarni, 2011). Bartel and Miliken (2004) talk about time orientation as cognitive frames used to understand events, and give order and meaning to personal and social experiences. Time orientation is part of an individual's personality (Thoms, 2004). Bluedorn (2002) refers to temporal focus as the degree of importance given to the past, the present, or the future. For Zimbardo and colleagues (1997), time perspective configures a psychological attribute that frames an individual's temporal standpoint regarding the present, past, or future. It is a nonconscious process in which experiences are temporally categorized giving order and coherence to the events (Zimbardo & Boyd, 1999).

Within the framework proposed by these authors, two features of time perspective have been meticulously analysed by the literature, the present and the future perspectives.

A present-oriented individual is more attentive to immediate occurrences and lacks concern for future consequences (Harber, Zimbardo, & Boyd 2003; Merchant, Rose, & Rose, 2014). Such persons live for the moment (Zimbardo, Keough, & Boyd 1997), they enjoy life, have a reduced concern about the future, emphasize newness, and seek to experience new sensations (Zimbardo & Boyd, 1999). Future-oriented people are characterized by planning and being focused on achieving future objectives. Their decisions are mostly influenced by projections of future consequences, and are less concerned with novelty search or sensation seeking (Harber, Zimbardo, & Boyd 2003; Zimbardo & Boyd, 1999). Present and future orientations are independent characteristics of an individual's temporal personality, and not opposite ends of a single scale (Mohammed & Nadkarni, 2011; Zimbardo et al., 1997). In this study we analyse temporal personality at a team level, regarding the particular characteristic of time perspective, at both aspects of team personality composition, elevation and diversity. For the rest of this paper, for simplicity reasons we will refer to the time perspective element of team temporal personality, solely as team temporal personality. We analyse the effects of team temporal personality elevation (TTPE) and team temporal personality diversity (TTPD) on team performance and on team improvised adaptation learning, as well as the mediating effect of team improvised adaptation between TTPE and team performance.

Team Temporal Personality Elevation, Team Improvised Adaptation, and Team Performance

Team temporal personality elevation (TTPE) was analysed for present and future time perspectives. For both perspectives, TTPE represents the mean of all team members in that particular time perspective. Several scholars have linked team personality elevation with team performance, but the results have been unclear. Some empirical studies found that conscientiousness, agreeableness, extraversion, and emotional stability predict team performance (e.g., Barrick, Stewart, Neubert, & Mount, 1998; Kichuk & Wiesner, 1997); yet, Cogliser, Gardner, Gavin, and Broberg (2012) found this relationship only with agreeableness, and other studies found it only with agreeableness and conscientiousness (Neuman et al., 1999; Halfhill, Nielsen, Sundstrom, & Weilbaecher, 2005). Some research has also linked openness to experience with group performance (e.g., Bolin & Neuman, 2006; LePine, 2003). This inconsistency in results points to the existence of boundary conditions on the relationship between team personality elevation and team performance.

Van Vianen and De Dreu (2001) argue that some of these boundary conditions relate to task characteristics. In our study we address the particular case of tasks that are performed under extreme time pressure due to unpredictable disruptions that lead teams to merge design and execution.

Present-oriented perspective

Although the relationship between team personality elevation and team performance have been the subject of prolific research, to our knowledge, little has been done regarding TTPE. However, there is abundant literature regarding individual temporal personality, especially time perspective. Present-oriented individuals tend to be impulsive, seeking sensory stimulation (Merchant et al., 2014). They make plans with shorter temporal scopes (Mohammed & Nadkarni, 2011) and are essentially focused on the reality of the current situation (Zimbardo & Boyd, 1999; Zimbardo et al., 1997). When they are immersed in an action moment they tend to think less about future consequences (Harber et al., 2003) and they are prone to take risks (Stolarski, Bitner, & Zimbardo, 2011; Zimbardo et al., 1997). Because team improvised adaptation processes imply a rapid immersion in action moments, implying some degree of risk since teams do not know the outcome of the solution that is being implemented, we argue that teams composed of present-oriented members will more likely adopt team improvised adaptation processes. Therefore, we propose the following hypothesis.

Hypothesis 2a: Team present-orientation elevation is positively related with team improvised adaptation processes.

Future-oriented perspective

Future-oriented people are likely to resist enrolling in immediate solutions that could divert them from long-term goals (Harber et al., 2003). They are not impulsive, and do not easily take risks (Zimbardo & Boyd, 1999). However, they base their decisions on anticipated future consequences of their actions (Zimbardo et al., 1997), they focus on goals and achievement and, therefore, they will do in the present what it takes to achieve their future targets (Taylor & Wilson, 2016). Taylor and Wilson (2016) suggest that those who are high in future orientation, because they envisage future consequences, are willing to do something in the present; and those who are low in future-orientation will neglect to act in the present because they do not as easily perceive the future. Moreover, although they dislike taking risks and acting impulsively, future-oriented people are willing to sacrifice their present enjoyment to avoid wasting time (Boniwell & Zimbardo, 2004). They tend to be aware of what is going on in the external environment, they create the future by taking action and, for them, problems are small barriers to be overcome so they can be successful in the future (Thoms, 2004). Thus, when faced with an unpredictable situation that endangers the achievement of their future goals, future-oriented people will immediately act to prevent negative consequences. We predict that teams composed of future-oriented members will more likely enrol in team improvised adaptation processes when an unexpected disruption arises. We then propose the following hypothesis.

Hypothesis 2b: Team future-orientation elevation is positively related with team improvised adaptation processes.

Time perspective and team improvised adaptation

As we have discussed, some evidence suggests that team adaptation mediates the relationship between several constructs, such as team learning (Santos et al., 2016a), implicit coordination (Marques-Quinteiro et al., 2013), and team performance. When faced with unpredictable events that disrupt the normal course of a team's activity, those teams that are able to adapt will achieve a better result (Burke et al., 2006; Maynard et al., 2015; Johnson et al., 2006). The same is true for the mediating role of team adaptation between team personality traits and performance. For example, the literature has linked openness to experience and team adaptive performance (Baard, Rench, & Kozlowski, 2014; LePine, 2003). Smith and Lewis (2011) propose that emotional equanimity (an emotional calm and evenness) promotes the acceptance of paradoxical tensions, such as those encountered in improvised adaptive situations, in which actors must decide whether to engage in untested *ad hoc* solutions to prevent major performance breakdowns. Given the emergency and time pressure frequently present in team improvised adaptation situations, we predict that those teams that are able to implement such processes will achieve a higher performance. Because we argue that team present-orientation elevation and team future-orientation elevation increase the likelihood of a team adopting team improvised adaptation processes, we foresee that team improvised adaptation processes mediate the relationship between both team personality traits and team performance. We therefore hypothesize the following.

Hypotheses 3a and 3b: Team improvised adaptation mediates the relationships between a) team present-orientation elevation, and b) team future-orientation elevation, and team performance.

Team Temporal Personality Diversity and Team Improvised Adaptation Learning

Team improvised adaptation learning is an outcome of team improvised adaptation processes. When teams learn from these processes, they become better prepared to address unpredictable situations of extreme time scarcity and, therefore, improve performance over time. This conceptualization of team learning is in line with the outcome perspective proposed by Edmondson, Dillon, and Roloff (2007), who define team learning in relation to the team learning curves in operational settings, consisting of performance improvements. Several aspects contribute to a team's capacity to learn. One of these is team diversity. Several studies relate team diversity with team learning. Van der Vegt and Bunderson (2005) suggest that in teams with collective team identification, expertise diversity promotes learning behaviours. Ely and Thomas (2001) propose that team diversity can be viewed as a resource for learning and adaptation. It has also been argued that cultural diversity may have positive effects on a team's ability to learn (Stahl, Mäkelä, Zander, & Maznevski, 2010). However, little has been said regarding personality diversity.

We consider diversity in time orientations again using future and present time perspectives. TTPD accounts for the variance among team members (Neuman et al., 1999) for the two temporal personality traits, present-orientation and future-orientation. A small number of studies have theorized about team temporal personality diversity. It has been proposed that temporally diverse teams can better deal with dynamic and uncertain contexts, in which different temporal perspectives are required to reconcile immediate actions with long-term objectives (Eisenhardt, 2004; Mohammed & Nadkarni, 2011). A similar argument is used by Bartel and Milliken (2004), who propose that temporal diversity might be useful for teams that have to combine short-term with long-term performance issues simultaneously. The authors argue that different time orientations "allow for a more complete analysis of alternative ways of approaching a task as members focus on different goals and different ways of completing and ordering sub-tasks" (p. 106).

While these arguments stress the positive potential value of temporal diversity, other theory has stressed its potential dangers. Teams with dissimilar temporal personalities might spend a considerable amount of time reducing temporal conflicts, using valuable action time on coordination activities, reducing time available to meet deadlines, and jeopardizing team performance (Mohammed & Nadkarni, 2011). Nonetheless, if this is true for the immediate implementation of team improvised adaptation processes, it is a less important matter for team learning over time, in which teams have time to coordinate temporal disparities and make use of the benefits of temporal diversity. In this line of thought, West and Meyer (1997) claim that some temporal diversity is needed to develop change capabilities in a team. We propose that temporal diversity will allow teams to integrate different time perspectives into a learning process, resulting in increments to team performance over time. Hence, we predict that TTPD in both present-orientation and future-orientation will promote team improvised adaptation learning. We thus hypothesize the following.

Hypotheses 4a and 4b: a) Team present-orientation diversity, and b) team future-orientation diversity are positively related to team improvised adaptation learning.

METHOD

Sample and Procedures

We collected data from a laboratory study with a sample of 180 full-time workers. The participants were employees of a company in the banking industry and were enrolled in an executive training program. All participants agreed to participate in the experiment, with full knowledge that it was for research purposes and that confidentiality was guaranteed. 53% of all participants were women. The average age was of 40.64 years (SD = 6.34). All teams comprised three members randomly assigned to a total of 60 teams.

The experiment was specifically designed to induce the execution of team improvised adaptation tasks, and consisted of a set of activities in which teams had to perform brick building tasks. There were six different tasks, comprising two sets of tasks. One set with two tasks, and one set with four tasks. Each set had a control task in which teams did not have to exert improvised adaptation, followed by one (in the first set), and three (in the second set) similar tasks that required the adoption of improvised adaptation. In the first set, teams had to make a construction similar to a model that was presented to them. They had instructions depicting the model, and had to build a similar structure in the least possible time with the minimum number of mistakes. At the end, mistakes were converted into building time. In the second task of this set, after building for two minutes, teams were given a new set of instructions requiring task adaptation. The new instructions included a new model with ten alterations to the original model. Teams had three more minutes to complete the task.

The second set of tasks included four complex tasks, since integrated one positive and two negatively correlated variables, yet integral components of the task. Teams were asked to erect the most profitable tower as possible. Revenues were related to the size of the tower; costs were related to the number of bricks and time spent in construction. All teams had written rules, which were also given orally. The tasks subsequent to the first were altered after two minutes, requiring some level of adaptation. Task two of the second set required changes in the building (e.g. number of columns on the base). Task 3 had changes in the task and in the team dynamics (team members were not allowed to talk during the task), and task 4 also had changes in the task and team dynamics (the bricks could only be handled by one member at a time, and that member had to change each 30 seconds). The duration of the whole exercise was around 90 minutes. At the beginning of the exercise participants completed a questionnaire to assess their temporal personalities, and at the end of the exercise all participants were asked to complete a questionnaire measuring team improvised adaptation. Both outcomes, team performance and team improvised adaptation learning, were objectively measured. In this activity, two elements related to a larger research project were manipulated (shared mental models and team reflexivity), but for the purposes of our study we controlled the effects of both manipulations.

Measures

Present-orientation

This personality trait was assessed with the present-hedonistic subscale of the ZTPI instrument (Zimbardo & Boyd, 1999). The scale has 15 items that include statements such as "If things don't get done on time, I don't worry about it", and "I do things impulsively". Responses were rated with a 5-point Likert scale that ranged from "Very uncharacteristic/never true" to "Very characteristic/always true".

Future-orientation

To measure this time perspective aspect, we used the future subscale of the ZTPI instrument (Zimbardo & Boyd, 1999). It is a 13 items scale with statements such as "I believe a person's day should be planned ahead each morning", and "Before making a decision, I weigh the costs against the benefits". Responses were also rated with a 5-point Likert scale that ranged from "Very uncharacteristic/never true" to "Very characteristic/always true".

Team improvised adaptation

We employed a scale developed by Abrantes and colleagues (2018) comprising 5 items: 1) “The team dealt with unanticipated events on the spot”; 2) “Team members thought on their feet when they had to respond to contextual changes”; 3) “When unexpected problems appeared, the team reacted at the moment”; 4) “When problems occurred, the team immediately tried new approaches”; and 5) “The team promptly identified opportunities for new work processes when an unpredicted situation emerged”. Responses were rated with a 7-point Likert scale that ranged from “Totally disagree” to “Totally agree”.

Team performance

For this measurement we created a performance measure using these steps: First – the absolute performance of the six tasks was measured in seconds (first and second tasks), and in profit (third to sixth tasks); second – to simplify the interpretation of the results and allow comparability, we rescaled the results across a 0-100 scale, using a min/max transformation, where zero corresponds to the lowest result and 100 corresponds to the highest result; third – to add reliability to the measure we computed the mean score between task 2 and task 4. We chose these two tasks because they both are team improvised adaptation tasks and the tasks are independent from each other, having completely different objectives and task dynamics. The mean score of the two tasks was our team performance measure.

Team improvised adaptation learning

We used a learning curve theory approach conceptualizing and measuring organizational learning, in this case team improvised adaptation learning. Specifically, we measured team performance improvements, which are reflected in trajectories of change over time (Edmondson et al., 2007). For this purpose we used tasks 4 through 6 since all configure conditions of unpredictability and extreme time scarcity. These tasks forced teams to plan and execute at the same time. We used the same performance measures described in the steps above, and assessed the trajectory of these scores to measure team improvised adaptation learning.

Control variables

As part of a related study, the exercise from which these data were retrieved involved the manipulation of shared mental models and team reflexivity which had been shown to affect the outcomes. Thus, we controlled the effects of these two variables. Both variables were binary (0 = no manipulation, 1 = manipulation) and teams were randomly attributed to each of the four conditions. Demographic variables were not controlled since the distribution of the participants by the different teams was random.

Analytic Strategy

This research involves different analyses requiring different methods. For the analysis of the direct effects of team improvised adaptation on team performance, we used hierarchical regression analysis to control the effects of the manipulations of shared mental models and team reflexivity. To analyse the mediation effects of team improvised adaptation between team temporal personality traits and team performance, we used the Hayes (2012) PROCESS macro (model 4), with 10,000 bootstrap samples for bias corrected bootstrap, with 95% confidence intervals (Preacher & Hayes, 2008). For the longitudinal analysis of the learning curves, we conducted a growth modelling using random coefficient models, as suggested by Bliese and Ployhart (2002), in two different levels. We performed this analysis in R version 3.2.3, with the multilevel and the nlme packages. In level 1 we defined the basic model for time with the growth parameters, and in level 2 we estimated our predictive model allowing individual differences around the intercept and the slope of the different teams estimated performance trajectories.

RESULTS

Confirmatory factor analysis (CFA)

We conducted a CFA with maximum likelihood estimation to evaluate the underlying factor structure of the measures of present and future orientation, and also of team improvised adaptation. The analysis was executed in R version 3.2.3, using the lavaan package. For team temporal personality we combined both time perspective (present and future), because originally they represent two dimensions of the ZTPI instrument (Zimbardo & Boyd, 1999). We removed five items that were not loading adequately for present-orientation, and similarly, three items for future-orientation (e.g., Ayoko & Chua, 2014). The remaining 20 items, 10 for each factor, provided an adequate measure of team temporal personality in the two dimensions, present-orientation and future-orientation. Both factors presented acceptable Cronbach's alphas (α = .72 for present-orientation, α = .71 for future-orientation). To test the fit of the two factor model we used the chi-square ($\chi 2$), the comparative fit index (CFI) and the standardized root mean square residual (SRMR). However, we focused our analysis on the combination of CFI and SRMR, following Hu and Bentler's (1999) recommendations for using this combination when samples are smaller than 250. The chi-square is a traditional measure of absolute fit but it has severe limitations, mostly on small samples (Hu & Bentler, 1999). The combination SRMR/CFI is recommended because SRMR allows the determination of the absolute fit of the model with the sample data, and the CFI gives us an incremental fit index, by comparing the sample covariance matrix with the independence model in which all latent variables are uncorrelated. Values of CFI above 0.90, and of SRMR below .08 are considered acceptable. The model fit was satisfactory with $\chi 2(df = 169) = 196.21$, $p = .074$; and the combination CFI/SRMR within recommended values (CFI = .92, SRMR = .06).

The team improvised adaptation scale also showed acceptable internal consistency ($\alpha = .85$), and the results from the factor analysis revealed one distinct factor, with a $\chi 2(df = 5) = 37.09$, $p < .001$; and showing CFI/SRMR values within an acceptable range (CFI = .92, SRMR = .05).

Data Aggregation

The elevation aspect of the team temporal personality composition variables is formed using an additive model. Therefore, the variance of the lower level elements does not have a theoretical or operational meaning, and the simple average of lower level scores is an adequate aggregation method (Chan, 1998). This type of composition model can be developed regardless of individual-level agreement indices, such as Rwg or ICC, to justify aggregation to a group level. TTPE was computed using the mean of the lower level individual scores.

The diversity aspect of the team temporal personality composition variables is created using a dispersion model in which the group level characteristic is the variability within the group. This is intrinsically a group level feature so agreement indices are not relevant (Chan, 1998). Harrison and Klein (2007) refer to this type of diversity as separation consisting on "composition of differences in (lateral) position or opinion among unit members, primarily of value, belief, or attitude" (p. 1203). The authors propose that diversity as separation should be measured using some version of standard deviation. TTPD was computed using the variance of the lower level individual scores.

Team improvised adaptation composition uses a direct consensus model, which means that the higher level construct depends on the consensus among lower level elements (Chan, 1998). This model is based on the aggregation of individual assessments about a group-level property, an often used way of assessing collective properties since it avoids social conformity issues (Stajkovic, Lee, & Nyberg, 2009). However, contrary to the previous composition models, direct consensus requires within-group agreement to justify aggregation to the team level. For this reason, we computed the inter-rater agreement indexes ($r_{wg(j)}$) (James, Demaree, & Wolf, 1984, 1993; Klein et al., 2000), and then we used interclass correlations [ICC(1) and ICC(2)] to evaluate the interrater reliability, and the group mean reliability, respectively (Bliese, 2000; Klein et al., 2000). Aggregation is justified when $r_{wg(j)}$ values are above .70 (Klein et al., 2000), ICC(1) are above .20, and ICC(2) are higher than .50 (Bliese, 2000). All indicators met the appropriate criteria, justifying the aggregation of improvised adaptation to a team level ($r_{wg(j)}$ = .91, ICC(1) = .42, ICC(2) = .69). Team improvised adaptation was computed using the mean of the lower level scores.

Hypotheses Testing

Direct effects on team performance and team improvised adaptation

Hypothesis 1 proposed that team improvised adaptation is positively correlated with team performance. The analysis of Table 5.1 reveals that team improvised adaptation is positively related with future-orientation (TTPE) ($p < .01$), and that team performance is positively correlated with team improvised adaptation ($p < .05$) and negatively related with future-orientation (TTPD) ($p < .05$). As reported in model 2 of Table 5.2, team improvised adaptation is significantly related to team performance ($B = .44$, $p < .01$) and the model is significantly better than model 1 ($\Delta R^2 = .17$, $p < .01$). Hence, hypothesis 1 is supported.

Hypotheses 2a and 2b predicted that present-orientation (TTPE) and future orientation (TTPE) were positively related with team improvised adaptation, respectively. In Table 5.3, model 2, present-orientation (TTPE) is not related with team improvised adaptation ($B = .20$, $p = .10$), not supporting hypothesis 2a. However, model 3 of the same table shows that future-orientation (TTPE) is positively related to team improvised adaptation ($B = .34$, $p < .01$), and the model is significantly better than model 2 ($\Delta R^2 = .11$, $p < .01$). This supports hypothesis 2b.

Table 5.1. Means, standard deviations, and correlations

Variable	M	SD	1	2	3	4	5	6	7	8	9	10
1. Manipulated shared mental models												
2. Manipulated reflexivity												
3. Present-orientation (TTPE)	3.41	.29	.22	.13								
4. Future-orientation (TTPE)	3.98	.24	.08	-.15	-.12							
5. Present-orientation (TTPD)	.19	.18	-.09	-.07	-.11	.02						
6. Future-orientation (TTPD)	.14	.24	.17	-.09	.15	-.30*	.20					
7. Team improvised adaptation	5.92	.62	.13	-.34**	.13	.37**	-.02	.05				
8. Team performance	58.64	17.99	-.04	.32*	.06	.22†	.06	-.30*	.28*			
9. Team performance time 0	59.87	24.16	.12	.40**	.10	.29*	-.02	-.39**	.12	.79***		
10. Team performance time 1	58.35	25.77	.14	.31*	.07	.08	-.17	-.30*	.10	.60***	.64***	
11. Team performance time 2	53.01	24.80	.21	.22†	.09	.02	.18	.04	.21	.59***	.53***	.69***

Note, N = 60 teams
† $p < 0.10$ (two-tailed)
* $p < 0.05$ (two-tailed)
** $p < 0.01$ (two-tailed)
*** $p < 0.001$ (two-tailed)

Table 5.2. Hierarchical regression analysis predicting team performance and controlling for shared mental models and team reflexivity

	Team performance	
Predictors	Model 1	Model 2
Manipulated shared mental models	-0.38	-.09
Manipulated reflexivity	.32*	.47***
Team improvised adaptation		.44**
R^2	.10	.27
ΔR^2		.17**

Note. N = 60 teams. Standardized beta coefficients are shown.
 * $p < 0.05$ (two-tailed)
 ** $p < 0.01$ (two-tailed)
 *** $p < 0.001$ (two-tailed)

Table 5.3. Hierarchical regression analysis predicting team improvised adaptation and controlling for shared mental models and team reflexivity

	Team improvised adaptation		
Predictors	Model 1	Model 2	Model 3
Manipulated shared mental models	.13	.09	.06
Manipulated reflexivity	-.34**	-.36**	-.31*
Present-orientation (TTPE)		.16	.20
Future-orientation (TTPE)			.34**
R^2	.13	.15	.26
ΔR^2		.02	.11**

Note. N = 60 teams. Standardized beta coefficients are shown.
 * $p < 0.05$ (two-tailed)
 ** $p < 0.01$ (two-tailed)

Mediation effects of team improvised adaptation.

Hypotheses 3a and 3b suggest that team improvised adaptation mediates the effects of present-orientation (TTPE) on team performance, and the effects of future-orientation (TTPE) on team performance, respectively. Table 5.4 shows the results of the mediation between present-orientation (TTPE) and team performance. Present-orientation (TTPE) does not have a significant direct relationship with team improvised adaptation (B = .34, p = .22), nor with team performance (B = -2.71, p = .72). Moreover, the bootstrap procedure does not reveal an indirect effect of present-orientation (TTPE) on team performance through team improvised adaptation (B = 4.23, CI = [-2.54, 15.51]). Thus, hypothesis 3a is rejected. Table 5.5 reports the results for the mediation effect of team improvised adaptation between future-orientation (TTPE) and team performance. The table shows that future-orientation (TTPE) has a direct effect on team improvised adaptation (B = .82, p < .05).

Also, team improvised adaptation has a positive effect on team performance (B = 11.27, p < .01). Although future-orientation (TTPE) does not have a significantly direct effect on team performance (B = 11.54, p = .22), the bootstrap procedure reveals an indirect effect of future-orientation (TTPE) on team performance through team improvised adaptation (B = 9.28, CI = [2.22, 22.07]). Thus, these results support hypothesis 3b.

Longitudinal analysis of team improvised adaptation learning

To assess our theory about the impact of time personality on team improvised adaptation learning we used two different levels following the stages suggested by Bliese and Ployhart (2002). In level 1 we analysed the intra-team change over time, and the growth parameters were defined; in level 2 the model was estimated with the integration of the predictors of intercept and slope variation.

Level 1 analysis – basic model definition

As suggested by Bliese (2000, 2006), level 1 analysis starts by evaluating the ICC(1) to determine the strength of the nonindependence of the data collected from the teams over time. Relatively high ICC levels reveals that between-team effects are likely to be present, and that they ought to be modelled at a higher level. Therefore, it would be appropriate a Level-2 analyses using a random intercept model. The estimate of ICC(1) was 0.61, which shows a high degree of nonindependence, meaning that it is necessary to use a random intercept model (Bliese & Ployhart, 2002). The next step is to test the relationship between team performance and time, to determine if it is linear or if a more complex model has better fit. We tested a linear relationship and the results were not significant (t = -1.51, p = .13). Subsequently we tested a quadratic model but the result revealed that the Type I error rate increased to 63% (t = -0.49, p = .63). Because in this study team performance is a relative measure, its absolute progression over time does not have a particular meaning. Thus, these results do not surprise. However, the relative progression of different teams will reveal the different performance trajectories and the respective predictors. Nonetheless, this analysis allows us to determine that a linear trajectory represents a more significant time function than more complex functions.

Table 5.4. Mediating effect of team improvised adaptation between present-orientation (TTPE) and team performance

	Direct effects on Team improvised adaptation			
Variables	*B*	*SE*	*t*	*p*
Intercept	4.92	.92	5.33	.000
Present-orientation (TTPE)	.34	.28	1.24	.222
Manipulated shared mental models	.11	.16	.73	.467
Manipulated reflexivity	-.44	.15	-2.86	.006

	Direct effects on Team performance			
Variables	*B*	*SE*	*t*	*p*
Intercept	-16.12	30.60	-.53	.600
Team improvised adaptation	13.02	3.61	3.61	.001
Present-orientation (TTPE)	-2.71	7.54	-.36	.721
Manipulated shared mental models	-3.06	4.22	-.73	.472
Manipulated reflexivity	16.86	4.43	3.81	.000

Indirect effect of present-orientation (TTPE) on Team performance				
Mediator	*B*	*SE*	*Boot LL*	*Boot UL*
Team improvised adaptation	4.43	4.54	-2.54	15.51

Note, N = 60 teams. Process macro (model 4), 10,000 bootstrap samples; 95% Level of confidence for all confidence intervals in output.

Table 5.5. Mediating effect of team improvised adaptation between future-orientation (TTPE) and team performance

	Direct effects on Team improvised adaptation			
Variables	*B*	*SE*	*t*	*p*
Intercept	2.76	1.26	2.19	.032
Future-orientation (TTPE)	.82	.31	2.63	.011
Manipulated shared mental models	.12	.15	.85	.397
Manipulated reflexivity	-.35	.15	-2.42	.019

	Direct effects on Team performance			
Variables	*B*	*SE*	*t*	*p*
Intercept	-60.65	36.55	-1.66	.103
Team improvised adaptation	11.27	3.72	3.03	.004
Future-orientation (TTPE)	11.54	9.25	1.25	.218
Manipulated shared mental models	-3.55	4.09	-.87	.388
Manipulated reflexivity	16.76	4.30	3.90	.000

Indirect effect of future-orientation (TTPE) on Team performance				
Mediator	*B*	*SE*	*Boot LL*	*Boot UL*
Team improvised adaptation	9.28	4.90	2.22	22.07

Note, N = 60 teams. Process macro (model 4), 10,000 bootstrap samples; 95% Level of confidence for all confidence intervals in output.

Next we analyse the intercepts and slopes of performance over time to determine if there are differences between the teams. To do this we compare the growth model with fixed intercepts and fixed slopes, to models in which both intercepts and slopes are allowed to change. Following Bliese and Ployhart's (2002) suggestions, we analysed the chi-square difference (i.e., −2 log-likelihood ratios [−2LL]). The results are depicted in Table 5.6. Model 1 consists of a baseline fixed model, model 2 represents a model with random intercept, and in model 3 both intercept and slopes were allowed to vary. The random intercept model (−2LL = -795.89) represents a significant improvement over the baseline fixed model (−2LL = -829.56) showing a better fit to the data (Δ2LL = 67.34, $p < .0001$). The model in which the intercepts and slopes were allowed to vary (−2LL = -794.46), although better than model 2, did not reveal a statistically significant improvement (Δ2LL = 2.87, $p = .24$). However, this test is very conservative (Bliese & Ployhart, 2002), and theoretical arguments might justify the use of random slopes. Because it is theoretically reasonable to assume that different teams have different performance trajectories over time, representing different learning curves (e.g., Edmondson et al., 2007), we opted to use a model that considers variable slopes and variable intercepts.

To finalize level 1 analysis, we assessed the error structure of the model. This analysis serves to evaluate whether the model improves its fit with the integration of autocorrelation and heteroscedasticity. The result of both tests showed that the model does not improve by controlling for autocorrelation (Δ2LL = 0.50, $p = .32$), and for heteroscedasticity (Δ2LL = 0.58, $p = .56$). Hence, it is not necessary to control these elements.

Level 2 analysis – predictors of team improvised adaptation learning

We now estimate a model including the control variables of shared mental models and team reflexivity, and the predictors present-orientation (TTPD) and future-orientation (TTPD). Hypotheses 4a and 4b predicted that present-orientation (TTPD) and future-orientation (TTPD) are positively related to team improvised adaptation learning. We tested these hypotheses with the incorporation of both predictors in the model defined in the level 1 analysis. The interactions with time were analysed in order to define the effect of present-orientation (TTPD) (Table 5.7) and future-orientation (TTPD) (Table 5.8) in team improvised adaptation learning. The interaction between time and present-orientation (TTPD) was only moderately significantly related to team improvised adaptation learning ($y = 13.94$, $t = 1.69$, $p = .09$). Hypothesis 4a; is not supported.

There was a significant two-way interaction between time and future-orientation (TTPD) on team improvised adaptation learning ($y = 20.01$, $t = 3.30$, $p < .01$). Hence, future-orientation (TTPD) did have a direct effect on performance, over time, in this study. The research context of extreme time constraints, means that teams high in future orientation diversity did learn better under these particular temporal circumstances. Hypothesis 4b is supported.

Interestingly, Table 5.7 shows a significant estimate of the intercept, meaning that future-orientation (TTPD) has a strong negative relationship with team performance at time 0 ($y = -42.95$, $p < .001$). This result suggests that diversity in future-orientation might jeopardize team performance. These findings led us to conduct a *post hoc* analysis to deepen our investigation on the effect of future-orientation (TTPD) in team performance.

Table 5.6. Results of fixed function for time – model 1, and of fitting random coefficient models to team performance – models 2 and 3

Parameter	*Model 1: linear function for time*		
Fixed Effects	*Estimate*	*SE*	*t*
Intercept	60.51***	2.93	20.64
Time	-3.43	2.27	-1.51
Goodness of fit			
-2 log-likelihood	-829.56		
AIC	1,665.11		
BIC	1,674.66		
Parameter	*Model 2: random intercept*		
Fixed Effects	*Estimate*	*SE*	*t*
Intercept	60.51***	3.11	19.44
Time	-3.43*	1.40	-2.45
Goodness of fit			
-2 log-likelihood	-795.89		
AIC	1,599.78		
BIC	1,612.51		
Parameter	*Model 3: random intercept and slopes*		
Fixed Effects	*Estimate*	*SE*	*t*
Intercept	60.51***	3.12	19.42
Time	-3.43*	1.54	-2.23
Goodness of fit			
-2 log-likelihood	-794.46		
AIC	1,600.92		
BIC	1,620.01		

Table 5.7. Results of present-orientation (TTPD) predicting team improvised adaptation learning – model 4

Predictor	*Model 4*		
Fixed effects	*Estimate*	*SE*	*t*
Intercept	52.54***	6.15	8.54
Time	-6.85*	3.14	-2.18
Manipulated reflexivity (MR)	19.00**	5.85	3.25
Manipulated shared mental models (MSMM)	0.88	5.86	0.15
Present-orientation (TTPD)	-10.45	16.13	-0.65
Time x MR	-3.71	2.98	-1.24
Time x MSMM	5.29†	2.99	1.77
Time x Present-orientation (TTPD)	13.94†	8.22	1.69
Goodness of fit			
-2 log-likelihood	-770.25		
AIC	1,564.51		
BIC	1,602.28		

Note, N = 60 teams
† $p < 0.1$
** $p < 0.01$
*** $p < 0.001$

Table 5.8. Results of future-orientation (TTPD) predicting team improvised adaptation learning – model 5

Predictor	*Model 5*		
Fixed effects	*Estimate*	*SE*	*t*
Intercept	55.50***	4.73	11.73
Time	-6.25*	2.53	-2.47
Manipulated reflexivity (MR)	17.41**	5.25	3.32
Manipulated shared mental models (MSMM)	4.65	5.30	0.88
Future-orientation (TTPD)	-42.95***	11.35	-3.78
Time x MR	-3.19	2.80	-1.14
Time x MSMM	3.23	2.83	1.14
Time x Future-orientation (TTPD)	20.01**	6.06	3.30
Goodness of fit			
-2 log-likelihood	-763.88		
AIC	1,551.77		
BIC	1,589.54		

Note, N = 60 teams
* $p < 0.05$
** $p < 0.01$
*** $p < 0.001$

Post Hoc Analyses

Given that we found a negative and significant relationship between future-orientation (TTPD) and team performance at time 0, we wanted to confirm this result with the team performance measure used to test hypotheses 1 to 3, which brings additional information to this relationship. Therefore, we performed a hierarchical regression analysis, regressing team performance on future-orientation (TTPD), controlling for shared mental model and team reflexivity manipulations. The results show a significant negative relationship between the two variables (B = -20.63, p < .05, $\Delta R2$ = .03). This result supports the previous findings, suggesting that future-orientation diversity initially negatively influences a team's performance on conditions of improvised adaptation.

Once we uncovered the cross effect of future-orientation (TTPD) on team performance and on team improvised adaptation learning, we decided to investigate whether a similar result would be found between future-orientation (TTPE) and the two outcomes, team performance and team improvised adaptation learning. To perform this analysis, we conducted a level 2 analysis of random coefficient modeling, interacting future-orientation (TTPE) with time. Table 5.9 has the results of this analysis, showing a significantly negative interaction between future-orientation (TTPE) and time, predicting team performance (y = -16.50, p < .01). The results also confirm that future-orientation (TTPE) has a positive impact on team performance at time 0 (y = 34.10, p < .01). These results suggest that teams high in future-orientation will perform better; however, they will have more difficulty learning from improvised adaptation situations than teams low in future-orientation.

Table 5.9. Results of future-orientation (TTPE) predicting team improvised adaptation learning – model 6

Predictor	*Model 6*		
Fixed effects	*Estimate*	*SE*	*t*
Intercept	-86.04†	47.33	-1.82
Time	62.13*	24.91	2.49
Manipulated reflexivity (MR)	21.68***	5.53	3.92
Manipulated shared mental models (MSMM)	-0.06	5.48	-0.01
Future-orientation (TTPE)	34.10**	11.78	2.89
Time x MR	-5.23†	2.90	-1.80
Time x MSMM	5.44†	2.88	1.89
Time x Future-orientation (TTPE)	-16.50**	6.20	-2.66
Goodness of fit			
-2 log-likelihood	-766.99		
AIC	1,557.98		
BIC	1,595.75		

Note, N = 60 teams
† p < 0.1, * p < 0.05,
** p < 0.01, *** p < 0.001

DISCUSSION

We proposed that team temporal personality influences the outcome of teams enrolled in team improvised adaptation situations. In particular, we argued that two different team composition aspects of present-orientation and future-orientation time perspectives impact team performance and team improvised adaptation learning, and that the adoption of team improvised adaptation processes mediates part of these relationships. We found that the adoption of team improvised adaptation processes positively impacts team performance when teams are faced with unpredictability and challenged by extreme time scarcity situations. However, we did not find any effect of present-orientation, neither from an elevation perspective nor from a diversity perspective. We found that future-orientation elevation predicts team performance, and that this relationship is mediated by team improvised adaptation. We also discovered that future-orientation diversity contributes to team improvised adaptation learning. Moreover, and although not initially hypothesized, we found a cross-over effect of future-orientation elevation on team performance and team improvised adaptation learning, and an opposite cross-over effect of future-orientation diversity, also on team performance and on team improvised adaptation learning. Teams that have a high level of future-orientation tend to perform well under severe time constraints, but have difficulty in learning from these situations and in improving performance over time. On the other hand, teams that have future-orientation diversity have difficulties in performing well when time is severely constrained, but improve performance over time, learning from these situations. Figure 5.2 describes the observed model for the variables with statistically significant results.

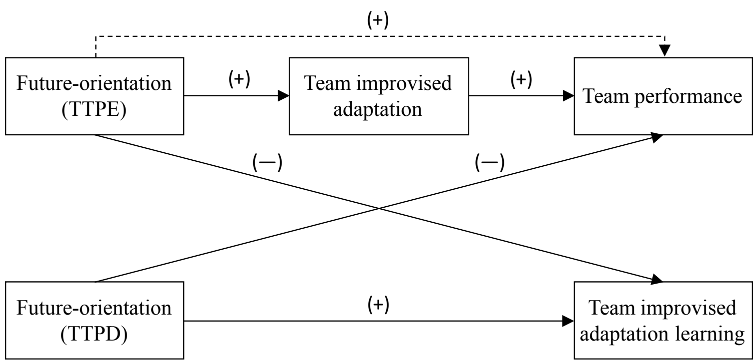

Figure 5.2. Observed model. Solid arrows represent direct effects. Dashed arrows represent mediation effects. TTPE – Team temporal personality elevation. TTPD – Team temporal personality diversity.

Furthermore, Figure 5.3 shows that teams that are diverse in future-orientation, while they start with a lesser performance at time 0, at time 2 have recovered to a level of performance very close to that of teams with less diversity (performance = 42.99, performance = 38.01, for low and high future-oriented diversity teams, respectively). In turn, low future-oriented teams, although starting with a poorer performance at time 0, because they increase performance over time, and teams high in future-orientation decrease their levels of performance, at time 2 both types of teams have very similar levels of team performance (performance = 41.90, performance = 43.19, for low and high future-oriented teams, respectively).

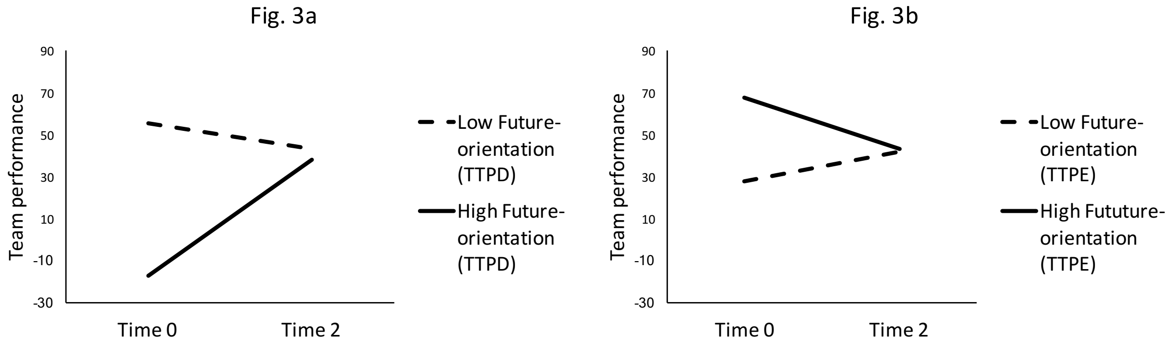

Figure 5.3. Interaction effect of time with future-orientation diversity (Fig. 3a) and future-orientation elevation (Fig. 3b).

Implications for Theory

Our results extend current knowledge on team temporal research and on team adaptation research: in team adaptation literature by revealing team temporal antecedents for team improvised adaptation, and enlightening the critical role of adopting these type of processes when teams face unpredictable and time constraint disruptions; in team temporal literature, by revealing the different roles of diversity and elevation of future-orientation team personalities on team performance and team learning.

Future-orientation elevation and team performance

Our findings reveal that some team temporal personality traits, in particular future-orientation elevation, promote team performance via team improvised adaptation. By leveraging individual personality traits to a team level, we follow Maynard and colleagues' (2015) call to better understand how a team can be composed to enhance team performance under unpredictable and time constraint disruptions. Moreover, our results enhance the importance of adopting team improvised adaptation processes in order to cope with unpredictability and change, requiring immediate and simultaneous re-planning and action, so that teams can maintain or improve performance under such extreme temporal contexts.

Additionally, several studies on temporal personality have linked future-oriented teams with team performance (e.g., Boniwell & Zimbardo, 2004; Shell & Husman, 2001; Zimbardo & Boyd, 1999). However, as Taylor and Wilson (2016) propose, the question today is less about whether future-orientation is positive or negative, but rather if future-oriented teams are willing to act *now* in the pursuit of *future* goals. The authors assess that teams high in future-orientation tend to procrastinate less than teams low in future-orientation. Our results confirm this assertion and add that, even under extreme time constraints, when these teams have to deal with unpredictable disruptions, they sometimes immediately act and engage on team improvised adaptation processes, which can in some cases lead them to higher team performance. Building on Thoms' (2004) proposal that future-oriented people initiate and lead organizational changes, our findings suggest that when this change is triggered by disruptions that force teams to adapt and improvise, future-oriented teams are well equipped to promote immediate and adequate change.

Future-orientation diversity and team improvised adaptation learning

Current literature is not clear about the advantages and disadvantages of homogeneity and heterogeneity regarding team temporal personality (Eisenhardt, 2004). Different temporal perspectives within a group might lead to balance, but might also give rise to conflict (Karau & Kelly, 2004). Different team contexts require different team temporal characteristics (Thoms, 2004). Mohammed and Nadkarni (2011) suggest that the advantages of diversity in temporal personality might be more visible when performance implies the synthesis of paradoxes. The results of our study are consistent this assertion.

When teams face unpredictable disturbances and choose to rapidly adapt to a new situation, they must experiment with immediate unknown and untested solutions so they can have a chance of achieving future planned goals. Moreover, after the action phase of an improvised adaptation episode, teams have to weigh their immediate experience, and to eventually integrate potential learning opportunities into their previous plans. This requires the simultaneous analysis of short-term and long-term goals, which seems more feasible for teams with a diverse future perspective (Mohammed & Nadkarni, 2011). Our results are consistent with the possibility that future-orientation diversity allows teams to learn from improvised adaptation processes and improve performance over time, under extreme time pressure. These results corroborate the perspective that diversity in temporal orientation allows for the integration of different time perceptions, reconciling inherent tensions (Eisenhardt, 2004), and promoting team learning and performance improvement over time.

Future-orientation – elevation vs. diversity

Another interesting result of the current paper relates to the cross-over effects of both future-orientation elevation and diversity on team performance and team improvised adaptation learning. Our findings help to reconcile opposing perspectives about the effects of temporal diversity and temporal elevation on different team outcomes. By analysing these effects in the particular circumstances of planning and execution merger in response to unpredictable events, we define boundary conditions for the effects of different aspects of team temporal personality composition.

We have seen, and the findings of this study is consistent with these theories, that teams diverse in future-orientation improve performance over time, even when faced with unpredictable and time constraint situations. We argue that one of the reasons for this is the fact that diverse teams will tend to spend time discussing and trying to reduce temporal gaps (McGrath, 1991), which will lead them to learn. However, it is precisely this element of temporally diversified teams that jeopardizes their ability to perform well when design and execution merge. Spending time reconciling temporal perspectives inhibits the immediate adoption of new solutions to disruptive events. Earlier research proposes that temporally diverse teams are more adequate to deal with complex, dynamic, and uncertain task environments (Eisenhardt, 2004). On the other hand, the conflict of temporal interests can develop tensions and create conflict within the team (Jansen & Kristof-Brown, 2005), leading to poorer performance. We found that teams with members that have distinct future-orientations will improve performance over time, but will struggle to adequately adopt team improvised adaptation processes and achieve a high level of immediate performance in situations in which they have to plan and execute at the same time as a response to an unpredictable disruption. The diversity will create barriers for immediate performance, but when teams have time to reconcile their differences, between improvised adaptation events, the advantages of temporal diversity can emerge and lead to team learning.

On the other hand, teams that are future-oriented will perform better under short-time bounded situations but, surprisingly, we also found that they will struggle to learn and improve performance over time. West and Meyer (1997) argue that future-oriented individuals tend to communicate frequently and importantly about a wide range of ideas, which would promote learning. However, improvised adaptation intends to resolve immediate and unpredictable disruptions and might not require the continuance of the modified process (Moorman & Miner, 1998a). Moorman and Miner (1998a) propose that in such cases, when the unpredicted situation is handled, teams might return to a previous state. The aversion to novelty that characterizes future-oriented individuals (Zimbardo & Boyd, 1999), might lead them to return to the initial plan after solving the disruptive situation. Moreover, as West and Meyer (1997) proposed, future-oriented teams may be unable to cope with new emergent opportunities. In turn, we found that teams that are low in future-orientation will increase performance over time under improvised adaptation circumstances. These teams usually postpone detailed planning “until later”, preferring longer-term goals that give them more time to plan (Taylor & Wilson, 2016). Because they are not as attached to future plans as more future-oriented people, they will more easily alter their initial plans to incorporate learnings from the improvised adaptation situations. This will lead them to improve the quality of their plans by integrating ways to deal with unpredictability. The result is higher future performance in situations marked by unpredictability and time constraints.

Implications for Practice

The current study has important implications for organizational teams. Contemporary business environments are increasingly affected by imponderability and speed of change. The effectiveness of the response of organizational teams to these dynamic contexts, affects their ability to perform well. The present findings reveal that under fast and unpredictable circumstances, teams must master the process of improvised adaptation if they wish to thrive. This capacity can be trained and developed (Cunha et al., 1999), and organizations operating in unpredictable and dynamic environments should equip their teams with the ability to manage improvised adaptation situations. One of the ways to do this is to compose teams with the appropriate mixes of characteristics. Teams composed with future-oriented members will more likely adopt improvised adaptation processes, when necessary, and will improve the likelihood of performing better and achieving better outcomes. However, a team composed solely of future-oriented individuals might be limited in its capacity to integrate knowledge acquired with improvised adaptation situations. For teams to improve performance over time when faced with unpredictable and time constraint situations, teams must be able to learn from those situations. Our findings show that teams diverse in future-orientation learn better and increase improvised adaptation performance over time.

Organizations face a dilemma. Composing their teams to perform well under unpredictable and extreme temporal contexts might jeopardize their ability to learn, and composing the teams to learn might limit their competence to simultaneously adapt and improvise. However, several solutions can be implemented. A balance can be reached between an elevated level of future-orientation and some level of diversity. In this way teams will be capacitated to adopt improvised adaptation processes and learn from episode to episode. Moreover, even with teams that are high in future-orientation and less diverse, team managers can induce team learning with the adoption of explicit team learning behaviours (Edmondson, et al., 2007), such as guided team reflexivity and feedback (Konradt, Schippers, Garbers, & Steenfatt, 2015). Therefore, recruitment policies, team development practices, and team learning processes are important tools that organizations have at their disposal to adequately prepare their teams to deal with unpredictable and time constraining situations requiring the adoption of team improvised adaptation processes.

Limitations and Directions for Future Research

This study contains limitations. First, we used a single company to perform this study, which allowed us to control the impacts of different organizations. However, future research should seek to confront the current results with diverse organizational samples. Second, our study does not delve into the content of learning, nor into its process. Team learning was conceptualized from an outcome perspective, and was operationalized by analysing team performance curves over time. This standpoint overlooks the content of learning and the learning process. From a content perspective, team improvisation learning can consist of how to improvise, how to perform the task, who does what better, and how does context influence the task and the team (Cunha et al., 1999). Within the same perspective, team adaptation learning can entail the revision of previous episodes and previous actions in order to prevent future mistakes (Burke et al., 2006). The current study does not discuss these critical aspects of team improvised adaptation learning. Future research should focus on learning content, trying to understand what teams learn from improvised adaptation processes. From a process perspective, team improvisation learning can be obtained with the implementation of simulation planning sessions in which team members conduct trial and error thinking, or by leaders challenging habits and established practices (Barret, 1998). Team adaptation learning can be implemented through information provision and guidance (Kozlowski, Toney, Mullins, Weissbein, Brown, & Bell, 2001). Given the specificity of improvised adaptation situations, future studies could analyse the impacts of different team learning processes on the capacity of teams to learn from such situations.

In this study, team personality was conceptualized through the traits of present- and future-orientation. However, other temporal personality traits might influence a team's ability to cope with unpredictability and fast change. Time urgency is another trait that has the potential to interfere with team improvised adaptation processes, as it consists on individuals being very aware of the passage of time which they perceive as an enemy (Waller, Conte, Gibson, & Carpenter, 2001). Waller et al. (2001) propose that time-urgent individuals might affect a team's ability to deal with time pressure situations. The examination of time urgency within teams that deal with improvised adaptation situations might prove rewarding.

The current study measured team improvised adaptation learning in a longitudinal design with three points in time. However, the performance episodes were separated by only a few minutes. Although the time between episodes was enough to detect differences in the different teams' capacities to learn from one episode to the next, future studies should replicate our analyses using larger periods of time between the performance events. More time between events will give teams more time to engage in learning processes and more time to assimilate the learnings from previous episodes. Also, this study was conducted in a laboratory environment, with the advantages but also the limitations of a simulated context. Future research should use real organizational scenarios to test our findings, giving more adherence to the reality of organizational teams.

CONCLUSION

Several conclusions can be drawn from this study. Dynamic and unpredictable business environments demand responsive and adaptable organizational teams. When disruptions occur and time is scarce, teams must be able to plan and execute simultaneously.

To do so, and achieve high levels of performance, teams should be future-oriented and acknowledge that they must immediately respond to the disruption, in order to achieve future goals. We also conclude that although future-oriented teams may find it difficult to integrate new knowledge into their routines, if they contain some level of future-orientation diversity, this will increase their learning ability. Therefore, a balance between future-orientation and future-orientation diversity will allow teams to perform well when faced with disruption and time scarcity, and also learn from improvised adaptation episodes and improve performance over time.

CHAPTER 6.

WHY AND HOW DO TEAMS IMPROVISE? A MODEL OF TEAM IMPROVISED ADAPTATION

ABSTRACT[3]

When time is of essence and teams face disruptive situations, they must quickly adapt. This paper adopts an interpretive, grounded theory approach to explore why and how do teams engage in improvised adaptation processes when confronted with such extreme situations. The study identifies two tensions driven by these contexts: a deployment tension between an inclination to maintain habitual routines and improvisational pressures; and a development tension between the need to elaborate a new plan and the need to start acting. The paper also identifies pivotal roles played by different team members, and boundary conditions based on improvised adaptation enablers that ensure the effectiveness of the process. These findings contribute to adaptation and improvisations literatures by delving into the adaptation process under the temporal merger of design and execution.

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[3] This paper has been submitted for publication as:

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INTRODUCTION

When time is of essence and teams are faced with an unpredictable disruption, they might consider improvisation (Cunha, Cunha, & Kamoche, 1999; Hatch, 1999). They deliberately merge design and execution (Baker, Miner, & Eesley, 2003; Weick, 1998) pursuing positive results (Hadida, Tarvainen, & Rose, 2015). The performance processes developed by teams when adapting to unforeseen events has been thoroughly identified by the team adaptation literature (e.g., Burke, Stagl, Salas, Pierce, & Kendall, 2006). However, the scarcity of time to plan alters the nature of the phenomenon changing the timing, sequence, and type of team performance processes (Abrantes, Passos, Cunha, & Santos, 2018), defined as cognitive or behavioural goal-directed actions (Rosen, Bedwell, Wildman, Fritzsche, Salas, & Burke, 2011), which has not yet been thoroughly explored by neither improvisation or adaptation scholars. The result is that we still have limited understanding of the team improvisational process itself. The knowledge of what happens during team improvisation is of particular importance for both theory and practice since it characterizes one performance alternative that teams can use to deal with unpredictability, mostly when established routines fail to accommodate change (Kamoche & Cunha, 2001; Magni & Maruping, 2013).

As the "conception of action as it unfolds, drawing on available cognitive, affective, social and material resources" (Kamoche, Cunha, & Cunha, 2003, p. 2024), improvisation requires the merger between planning and execution. But unpredictability and time pressure are not enough for team improvisation to occur. Cunha and colleagues (1999) assert that for improvisation to happen teams must consider that they operate in an experimental culture that promotes action and tolerates errors, and the set of controls employed must be minimal, reflecting a minimal structure, and allowing teams to explore new ways of performing. Also, the quality of improvisational actions is contingent to a number of influencing factors. Crossan and Sorrenti (1997) propose that team members' ability to work as a team, and their intuitive and technical capacity, are determinant for the efficiency of team improvisation. It has also been broadly established by improvisation scholars that team improvisation hangs on the team's collective capacity to develop actions in an interdependent manner (Bechky & Okhuysen, 2011; Magni, Maruping, Hoegl, & Proserpio, 2013; Vera & Crossan, 2005).

When teams are improvising as a response to a disruption, they are also adapting, i.e., they are engaging in team improvised adaptation (Abrantes et al., 2018). The team adaptation literature has made solid contributions explaining the adaptation process. When adapting, teams start by assessing the situation, then they formulate a plan, they execute it, and finally learn as a team (Burke et al., 2006). Although thorough, this model sheds little light to the adaptation process when there are extreme time constraints that force planning and execution to merge. Marks, Mathieu and Zaccaro (2001) claim that when unforeseen events occur during action, teams need to adjust by implementing a reactive strategy. Yet, how this strategy is developed and implemented during action lacks clarification. To understand this process is to delve into how can teams accommodate unpredictable and rapid change, and still perform at adequate levels.

In this study we explore the team improvised adaptation process and the respective boundary conditions that lead to learning outcomes. We seek to answer four questions: why do teams improvise? what are the different steps a team must take when engaging in team improvised adaptation? what are the elements ensuring the effectiveness of these steps? and what kind of knowledge can be acquired as an outcome of team improvised adaptation processes? Answering these questions is critical because “adaptation lies at the heart of team effectiveness” (Burke et al., 2006, p. 1189), and a teams’ capacity to adapt to changeable and unpredictable environments represents a differentiation factor increasing organizational flexibility (Crossan, Lane, White, & Klus, 1996). To address our research questions we performed an inductive study conducting 50 semi-structured interviews to mid and top management professionals in various sectors, who have experienced team improvised adaptation situations.

Burke and colleagues’ (2006) model of team adaptation was expanded by Rosen and colleagues (2011) with a detailed account of team performance processes that may be implemented in the various phases of the adaptation process. Examples of such performance processes are *mission analysis* and *strategy formulation*, or *coordination* and *systems monitoring*, within the plan formulation and plan execution phases, respectively. It was also proposed that the type and severity of the trigger giving rise to need for adaptation determines what kind of processes would be mostly deployed during adaptation (Maynard, Kennedy, & Sommer, 2015), either action, interpersonal or transition processes (Marks et al., 2001). Expanding beyond these portrayals of the team adaptation process, and building on Abrantes and colleagues’ (2018) concept of team improvised adaptation, which considers the time between the trigger and the starting of the action phase as a critical aspect of the adaptation process, our findings begin to explain why and how teams perform when they have to adapt and cannot timely prepare a plan prior to its execution.

While conducting the analysis of the initial data, we realized that the team improvised adaptation process is marked by two basic tensions, reflected on a discomfort in making choices and moving forward in organizational situations (Putnam, Fairhurst, & Banghart, 2016): the tension between a routine template, that prevents teams from improvising, and the need to solve the situation at hands; and the tension between the need to have something similar to a plan and the need to start acting on the emergent situation. Our research then focuses on how these two tensions can be solved and teams can engage in effective team improvised adaptation processes. We further developed our investigation to uncover the factors that determine the effectiveness of the whole process, and to understand what kind of team knowledge can these processes produce. Our research expands theory of team adaptation and team improvisation by delving into the process of team improvised adaptation and beginning to explain the dynamics of team performance processes when design and execution merge.

THEORETICAL BACKGROUND

The last two decades have seen significant advances on the study of team adaptation and team improvisation. As adjustments to relevant team processes in response to disruptions requiring adaptation (Maynard et al., 2015), team adaptation deals with the unforeseen, and scholars have tried to explain the phenomenon from an input-process-output perspective (e.g., Burke et al., 2006; Randall, Resick, & DeChurch, 2011; Rosen et al., 2011). On the other hand, team improvisation, characterized by the merger of design and execution (Baker, Miner, & Eesley, 2003; Cunha et al., 1999; Weick, 1998), has been studied mostly in order to identify antecedents (e.g., Moorman & Miner, 1998a; Vera & Crossan, 2005) and on attempts to classify the construct (e.g., Cunha, Clegg, Rego, & Neves, 2014; Hadida et al., 2015). This study focuses on the construct of *team improvised adaptation,* which reflects an event in which teams are adapting and improvising simultaneously, i.e. team improvisation as a response to a disruption (Abrantes et al., 2018).

Team improvisation

To effectively improvise teams must possess certain characteristics that favour improvisation. The literature has profusely identified improvisation antecedents. Scholars have argued that team members must share a diversified set of competencies (Crossan, Cunha, Vera, & Cunha, 2005; Vera & Crossan, 2004, 2005), the team must be cohesive

(Crossan & Sorrenti, 1997; Magni, Proserpio, Hoegl, & Provera, 2009), and communication must freely and abundantly flow (Cunha et al., 1999; Magni, Provera, & Proserpio, 2010). When teams improvise they merge design and execution (Baker et al., 2003; Cunha et al., 1999; Moorman & Miner, 1998b), produce some sort of novelty (Miner, Bassoff, & Moorman, 2001; Vera & Crossan, 2005), and act deliberately (Cunha, Kamoche, & Cunha, 2003). However, it is the merger between design and execution that gives team improvisation a particularity that is not binding in team adaptation. Teams can adapt by adjusting their performance processes prior to its execution, which gives them time to plan. On the other hand, while improvising teams must plan and execute simultaneously.

Teams can improvise pursuing a private agenda, for example "as a reminder of their fundamental freedom" (Cunha et al., 2014, p. 366), but most commonly they improvise as a response to an unexpected event (Hadida et al., 2015) that does not cope with any pre-established routine or plan (Moorman & Miner, 1998a). They improvise aiming to obtain positive results that can go beyond the emergent situation (Hadida et al., 2015). For example, improvisation has positive impacts on new product development (Akgun & Lynn, 2002; Kamoche & Cunha, 2001), it contributes to develop organizational flexibility (Cunha et al., 1999), and teams become better at innovating (Vera & Crossan 2005) and at improvising (Crossan et al. 1996). In fact, this last argument is critical because although teams improvise as a reaction to unforeseen events, improvisation itself can be practiced (Cunha et al., 1999) and teams can develop the competence of reflecting while acting (Yanow & Tsoukas, 2009). They can do it concurrently to action or they can briefly pause to reflect during action (Schmutz & Eppich, 2017).

However, improvisation does not necessarily result in positive outcomes, it also has a dark side (Hadida et al., 2015), as in the disastrous case of the fatal sinking of Costa Concordia (Giustiniano, Cunha, & Clegg, 2016). Giustiniano and colleagues (2016) revealed that when organizational actors, bearing decision-power, have a level of autonomy that allows them to bend fundamental organizational standards, the result can be tragic. The authors identified several dark aspects of improvisation, such as the organizational drift from organizational values, or a freedom of judgement based on professionalism and leading to the fulfilment of personal needs over team and organizational goals.

Team adaptation

Team adaptation is a reaction to changes, whether in the environment or in the task, requiring modifications in a number of team performance processes so that teams can cope with these changes (Baard et al., 2014). One of the antecedents for team adaptation is adaptability, or the team's capacity to perform the needed adjustments (Kozlowski, Watola, Nowakowski, Kim, & Botero, 2009; Maynard et al., 2015). Kozlowski and colleagues (2009) argue that in the team improvement phase of team development, teams devote to the enhancement of their ability to respond to new demands. This ability is inherent to the team and depends on the characteristics held by team members and by the respective leader (Maynard et al., 2015). For example, Randall and colleagues (2011) found that psychological collectivism [i.e. members' preferences to work in groups, to cooperate, and prioritize team goals (Chen, Chen, & Meindl, 1998)] facilitates information sharing developing team adaptability.

When teams face a disruption, in order to adapt they must start by assessing the situation (Burke et al., 2006). Only then can they develop a new plan for further implementation. Several performance processes can be conducted in the different phases of team adaptation (Rosen et al., 2011). In the new plan development phase, teams start designing a new strategy that will allow them to achieve the desired goal, taking into account the new circumstances (Burke et al., 2006). The performing phase of team adaptation is plan execution, in which team members implement a number of processes that directly contribute to the resolution of the adaptive situation (Rosen et al., 2011). This phase represents the rollout of the plan delineated during plan development. However, Maynard et al. (2015) claim that the adoption of these processes is contingent to the type of trigger (task-based or team-based) and its severity. A task-based trigger, which relates to what the team is doing, mostly prompt action processes; and team-based triggers, which relate to the means used to accomplish the task, mostly prompt interpersonal processes. Moreover, the deployment of transition processes depends on the severity of the trigger, such that the higher the severity of a trigger, the more the team feels the need to perform transition processes (Maynard et al., 2015). This means that team adaptation as a response to mild triggers need less processes within the plan formulation phase, i.e., need less mission analysis and new planning, for example. As for teams exposed to severe triggers, they might need to go over the whole plan and reformulate it. The question that rests is then the following: how can teams perform these plan changes when the scarcity of time is such that they might not have time to go over the plan? As Marks et al. (2001) propose, they can decide 'on the fly' to adjust the original plan, but why and how do they do that?

METHOD

To delve into the process of team improvised adaptation and begin to understand how teams improvise when subject to a disruption without enough time to adequate prepare a new plan or strategy, we conducted a series of semi-structured interviews with mid and top managers who already experienced situations of team improvised adaptation. Our method followed an interpretive research approach, using a first-order level of analysis to give voice to those that actually faced unpredictable events and improvised, hence becoming the foundation of our analysis (Van Maanen, 1979). We adopted the principles of grounded theory starting with an inductive logic, followed by an abductive reasoning as a way to capture emergent empirical findings through an interpretative laying of several theoretical possibilities and further development of the most plausible interpretation of the observed data (Charmaz, 2008). For this purpose, and according with grounded theory guidelines, we progressively integrated existing literature as a source of data, in a continuous comparative analysis process (Glaser & Strauss, 1967).

Data collection

We collected data using a theoretical sampling method (Corbin & Strauss, 1990), intertwining data collection and analysis until theoretical saturation was reached (Glaser & Strauss, 1967). We identified 92 percent of the second-order themes at the tenth interview, which is consistent with the prediction by Hennink, Kaiser and Marconi (2017). The author conducted 50 face-to-face interviews, all interviews were recorded and transcribed, and to all interviewees was guaranteed anonymity. All interviewees reported and described at least one situation in which as members or leaders of a team, they experienced a team improvised adaptation situation. Interviewees were middle and top managers of 16 different sectors and 30 different companies. The most represented sector was banking accounting for 28% of the whole sample. The average age was 43, 62% of the interviewees were men, 56% were middle managers, and 44% were top managers.

The interviews took place between March 2013 and October 2017 allowing a sound reflection on the insights and an iterative reviewing of the questions. Interviews lasted between 15 and 75 minutes. The average duration of the first 22 interviews was 35 minutes. Because theoretical saturation was reached around the seventeenth interview, after the twenty second interview we started narrowing our questions on specific issues that we wanted to explore deeper. For this reason, interviews became shorter. The interviews were semi-structured along a protocol ensuring consistency between interviewees. We used open-ended questions to ensure a complete description of the experiences lived by the interviewees (Gioia, Corley, & Hamilton, 2013). During the interviews participants were stimulated to describe situations experienced by them, in which a team had to adapt to an unforeseen disruption and did not have time to prepare a new plan. Then, interviewees were asked to explore those situations from different perspectives that were elicit by the interviewee. Whenever interviewees presented a new response, the interviewer encouraged them to elaborate on the answer. As new themes emerged from the data, we adjusted the script to further investigate those themes in more depth (Charmaz, 2008). Our approach incorporated enough flexibility allowing the emergence of new concepts (Gioia et al., 2013).

Data analysis

For data analysis we followed the procedures prescribed by Gioia et al. (2013) and started by analysing the transcripts and producing first-order concepts. Then we extracted second-order themes and sub-themes, and developed third-order aggregate theoretical dimensions by establishing links between the second-order themes. Finally, we developed a grounded theory of the team improvised adaptation process through the identification of relationships and connections among the second-order themes and third-order aggregate theoretical dimensions. Table 6.1 depicts the first-order concepts, second-order themes and sub-themes, and aggregate theoretical dimensions that emerged to foster our theory.

The first phase consisted in the identification of the first-order concepts (Van Maanen, 1979), which implied a detailed analysis of the interview transcripts. This phase produced 68 first-order codes, which primarily used participants' own language and terms (Corbin & Strauss, 1990). Along the analysis and across interviewees we recurrently compared data to identify the most significant concepts. As much as possible, we used short sentences. To help organizing, recalling and adapting our codes, we utilized the software program ATLAS.ti version 8.1.0. The program supported the accurate development of the data structure, facilitated the efficient search of codes at different levels of analysis, and ensured the transparency of the coding process. The coding team analysed the coding process and all disagreements were discussed until consensus was obtained (Gioia et al. 2013; Miles, Huberman, & Saldana, 2014). This process allowed the enhancement of our confidence on the findings (Gioia et al. 2013). Although not necessary in a pure interpretative approach (see, Clark, Gioia, Ketchen Jr., & Thomas, 2010; Miles, Huberman, & Saldana, 2014), in order to reinforce the trustworthiness of the study, an auditor[4], which did not engage in coding remaining as an 'outsider' to this process, performed an analysis of the coding structure (Gioia et al., 2013; Strauss & Corbin, 1990). This process was executed in two stages: one in which a random sample of the codes was evaluated by the 'outsider'; and one consisting of a discussion with the coding team to clarify some coding related questions, and to decide on the inclusion or discard of specific codes. For this last stage only minor aspects of data analysis were carried out.

In the second phase we unveiled deeper patterns and relationships that cannot be seen in first-order concepts. To detect second-order themes and sub-themes we conducted a more structured analysis allowing a higher level of abstraction. To perform this phase, we applied an axial and selective coding technique (Strauss & Corbin, 1990). Our goal was to identify codes that were representative of the data and, therefore, frequently appeared. In order to be considered for a second-order theme, a code had to appear in, at least, five interviews (10 percent of the interviewees) (see, Hannah & Robertson, 2015). This phase produced 24 second-order themes and sub-themes. Table 6.2 depicts second-order themes and sub-themes, and representative quotes of the respective first-order concepts. At this stage we analysed connections and relationships between the second-order codes and identified aggregate theoretical dimensions. This process stemmed six overarching dimensions (deployment tensions, development tensions, team improvised adaptation learning, team learning outcomes, team improvised adaptation roles, and team improvised adaptation enablers) that capture the fundamental structure of the process of team improvised adaptation.

The final phase of data analysis was the development of our theory, consisting of identifying how second-order themes and sub-themes, and third-order aggregate dimensions are connected, and the type of relationships they entail. Our goal was to identify why and how teams operate when time is scarce and they face a disruption that calls for adaptation. We discovered an initial tension that leads to the deployment of improvised adaptation processes, a development tension that holds different team performance processes, different roles that must be played by different team members, team factors that enable improvisation to occur, and learning outcomes that teams extract from improvised adaptation processes.

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[4] The auditor was the fourth author of the article that corresponds to this chapter.

This process was conducted with a permanent iteration between data, our theory, and the literature (Strauss & Corbin, 1990).

Table 6.1. Data structure

1st order concepts	2nd order themes and subthemes	3rd order aggregate dimensions
• Teams collectively identify the problem. • The member or members that identify the problem immediately summon the team.	Situation assessment	**Deployment tension**
• Teams avoid assuming risks and responsibility • Solving the problem implies a bigger effort • There are organizational barriers, strict rules and processes	Routine inertia	
	Improvisational pressures	
• Unpredictability mandate that teams improvise. • Impossibility of planning everything leading to context changes that demand improvisation.	*Unpredictability*	
• Not solving the problems is not an alternative. • The impact on the business mandates an immediate solution. • The impact on the client mandates an immediate solution.	*Business pressure*	
• Under time pressure people must improvise. • The sense of urgency deploys improvisation. • The deadline has to be met so teams must improvise.	*Time pressure*	
• Things are not solved perfectly, but good enough. • Temporary solution. • Even with inefficiencies, is better than nothing	Will to accept sub-optimal results	
	Static development	**Development tension**
• The team gathers to evaluate the situation. • The team starts crossing information among team members.	*Situation analysis*	
• The team clarifies the big picture. • Develop the initial steps of the solution. • Someone has the first ideas and the team adds of those ideas. • The team rapidly discuss alternative solutions.	*Germinal plan development*	
• Someone distributes the initial tasks. • The team distributes the different tasks among themselves. • The leader distributes the tasks among the team.	*Initial task distribution*	
• An emergent leader initiates action. • Someone with experience initiate the action. • Someone initiates the action.	*Initiating decision*	
	Dynamic development	
• Team asks for help outside the team. • Members activate personal network to solve the problem. • Team gets material resources outside the team.	*Search for alternative resources*	
• The plan is developed by trial and error. • The plan is adapted along the way. • There is a base and then the plan is adapted along the way.	*Dynamic plan development*	
• Different tasks are identified along the way. • As new tasks rollout, naturally people assume them. • In an ad-hoc way some people do one thing and other people do other things.	*Dynamic task distribution*	

Table 6.1. Continued

1st order concepts	**2nd order themes and subthemes**	**3rd order aggregate dimensions**
• Get together after the situation to learn from it • Regular meetings to discuss everything, even unpredictable events	Reflect and discuss	**Team improvised adaptation learning**
• Teams learn what cannot be repeated. • Create mechanisms to report all unpredictable situations.	Solutions to prevent future occurrences	**Team learning outcomes**
• Teams learn how to deal with unpredictable situations. • Develop a backup system to deal with unpredictable situations. • Teams get more flexible and with a broader knowledge.	Solutions to strengthen improvisational performance	
• Discover new ways of doing things that were never tried. • With improvisation teams get more creative. • With improvisation team cohesion gets higher.	Positive improvisation by-products	
• In improvisation situations a leader emerges among the team. • The leader emerges from technical expertise. • Teams must have a leader to improvise.	Improvisation leader	**Team improvised adaptation roles**
• You must have someone with technical expertise. • Teams must have a specialist on the subject. • Teams must have someone that has experience on the subject.	Task specialist	
• You need someone that always find a new approach. • Teams must have someone who improvises. • Teams need someone that with no process or method, can come up with a solution.	Improviser	
• Someone that establishes contacts with all others. • Someone who coordinates activities. • Someone that puts everything together and gives order to the chaos.	Coordinator	
• Teams must have a clear goal so they can get involved in problem solution. • Teams must share a goal.	Clear and common goals	**Team improvised adaptation enablers**
• Team cohesion is fundamental for improvisation. • Teams must have a good team spirit to respond rapidly. • People must get along with each other. • Team members must cooperate with each other. • Team members must trust each other.	Team cohesion	
• Teams must share information very quickly and continuously. • Teams must communicate externally to other stakeholders.	Communication fluidity	

Table 6.2. Representative supporting data for each second-order theme

2nd Order Themes	**Representative 1st Order Data**
Situation assessment	“First it is important to be aware of the situation. In small structures it is easier because people are closer to each other.”
	“The alarm beeping and we went running to the store trying to know what it was, what was happening.”
	“The first thing was trying to figure out why we did not have gas. The first person was the one who was cooking that sensed and soon called everyone.”
	“This is almost like in sports, there is someone who whistles, calls everybody and says ‘we have this situation, Antonio was missing, he did not come to work, we have to react, we have to do something’”
Routine inertia	“Teams tend not to take risks. But there are situations where people have to improvise, but if they can avoid it they do not improvise.”
	“People do not like to make a decision without adequate superior support.”
	“I feel more uncomfortable because I cannot solve the problem but I am safeguarded, no one can blame me and I'm always clear because I'm complying with the rules.”
	“Now, what complicates a little our life is that it usually requires additional effort.”
	“But there are a number of organizational barriers and rules, and even technological ones, that would have to be overcome in order to be viable.”
Unpredictability	“In a situation that was not foreseen, I do not think people should be restrained so they do not invent.”
	“many times have to jump (to implementation) because the unforeseen happens and then there is no way to solve other than skip some processes.”
	“Well, if the problem was not anticipated, when we face it, there is no way not to attack it.”
	“I think that the level of uncertainty we are subject to, and the speed with which everything changes, also makes this (improvisation) more and more frequent.”
	“Well, you must improvise when you do not expect something.”
Business pressure	“When we have a project and is 6 in the afternoon, and this has to be in the air at 7, with a series of things, we do it, and only then we check if something bad happens. There is no other way.”
	“It is necessary to do it either by pressure from the management or from the customer, there are a thousand and one reasons behind it.”
	“Yes, we had to make decisions, we had the business running, with the things that were there that were always going wrong, and things had to be sorted out and we had to move on.”
	“We are always pressured to resolve, usually who has clients, is the client himself, who does not let you stay ... it involves other structures, involves other people, involves other calendars.”
	“There were a lot of things arranged, it was announced in the market, in this case everything was announced.”
Time pressure	“I have to finish, I have this deadline and I have to finish, we are under pressure, so I have to improvise, I have to do it.”
	“We, in terms of work context, have deadlines to meet. The deadline pressure is too great.”
	“We had timings associated, meaning that the impact was immediate … It was a time constraint.”
	“People, under pressure, as long as they cannot escape resolution, people tend to solve.”
	“As there was a very specific timeline, …, they had to apply themselves thoroughly.”
Will to accept sub-optimal results	“Things are not resolved the way they were supposed to be, but ... Things often adapt to the problem. It's not important ... people solve.”
	“If you asked me if they solved the way I would have solved, probably not, but they did solve.”
	“It may not be the best way to solve it, but if we are properly prepared for what we are doing it is easy to link the creative aspect of the solution.”
	“And I think it was decided at the time that we would do everything possible to correct a series of errors, knowing in advance that it would not be 100%.”

Table 6.2. Continued

2nd Order Themes	Representative 1st Order Data
Situation analysis	“The best way is for the team to get together and debate the problem.”
	“In the face of such a situation, you gather a group of people who can give their valid input to identify that problem.”
	“They immediately started managing the situation, ‘let's have a meeting, call this guy, go to a room, and figure out what's going on.’”
	“Well, you typically have to make a diagnosis of the situation by calling the people who are most relevant to make the diagnosis.”
	“Well, you get into the "war room" mode, where you call everyone.”
	“But first you always have to be able to make a diagnosis of the problem that happened.”
Germinal plan development	“I think the worst mistake one can make is to panic and start running without planning anything. It could be a paper, a pen and 4 or 5 people around a table. But I think planning should be done. It has to be done in a very agile and, perhaps, more informal way, but it has to be done.”
	“Try to realize what it is has to be done to solve (the situation).”
	“Come up with the best solution, what will be the best solution for this situation.”
	“There is always someone who moves forward and who takes the initiative to come up with a solution or try to wrap up what happened, ‘in the face of what has happened, what we can do is this’. And somehow it opens the way for others to add.”
	“There is a certain tendency for people to add value to each other. They build on what has already been said.”
	“Within the options analyse and see which are the ones with the greatest potential of success and see which are possible.”
Initial task distribution	“Then you ask ‘look, are you available to stay two more hours?’ or ‘don’t worry, I'll take his place.’”
	“And then split into groups or small teams and try to execute.”
	“In this case, the team meets, assesses the options, chooses one and divides the tasks.”
	“We distributed the tasks among ourselves and then we continued to work. It was a bit ... it was all very fast, we had 30 children in each room, it's a very practical process.”
	“That's what we did, … we split into two groups, one more dedicated to some types of waiting lists another more dedicated to other types of waiting list.”
	“Then defined the solution, outline a plan in which the whole team is assigned to one task or to different tasks.”
Initiating decision	“’We are facing this scenario and we are going to have to do this’ and that's it, the rest was keep going.”
	“So there must always be someone who stands out and has that ability to pull the team forward.”
	“If there is not time, someone has to have the courage to get ahead and tell you what to do.”
	“Usually, the person who has been there for the longest time has the initiative, the person who has more practice and more experience.”
	“There is usually one that has the ability to take hold of the situations and initiate a solution.”
Search for alternative resources	“We called another department to see if they could help and what where the requirements to make things work.”
	“Asking for help, usually, to outsiders with capabilities and means other than those that we have.”
	“Typically going to get people who have experience and knowledge and proximity to the subject.”
	“Everyone has a network that tries to activate to find the solution, or help to overcome the problem.”
	“They had to seek help, order means to be able to minimize the damages and they were able to solve the problem.”

Table 6.2. Continued

2nd Order Themes	Representative 1st Order Data
Dynamic plan development	"In many other cases there is a trial and error, if it is a more engineering theme, then we are talking about something more trial and error, let's see if it is here, if it is there."
	"Then along the job we were adapting what we had to do... each one added his idea."
	"It was just the basis for the work, after the base is the logic of evolving and improving and not making mistakes."
	"In the middle of the circuit we may see that we have to adjust so we can achieve what was requested."
	"Our initial plan was shaped along the way."
Dynamic task distribution	"It was an organic thing. The necessities appeared and each one occupied the space to solve them, to make decisions, by means of his availability of time and his knowledge of the business and also their ability to make decisions."
	"While some solved the computer problems, others solved other minor issues that were unresolved. For example, the store was not yet set up, there were concrete things. But I think it was almost natural, people were worried… it was all very ad-hoc."
	"People then decide if they need to meet again to redistribute tasks or just resolve by adapting."
Reflect and discuss	"One of the things we do when there are situations outside our routine is to do a briefing to see what we have learned from the experience."
	"You can have a debriefing. You can take a moment to analyse the situation and try to work it a little. What went well and what went wrong, what could we have done differently?"
	"Reflect on them. One cannot miss an opportunity to reflect on an unforeseen situation. The next day this has to be studied, you have to watch the "video", as in sports."
	"We have regular meetings of experts. At certain times it is weekly, sometimes it can be biweekly. In these meetings all type of learning is shared."
	"We hold fortnightly meetings with all department heads, first to find out how things are going. Then to try to prevent some of these situations."
Solutions to prevent future occurrences	"We finding what we cannot repeat."
	"When it happens, we get the team together and say, 'look, this situation has happened, what are we going to do so it does not happen again.'"
	"After the stress, we sat down and started discussing what we had to do to keep it from happening again."
	"You can create a framework in which with some frequency and with certain tools, you share. This nowadays is easier and easier, with intranet, blogs, chats, all this stuff, you can do it from one more structured or less structured, more flexible or less flexible, but try to bring that know-how to the company."
Solutions to strengthen improvisational performance	"Most importantly, it is the team's ability to assimilate what has been done well or badly to have the team know themselves in the next unforeseen situation to have a different capacity to think about aspects that they had not previously thought about."
	"It is more and more an experience, it is always an experience and if it is well resolved, the next time a situation happens, you can solve it more quickly."
	"When you look back you say 'hey, I would do it in a different way'. Analyse what you would have done differently so that the team in the next situation has more inputs to achieve a more effective resolution."
	"Implement a system for when normal systems fail. A kind of backup plan."
	"That is, it gives us a little more know-how, generalized, but more know-how, more flexibility, more knowledge in other areas."

Table 6.2. Continued

2nd Order Themes	**Representative 1st Order Data**
Positive improvisation by-products	"In the midst of the chaos of trying to do something in a hurry, someone discovers a much faster method of doing things, because we are taking paths we have never tried."
	"In some cases, oddly enough, we ended up with solutions that were not considered optimal solutions, but that after implementation we said 'after all this was a simple thing and we were trying to create a bigger problem.'"
	"Creativity is one of them, positive, we can be very creative when we have to find a solution and the dead line is coming."
	"This gave a stronger force to the team, because we were all implicated in the problem. It was a challenge."
	"It is curious, when there are these situations of crisis, we notice a greater involvement of the people with the process than what they have in routine things. There is more motivation."
Improvisation leader	"They met, got together, usually we notice some leadership in the team that appears naturally."
	"That was a group of 12 people and within the group someone, they are at the same hierarchical level, and someone took the lead."
	"The emergence of informal leaders makes people, who have not yet overcome the psychological fear barrier, feel more comfortable with someone close to them."
	"In any team there must always be a leader… having no leader we have to nominate a leader who then guides the team."
	"The tension will be resolved by the team leader… Someone who has an ability to absorb the ideas at stake and must be able to mediate and ponder the path that will be followed."
Task specialist	"You have to have very good people technically."
	"Usually the specialists realize that when you have a situation like this you do not have only one piece that you can play to solve the problem, you usually have several pieces."
	"You need a person who masters the tools and is knowledgeable of the various resources."
	"I think we should have people who are experts in the subject."
Improviser	"You need someone that would unravel the situation whenever there is a problem."
	"But he was great to solve the problem whenever there was something out of the box."
	"I think when there's something unexpected, it's good to have a more creative person who values other ways and who throw more ideas into the air, more out-of-the-box."
	"Then you need more inspired people, they are not organized, but they have the ability to creatively find solutions to things that come up."
	"I think we need to always have those people who sort things out."
Coordinator	"The first profile would be the best person to coordinate teams, the most responsible."
	"But I can have someone on the team who knows how to coordinate people."
	"A person who could interact with the various elements of the team."
	"You need a highly systematic one, who plans, who has everything right."
	"Even when the time is very tight … there has to be an organization. You have to organize yourself."
	"I think there must always be a perfectionist, a person always attentive to the details, because they are usually the most rational, are the most methodical."
Clear and common goals	"In practice, you must make it very clear to the entire organization what your goals are."
	"We must have a macro goal, a purpose, 'okay our goal is this' and then let the plans be developed."
	"First, you need alignment. There must be alignment on long-term and medium-term objectives, whatever they may be."
	"We have to have the same goal. All have to be focused on the same goal."
	"I think we need to clearly define what we want."

Table 6.2. Continued

2nd Order Themes	Representative 1st Order Data
Team cohesion	"They talk a lot, they do very well. It is a spirit that is very focused on the team."
	"As a team, I think the theme of cohesion as a team is critical."
	"I think that was a team united, trying to see what was happening to solve it as quickly as possible."
	"Then there has to be a spirit of loyalty in the team."
	"I think there has to be a great spirit of sharing, and the ability to work in a team."
	"It is the complicity that exists between the elements of the team. There has to be a very strong relationship for when anything unexpected comes up people get together and solve."
Communication fluidity	"There must be fluent and fast communication."
	"There is one very important thing that is communication management. Internal communication about what is happening."
	"It is trying to pass information so that everyone has the same level of knowledge."
	"It is necessary to ensure a quick process of feedback of the decisions so that we are aware of what is happening, otherwise it will break up very quickly."
	"But external communication is crucial, which is to warn other stakeholders that may be impacted by the situation."

FINDINGS

Our study focuses on team improvised adaptation processes (Abrantes et al., 2018). Participants described a myriad of these processes, ranging from unexpected business related events, to completely unrelated disruptions that directly affected the normal flow of work. Here some examples of such situations. One bank manager reported that once, while the branch was open, one entire external glass wall was destroyed by a ball kicked by some kids. They had to keep serving the clients, without an external wall, and try to solve the situation the fastest they could. Another situation described was that of a gas shortage in a restaurant during lunch time. The restaurant was full and they had to find a way to continue serving food. Also a member of a television news crew explained how they reacted when a bomb blasted near the reportage site and they immediately decided to change and report the new incident. All these situations reflect the need for improvisation as a response to a trigger.

During the inductive analysis, we realised that there were specific factors that lead teams to improvise. These factors represent a tension between a routine inertia and the need to act immediately because of improvisational pressures. This tension occurs after the situation has been assessed and is solved by the team's will to accept sub-optimal results. We also understood that when teams start improvising, a second tension prevails: on the one hand, teams must start acting as soon as possible; on the other hand, they need to sort-out what to do in face of that unpredictable event. This last tension reveals two predominant development phases: a static development in which teams mostly discuss action; and a dynamic development in which teams mostly undertake action. In each development stage occur different team performance processes in a strongly intertwined manner, evolving in an iterative and, sometimes, simultaneous way. Our data led us to identify a specific moment in which teams move from the static to the dynamic development. It is the moment in which someone in the team takes the lead and decides to move forward.

Once we established why teams start improvising and what are the main performance processes used during execution, we began to unpack the factors that would ensure a smooth development of the improvisational process. We discovered that specific team member roles and specific team enabling factors determine the quality of the whole process. Our next step was to understand what kind of team knowledge could be extracted from such processes. The next sections will detail the findings and how the different second-order themes and subthemes, and third-order theoretical dimensions interact to produce an emergent model of team improvised adaptation.

Deployment tension

Participants explained that when teams face a situation where an unexpected event or trigger disrupts its normal course, team members face a tension: on the one hand, there is an initial inertia that originates a tendency to comply with the habitual routines; on the other hand, team members feel that they must immediately address the situation and try to handle it, even if that means diverging from pre-established protocols. We call this tension *deployment tension* because its resolution defines whether or not teams engage in team improvised adaptation processes. Several elements contribute to the tension or to its resolution. We discuss each of these elements next.

Situation assessment

For the tension to take place teams must recognise the disruption and make sense of it (Burke et al., 2006). In our study, team members observed that it was fundamental to assess the situation as a group, and that without this assessment teams cannot engage in team improvised adaptation. One participant echoed this assumption as follows:

…but first it is important to be aware of the situation. In small structures it is easier because people are closer to each other. In a company of five it is very easy, in a company of one thousand people, things are more difficult.

For the whole team to get hold of the new situation the word must be spread immediately. One participant described the way a gas shortage was identified in a restaurant and how that information was spread straightaway:

The first thing was trying to figure out why we did not have gas. The first person was the one who was cooking that sensed and soon called everyone. He started screaming to say that he had no gas, and the word started to spread.

Another participant used a sports metaphor to explain the need for the team to assess the situation.

This is almost like in sports, there is someone who whistles, calls everybody and says "we have this situation, someone is missing, he did not come to work, we have to react, we have to do something.

Routine inertia

When the situation is assessed and teams completely understand its full implications, there might be a tendency to retreat to a defensive position that prevents improvisation. Team members have assumed that one of the reasons for this tendency is to avoid risk and responsibility. One participant noted:

Teams tend not to take risks. But there are situations where people have to improvise, but if they can avoid it they do not improvise.

Another reason is that trying to solve the problem requires more effort, and employees feel they should not do the extra work. One participant mentioned that 'what complicates a little our life is that it usually requires additional effort'. However, regardless of the team members' feelings, there are also organizational barriers, usually translated into strict rules and processes, that limit the adoption of improvisational processes. One member reflected on this obstacle in the following way:

But there are a number of organizational barriers and rules, and even technological ones, that would have to be overcome in order to be viable.

Although teams might feel that this inertia prevents improvisation, there are a few elements pushing teams to improvise and creating a pressure between routine inertia and the need to act. We call these elements *improvisational pressures*.

Improvisational pressures

Participants perceive that on the opposite end of routine inertia there are factors that compel teams to improvise. We identified three improvisational pressures: *unpredictability*, *time pressure*, and *business pressure*. The fact that the situation is unpredictable creates a scenario in which improvisation becomes an alternative (Kamoche & Cunha, 2001). One of the interviewees pointed out that in such circumstances, improvisation can be accepted.

In a situation that was not foreseen, I do not think people should be restrained so they do not invent. I think people should invent and it is necessary to assume the result of this creativity.

Also, the fact that there are schedules and deadlines facilitates the decision to improvise. They instil a sense of urgency that is critical for improvisation to unfold. As one participant stated:

In any of the cases referred there were timings associated, meaning … that the impact was immediate because I only had product if I could find ways to pay suppliers. It was a time constraint.

Finally, there are business reasons that go beyond the tendency to use pre-established routines when the situation is not suitable for the use of these routines. Typically, participants referred that not solving the situation was not an alternative:

Because there is no alternative, they have to solve the situation, normally the operational teams are those that have the role of keeping the network running.

They also indicated that there are specific impacts on the business, or that a particular aspect of the business, such as a customer for example, would be affected without a rapid intervention.

There is always the need to act immediately because typically these things have a big impact on the business.

A customer cannot be harmed. If the decision is not the most appropriate, we will have to rectify in the near future so we can make it better. But the decision has to be made.

The conflict between *routine inertia* and *improvisational pressures* creates a tension that must be solved, otherwise teams will not engage in improvised adaptation and will not address the new situation in a timely manner.

Willingness to accept sub-optimal results

Our research uncovered one key to unlock the tension between routine inertia and improvisational pressures. If teams have the willingness to accept sub-optimal results, most likely, they resolve this tension and improvise a solution outside habitual routines. Respondents revealed that for teams to engage in team improvised adaptation, they must alter their original goals, reducing expectations, and accepting sub-optimal outcomes. It is this disposition to change team goals that settles the tension between routine inertia and improvisational pressures. One respondent said that the team had to improvise even if they knew that it would not be perfect.

And I think it was decided at the time that we would do everything possible to correct a series of errors, knowing in advance that it would not be 100%.

The need to lower goals becomes more evident when teams realise that the expected result from the improvised adaptation process is better than not engaging in improvisation. Participants acknowledged that even with inefficiencies the improvisational solution would be better than doing nothing, and also that it was a temporary solution until they could implement a better one, as the case of the respondent below:

It was a precautionary measure, it worked for that day, we managed to minimize the dissatisfaction and mainly because it was a time of the year that we consider 'big season' and a day not working can mean a lot of money and customers dissatisfaction.

The combination of improvisational pressures with the identification of a sub-optimal but satisficing (Simon, 1956) objective allows teams to solve deployment tensions and start improvised adaptation processes. However, the start of this process activates a new tension between starting to act immediately or stopping for a brief moment to analyse the situation and prepare a new plan.

Development tension

We now present our findings regarding team improvised adaptation processes. A new tension was identified between immediately starting to directly unravel the situation, or briefly analyse alternative courses of action and start to devise a new plan. We call this stage *development tension* because teams are already involved in developing solutions to properly address the present episode. This tension comprises two sub-stages: one in which teams start developing new strategies in a static way, *static development*; and one in which teams start executing, *dynamic development*. The tension is resolved when teams decide to shift from static development to dynamic development, usually because one team member makes that decision.

Static development

During static development, teams conduct three performance processes: they *analyse the situation*, iteratively *develop a germinal plan*, and perform the *initial task distribution* among team members. Although time is restrictive, teams aiming to solve an unpredictable situation in an effective manner, do not discard a brief moment to analyse it, even if this analysis is insufficient to properly evaluate the whole situation. One participant referred to this process as entering the *war room* mode, he said ´you get into the war room mode, where you call everyone’. Another participant pointed out that the tendency to immediately start acting can constitute a potential hurdle to a good and efficient solution:

Often teams do not immediately join ..., and it has to be, there is no other way, you will have to involve a certain number of people on the team immediately. So I think one important point is to immediately share the challenges [ahead].

Situation analysis, germinal plan development, and initial task distribution are performed iteratively, sometimes simultaneously, and under an inherent pressure to start acting. Teams do not have time to prepare a full plan, instead they devise the first few steps of a germinal plan and assign the first tasks. One participant summarized these two performance processes as follows:

Then a determination of the three or five things that we must do, the next steps, then assign responsibilities.

Any team member can start proposing the first ideas to solve the problem. Then, other team members start adding and building on top of the initial ideas. The next quote condenses most participants' perspectives on this matter:

There is always someone who moves forward and who takes the initiative to come up with a solution or try to wrap up what happened, 'in the face of what has happened, what we can do is this'. And somehow it opens the way for others to add.

The three process are made iteratively and very quickly since teams have the perfect notion that time is scarce and they must start acting. One participant from a private museum expressed this concern as follows:

We distributed the tasks among ourselves and then we continued to work. It was a bit ... it was all very fast, we had 30 children in each room, it's a very practical process.

The tension between static and dynamic development is resolved by the *initiating decision*. This decision may come from someone recognized as a leader, formally or informally, or any team member who stands out for some specific reason, such as his or her technical competence or experience. One participant referred to the leader as the one who decides to initiate execution, saying 'someone has to make the decision and is usually the leader that says, "ok, go"'. Another interviewee identified the most experienced person as the one that takes the lead and decides to move forward.

Usually, the person who has been there for the longest time has the initiative, the person who has more practice and more experience.

Dynamic development

Once the decision is made, and the dynamic development is initiated, an iteration between three different team performance processes starts. At this stage teams move from one process to the other in a random pattern, as new information is revealed. Teams start *searching for alternative resources*, they continue developing the strategy with a *dynamic plan development*, and they move to *dynamically distribute tasks* as they seem fit. Our data shows that when teams are improvising they try to get new resources outside the team. These resources can be other people that have a better knowledge of the situation at hand or have other means to solve the problem. One respondent referred to ‘asking for help, usually to outsiders with capabilities and means other than those that we have’. But the resources that team members scan outside the team can also be material resources. One participant said that to solve an electricity shortage they had to quickly move to a different office so they could continue working.

What happened was that our general manager called one of the other directors and wondered if there was a chance we would use one of their rooms. What happened? ..., we went to their office.

For this to happen, team members activate their network of contacts. This can be seen in the following statement:

Everyone has a network that tries to activate to find the solution, or better to overcome the problem. There is always someone who ... for example in a difficulty of transportation, there is always someone who helps and has transportation.

As team members search for alternative resources, they also continue to develop the new plan. The initial plan only defines the first steps. As the situation evolves new steps must be added. Also, new information is gathered as execution progress, requiring that the teams continue to adapt. This process was explained in the following terms:

Our initial plan was shaped along the way. We changed places over time and, on improvisation basis, we decided what we were going to do next.

Dynamic plan development implies that new tasks appear and must be distributed. The distribution of the tasks occurs in a dynamic and organic manner, as team members decide to undertake them as they emerge:

It was an organic thing. The necessities appeared and each one occupied the space to solve them, to make decisions, by means of his availability of time and his knowledge of the business and also their ability to make decisions.

Throughout the iteration between the search for alternative resources, the dynamic plan development, and the dynamic task distribution, the solution for the unforeseen event starts to take shape, and teams are able to overcome the initial obstacles imposed by the disruptive situation. However, our findings have shown that most likely teams would not achieve the expected sub-optimal outcome unless other factors play their role. Next we discuss these factors.

Team improvised adaptation roles

Our analysis indicated that when teams engage in collective improvised adaptation, specific roles must be played so that improvisation can be effective. Soon in our research we discovered that the *improvisation leader* role was determinant for the success of the process. Nonetheless, along the interviews, we came to realise that other three roles were equally important: the *coordinator*, the *task specialist*, and the *improviser*.

Improvisation leader

One of the elements promoting improvisation is the capacity of team members to add and propose solutions that, at some point, must be brought together and a decision made by someone who takes a leadership role. Participants have voiced their concern that, in order to effectively improvise, team members must talk and express their ideas. The following quote captures the importance of speaking up:

[To improvise] you must have an open environment in which everyone can speak their mind. People are all on the same level.

Nonetheless, we observed that the gathering of ideas should result in a decision that might be taken by the formal leader, as the following quote demonstrates:

The tension will be resolved by the team leader… Someone who has an ability to absorb the ideas at stake and must be able to mediate and ponder the path that will be followed.

Yet, although the improvisation processes might be headed by the formal leader: ‘we have to have a great leader, otherwise it will not be possible to join such different people, otherwise we cannot steer the team’; it can also emerge informally among other team members. The next quote illustrates the emergence of an informal leader due to superior experience:

Finding the solution is to identify who is the most experienced and with more years in the company. He or she should stand out and start doing something to solve the problem. It is *normal for more experienced people to get ahead and start solving the problem immediately.*

The leader does not have to be the same in different situations. The participants observed that some situations call for one leader, but other situations call for a different leader. The following quote supports this argument:

There has to be someone who can guarantee that this is done in some way. It does not have to be always the same but you have to have at least one person that is able to pull others in that direction. A leader, right?

However, a rotating leadership demands that teams have been delegated decision-making authority:

We try to have teams that are capable of responding to [improvisational] situations with autonomy, even if they are atypical situations.

Coordinator

Coordination is key for the success of improvisation. One team member noted that 'between us we had that implicitly coordinated to make sure things got where we wanted'. Participants argued that this coordination was most effective if one team member assumed that role. The *coordinator* role represents a key aspect of a team's capacity to coordinate action during an improvised adaptation episode. The following quote is a good example of such role:

[To improvise] the first profile would be the best person to coordinate teams, the most responsible, the one with a 360º vision.

The coordinator role can be assumed by the leader (formal or informal). A good example is a quote by one respondent referring to the leader as someone who creates checklists and tasks:

You need the organizational leader, the profile that gets a loose conversation start creating a checklist and tasks. He is almost the arbiter of our progress.

But most respondents affirmed that the coordination and the leadership roles can be played by different team members. The following quotes describe this perspective:

We need organized people. But often these do not have leader profiles, but they are essential.

In the team we must have a clear coordination and leadership, which are not necessarily in the same person.

Task specialist

A third role uncovered by our analysis is that of the task specialist. In a team not everybody needs to be highly qualified, but you need at least one specialist. One respondent pointed out that 'you need a person who masters the tools and is knowledgeable of the various resources'. The task specialist can dominate the product as one team member observed 'I would choose the expert on those tasks, the product specialist', and can also be an expert on the subject at hand. One team leader observed that by saying 'obviously you want those that most understand the process and the technology'. But you also need people that are specialists due to their experience. The following quote describes this person:

It is important to have someone with more years of experience, someone who is a bit more compliant … someone with 10 or 15 years of experience, with a solid professional background.

Improviser

Team members emphasised that the role of the *improviser* is critical to foster the ability of a team to temporally merge planning and execution (Moorman & Miner, 1998b) and therefore to promote the collective improvisational capability. This study showed that the improviser is someone that unravels situations, is a dynamic person, does not fear assuming risks, is intuitive and creative, and is someone that finds a way to sort-out a problem. The following quotes represent the role of the improviser:

I think when there's something unexpected, it's good to have a more creative person who values other ways, and who throws more ideas into the air, more out-of-the-box.

Then you need more inspired people, they are not organized, but they have the ability to creatively find solutions to things that come up.

Another relevant aspect is that the various roles are of different importance in different sub-stages of the execution phase. The improvisation leader assumes a critical role in static development. During this stage teams need someone who takes the lead, helps give sense to the situation (Gioia & Chittipeddi, 1991), and initiates action. The leader can assume these responsibilities. The following quote is a good example of the timing where leadership assumes its role:

Usually there has to be a command voice that makes a decision, and the manager will naturally be the one who will take it.

Although the task specialist is relevant during the whole execution phase, his or her role becomes determinant as teams delineate the germinal plan during the static development stage. This quote represents well the role of the task specialist in the situation analysis and germinal plan development:

Usually the specialists realize that when you have a situation like this you do not have only one piece that you can play to solve the problem, you usually have several pieces. "If I play this piece, this is likely to happen and the impact is this, if you touch this the impact is this".

The improviser is also important in all development tension phases, but during dynamic development, as alternative resources are procured and new strategies are developed along the way, his or her creativity and capacity to make things happen become a useful resource. On respondent gave a good example of the usefulness of the improviser during dynamic development.

The improviser is the one that is able to talk with Joaquim, with Antonio, with José, scream with the truck driver, and ensure that the things are done.

When action actually starts after the initiating decision, the coordinator gains relevance. As new tasks emerge, they must be organized and someone must ensure that the same task is not being performed by several people. As referred by one respondent, you need someone that keeps track of the whole process.

You need someone who keeps an eye on the final process and goes on saying, "Okay, we're at x%".

The different roles do not have to be played by different people, since the same person can accumulate several roles. If you have a team of three you still need the four roles.

Also, roles have a fluid nature, in the sense that in one task one person can assume a certain role, and take a different role in a different subsequent task, particularly the task specialist, as the nature of this role is task dependent. But different roles do not solely ensure the effectiveness of the improvisational process; other team elements must coexist to ensure the quality of team improvised adaptation episodes. We call these elements *team improvised adaptation enablers*.

Team improvised adaptation enablers

Throughout our investigation it became clear that apart from the improvisational roles, efficient team improvisation requires the presence of factors that enable teams to adequately respond to disruptions in real-time. Three factors were identified: *clear and common goals*, *team cohesion*, and *communication fluidity*.

Clear and common goals

We found that if teams have to react to unpredictable situations when there is an extreme time scarcity, focusing on clear and common goals becomes critical. Often participants echoed opinions pointing to a master goal orienting the whole process, such as the following:

[In order to improvise] we must have a macro goal, a purpose, 'okay our goal is this' and then let the plans be developed.

Having a clear and common goal can mitigate the effect of potential disadvantages of having a diversified team, provide a purpose to the team, and align behaviours on the same direction. The following two quotes reflect these effects:

It does not mean that people are all the same or have all the same characteristics, but [if they have] the same objectives, if they all know what they are there to do, then it will be easier to deal with these things.

This is like an ancient roman boat, [when improvising] we all have to row in the same sense because if one does not row in the same direction, the boat will not end in the final port.

Team cohesion

Participants also stated that for improvisation to work, apart from a clear and common goal, teams also need to be cohesive. One participant reflected in detail the feeling of most interviewees regarding the importance of having a cohesive and motivated team.

Team members must, in addition, give their best to the organization, the group, the place where they work. They must, somehow, see the problems of the group as theirs and try to give an answer and feel responsible for it. A team has to be motivated to feel that way. A team has to be cohesive, they have to be all working for the same cause.

For a large group of respondents, team cohesion reflected a good team spirit and a sense of loyalty. One team member pointed out that 'there has to be a spirit of loyalty in the team'. The capacity to work as a team was mentioned as part of team cohesion. A participant expressed 'I think there has to be a great spirit of sharing, and the ability to work as a team'. For interviewees, being cohesive also means that team members care about and support each other. This quote expresses the opinion of several respondents:

It is the complicity that exists between the elements of the team. There has to be a very strong relationship for when anything unexpected comes up people get together and solve.

Communication fluidity

Complementing these two factors, the analysis of the data also revealed that teams must promote a fluid communication if they want to succeed in an improvised adaptation episode. They must continually talk to each other, report what they are doing, give regular feedback, and immediately transmit information as it arises. The need for fluid communication was well expressed in this participant's opinion:

[team members] must talk to each other so they can solve situations or find solutions for them. I think communication is very important.

Things happen fast and new information is rapidly emerging. As new strategies are developed and implemented, team members need to inform other members. A permanent stock of what is going on with the process is fundamental for its success. This was explained by one participant:

It is necessary to ensure a quick process of feedback of the decisions so that we are aware of what is happening, otherwise it will break up very quickly.

Communication must not only flow among team members, but also to other stakeholders outside the team, such as clients or other teams in the organization, so they can follow the situation and be prepared, for example, for sub-optimal results. One participant summarized this argument as follows:

But external communication is crucial, which is to warn customers or other stakeholders that may be impacted by the situation.

The team improvised adaptation enablers guarantee a framework that ensures the unfolding of the improvisational process. The question now becomes if teams can learn and how they can learn from these processes.

Team improvised adaptation learning

In this section we present our findings regarding the participants' perspective on how and what can be learned from team improvised adaptation processes. We focus on the learning process, i.e. what did teams do to learn from improvisation episodes; and on the outcomes, or what did teams learn from these episodes. Respondents emphasized one group process as a way to learn, *reflect and discuss*, and three outcomes of this process, *solutions to prevent future occurrences*, *solutions to strengthen improvisational performance*, and *positive improvisation by-products*.

Reflect and discuss

A majority of respondents explained that for teams to learn, they have to meet after the event and discuss what happened. The following quote summarizes their understandings:

One of the things we do when there are situations outside our routine is to do a briefing to see what we have learned from the experience.

Participants revealed that the reflection and discussion process consists on an *ex post* analysis of the situation, a stock of what went wrong and what was done right, and what kind of lessons can be taken for the future. The following statement describes the general feelings about this team performance process:

You can have a debriefing. You can take a moment to analyse the situation and try to work it a little. What went well and what went wrong? what could we have done differently?

But learning can also result from regular meetings where teams discuss all relevant matters, particularly those that arise from unexpected events and can constitute future performance improvement and better preparation for the unexpected:

We hold fortnightly meetings with all department heads, first to find out how things are going. Then to try to prevent some of these situations.

The outcomes of the learning process on team improvised adaptation episodes was uncovered when participants started to express the positive results of improvisation. We next explore the three main learning outcomes identified.

Solutions to prevent future occurrences

Although unpredictability is increasingly a reality to which teams must cope (Magni & Maruping, 2013), some of that unpredictability can always be avoided with more accurate prediction systems. Unpredictable situations are a good opportunity for teams to learn and develop solutions to prevent future occurrences. One participant noted that 'after the stress, we sat down and started discussing what we had to do to keep it from happening again'. This conduct was expressed by several team members that recognised the importance of reducing the likelihood of unpredictable events. One top manager noted that creating a reporting mechanism could serve this purpose:

You can create a framework in which with some frequency and with certain tools, you share. This, nowadays, is easier and easier, with intranet, blogs, chats, all this stuff, you can do it more structured or less structured, more flexible or less flexible, but try to bring that know-how to the company.

Solutions to strengthen improvisational performance

No matter how good a team plans, participants acknowledge that unpredictable events will always happen. Therefore, teams should develop mechanisms to reinforce their improvisational performance. This way teams will become more prepared to deal with unpredictability. Improvised adaptation episodes represent a practical and perfect setting to such preparation. One participant expressed this by saying that teams can use improvisation episodes to learn how to think differently.

Most importantly, it is the team's ability to assimilate what has been done well or badly to have the team know themselves in the next unforeseen situation to have a different capacity to think about aspects that they had not previously thought about.

The learning extracted from improvisational episodes can serve other teams in the organization, and can be used to develop mechanisms to better deal with unpredictable situations, as stated by this team leader:

What was interesting after this happened was that the other offices of our company began to do simulations.

This participant explained that after the improvised adaptation episode, the organization decided that teams should practice a response to unpredictable situations, and implemented a simulation-based program, in which teams would engage in simulated improvisation episodes.

Positive improvisation by-products

There are also other positive consequences of team improvisational episodes that can be considered outcomes of the team learning process. In our investigation, participants reported several examples of such by-products, particularly that teams discover new ways of doing things because they try approaches never attempted before, teams get more creative, and team cohesion gets higher. When teams are improvising they adopt solutions that would never been tried if not for the unpredictability of the event. A manager´s testimonial shows that sometimes teams can find original solutions that improve pre-established routines:

In some cases, oddly enough, we ended up with solutions that were not considered optimal solutions, but that after implementation we said 'after all this was a simple thing and we were trying to create a bigger problem'.

Improvisation requires creativity but it can also promote it. By improvising, team members seek new ways of addressing the problems, which forces them to think differently from what they are used to. This practice leads to an increase of the teams' capacity to develop new solutions and think creatively, as expressed by this participant's comment:

Creativity is one of them, positive, we can be very creative when we have to find a solution and the dead line is coming.

Several participants also expressed that when teams go through improvisational situations, the tension to which they are subject contributes to create a better team spirit and an increased team cohesiveness.

Yes, that team learned that we needed each other. From then on, our team spirit was much stronger than it was before.

In organizational settings, improvisation is not an objective, but situations emerge in which teams must improvise. A good use of improvisational approaches can lead teams to maximize the utility of team improvised adaptation and improve future performance in unpredictable situations by means of the knowledge obtained.

DISCUSSION

We started this study by stressing the relevance of the team improvisation process when teams face unpredictable events and are subject to extreme time constrains. Our research was developed mainly to uncover the reasons why teams decide to improvise, and how they improvise. To conduct our research and find answers to these questions, we performed an inductive study of 50 managers that showed evidences of having been exposed to team improvised adaptation circumstances. Our findings extend current knowledge on how teams adapt when time is so limited that design and execution merge into an improvisational episode (Moorman & Miner, 1998b).

The results suggest that an initial tension to adopt improvisation germinates after the situation has been assessed. This tension develops around an inertia motivated by the desire to adhere to habitual routines, sometimes strengthened by strict organizational rules and processes, and the need to start solving the current situation, fuelled by specific improvisational pressures – unpredictability, business pressure, and time pressure. This tension is resolved by the team´s will to accept sub-optimal results, mostly when they realise that these results might be better than the alternative of not immediately tackling the situation. The study also begins to uncover the improvised adaptation process and how does design and execution merge, by revealing a second tension between the need to evaluate and plan, and the need to start executing. This tension comprises a static and a dynamic development in which teams intertwine analysis, plan development, task distribution, and search for external resources. It is resolved by a decision to initiate action, that usually takes place when the new plan is yet at its early stages. It is during the dynamic development, when teams are directly contributing to unravel the situation, that the plan is finalised and tasks are fully distributed. Further, the study reflects the relevance of the improvisational roles (improvisation leader, task specialist, coordinator, and improviser) and improvisational enablers (clear and common goals, team cohesion, and fluid communication), elements that are critical for the effectiveness of the process. Finally, our findings point to improvisational learning outcomes which derive from a team process of discussing and reflecting on the past improvised adaptation episode. In this discussion we explore the insights depicted in the model of Figure 6.1, and elaborate on how they expand literature on team improvisation and team adaptation. The model represents the dynamics contained in the tensions described earlier, and explores the framing elements enacted by the improvisation roles and enablers, and the way the process unravels over time resulting on the production of specific team improvised adaptation learning outcomes.

Team improvised adaptation tensions

When teams are faced with a trigger that disrupts the normal course of action they must first recognize the trigger and ascribe meaning to it (Burke et al., 2006). Burke and colleagues (2006) assert that habitual routines make it difficult to acknowledge adaptation cues and that the assessment of the situation facilitates that recognition, that must be further communicated to the rest of the team. The authors propose that once teams assess the situation, they gain situation awareness, or a shared understanding of the current situation (Salas, Prince, Baker, & Shrestha, 1995), and are ready to move to plan formulation and start adapting. This sequence does not fully apply to an improvised adaptation situation because the nature of the adaptive process changes when teams do not have time to plan prior to implementation (Abrantes et al., 2018). In turn, improvisation scholars propose that improvisation is often triggered by unexpected events requiring immediate action, and routine procedures do not properly address those events (e.g., Hadida et al., 2015). The question resides on why do teams engage on improvisation, what is their motivation? Our findings expand both perspectives by beginning to answer this question. We acknowledge that when time is scarce and teams do not have enough time to plan, they might retract from adapting immediately. By suggesting that this tension is resolved by the team's will to accept sub-optimal results, we start to delve into the reasons for team improvised adaptation.

However, our findings go further on the understanding of goal definition in improvisational episodes. The connection between improvisation and performance is ambiguous, meaning that improvisation can benefit or jeopardise organizational outcomes (Vera & Crossan, 2004). Although the literature has tended to consider improvisation as a positive contributor to performance, most researchers have considered performance from an innovation or adaptability perspective (Crossan et al., 2005). This means that the focus has been on the capacity of organizational actors to create novelty or adapt, often implying a shift on the original organizational goal. A well-known and often cited example of improvisation is the Mann Gulch disaster (Weick, 1993b), in which a firefighter, under conditions of severe time scarcity, abandoned his pre-established routines to successfully avoid dying in a fire. Considered as a successful example, this situation configures a dramatic shift of the original plan, which was to extinguish the fire. Given the dramatic development of the situation, the goal became to escape the fire, which was successfully achieved by some firefighters. Our study suggests that for teams to perform improvised adaptation, they must alter their goals and start measuring the success of the improvisational process in relation to the new goals. When teams realize that the new goals, although lower than the original ones, are better than postponing the unravelling of the situation, their motivation to improvise increases and the deployment tension is resolved.

A second contribution relates to the explanation of the improvisational process and the acknowledgement of a tension between static development and dynamic development. In typical adaptation processes, in the plan formulation phase, teams conduct a number of performance processes, for example they analyse the mission and specify new goals (Rosen et al., 2011). However, in improvised adaptation processes, given the scarcity of time teams move straightforward to the action phase. This would suggest that teams immediately start executing after deciding to improvise. Our findings indicate otherwise. Although they do not have time to plan, they do not discard a brief moment to analyse, plan, and ascribe tasks. However, they intertwine these processes and they do not perform them exhaustively. At a given time, pressed to start acting, a team member, often a formal or informal leader, decides that the team must move to a dynamic development phase. At this point the team starts executing the few first steps already defined. This dynamic plan development is similar to

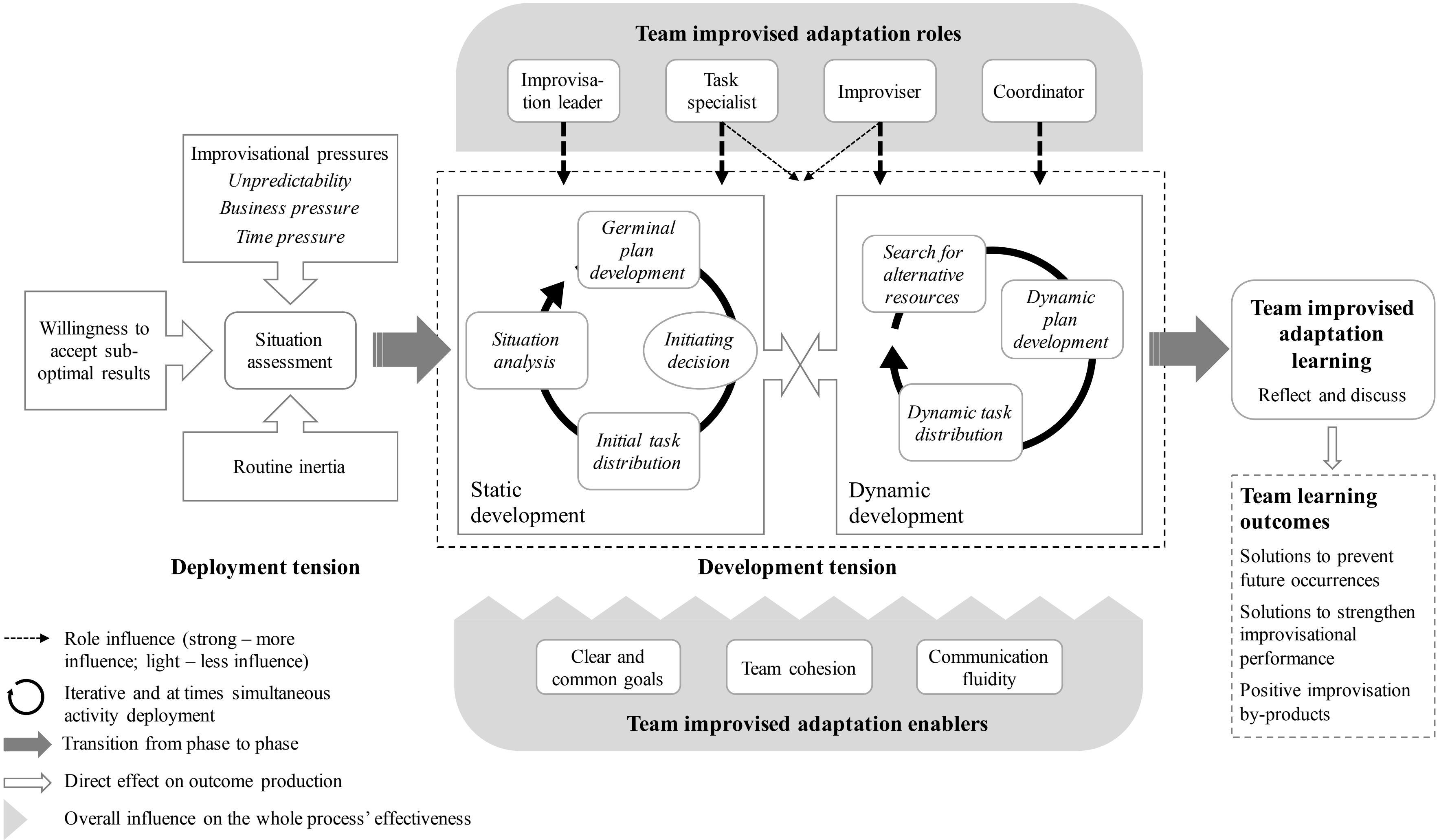

Figure 6.1. An emergent model of the team improvised adaptation process

the reactive strategy planning defined by Marks et al. (2001) and represents an "adaptive redirection of the team's activity" (Rosen et al., 2011, p. 112). However, the dynamic plan development does not arise from environmental changes to the adaptation plan, as suggested by Rosen et al. (2011), but from the progressive development of the initial germinal plan, as the situation evolves and team members get more acquainted to the new situation.

One fundamental aspect of improvisation relates to the concept of *bricolage* or the use of whatever resources are at hand to execute a given task (Weick, 1993a). This concept is present in several improvisation definitions, and is based on the assumption that when teams improvise they need to act on the spot with the resources that are available (Hadida et al., 2015; Kamoche et al., 2003; Sonenshein, 2014). However, other improvisation definitions ignore the concept of *bricolage* to focus on its temporal dimension, translated into the merger of design and execution (e.g., Miner, Bassof, & Moorman, 2001). Some authors argue that teams might also need to acquire new resources because those available to them are not adequate (e.g., Plowman, Baker, Beck, Kulkarni, Solansky, & Travis, 2007). Moreover, one of these recourses is knowledge, and the ability to gather external knowledge positively influences a team's capacity to improvise (Vera, Nemanich, Vélez-Castrillón, & Werner, 2016). Our findings help to clarify this dispute by acknowledging that when teams improvise they search for outside resources, not only knowledge, but also material resources. They do it iteratively and often simultaneously along the dynamic plan development and the dynamic task distribution.

Framing team improvised adaptation

We also expand team improvisation literature by explicating how teams ensure that the improvisational process unfolds in an effective manner. Particularly, our study identifies four improvised adaptation roles and three improvised adaptation enablers that contribute to a smooth and effective process. Cunha, Cunha and Kamoche (1999) argue that when dramatic changes occur, the role of the leader is to frame those changes so that teams do not retract to defensive routines, preventing the adoption of improvisational actions to cope with the emergent situation. Edmondson (2003) proposed that in teams in which members must improvise and coordinate their actions in unpredictable situations, team leaders can minimize power differences and increase the ease of speaking up, hence facilitating successful implementation. Our research supports these arguments identifying the role of the leader in team improvised adaptation processes in a more granular way. Moreover, we propose that the leader role is played by different actors in different situations. Cunha et al. (1999) stated that a rotating leadership helps organizational improvisation because the complexity and interdisciplinary nature of situations experienced by organizational teams demands different knowledge and competencies, which are brought by the mobilization of diverse participants, promoting innovation (Davis & Eisenhardt, 2011). Our results also reveal that for teams to adopt a rotating leadership, they must be able to empower team members to assume a leadership role when necessary. This empowering leadership has been proposed to promote team improvisation (Magni & Maruping, 2013).

But this study also suggests that the coordinator, the task specialist, and the improviser roles complement the leader role during the course of improvisation. Coordination is key on adaptation processes. When teams adapt, coordination becomes a crucial element of plan execution (Burke et al., 2006; Rosen et al., 2011). Coordination is the “orchestration of the sequence and timing of interdependent actions” (Marks et al., p. 363), and in typical improvisational situations, such as emergency response teams, might be assumed by a single individual (Mendonça & Wallace, 2007). Our findings confirm this perspective since coordination is often assumed by one particular team member. We have also witnessed that this team member can be the leader, supporting Magni and Maruping’s (2013) argument that empowering leadership contributes to the coordination of spontaneous action when time is scarce. But it can also be assumed by other members in the team.

Another role uncovered in our study was that of the task specialist. The improvisation literature has recognised the relevance of technical skill and expertise in improvisation (e.g. Crossan & Sorrenti, 1997; Cunha et al., 1999; Magni et al., 2010). However, improvisation can be undertaken by anyone, as long as they have the will to do it. Nonetheless, if teams want to ensure the quality and efficiency of the process, they need technical competence (Kamoche et al., 2003), which as our study showed can be ensured by a task specialist who masters the technology, the matter at hand, the process, or has a significant experience on the task.

One final, but equally important role was that of the improviser: someone that is creative, resourceful, uses lateral thinking, is not afraid to take risks, and has the ability to unravel complex situations. The improvisation literature has surfaced the characteristics of this role by referring to the importance of improvisational capabilities, defined as “the ability to spontaneously reconfigure existing resources to build new operational capabilities to address urgent, unpredictable, and novel environmental situations” (Pavlou & El Sawy, 2010). Although conceptualized as collective and purposeful, improvisational capabilities mostly reside on the team members' capacity to improvise (Cunha et al., 1999). As observed for the leader role, our findings suggest that all different roles are played in different episodes by different team members. This observation is in line with Mendonça and Wallace's (2007) argument that in emergency response teams it is common to observe team members assuming roles previously taken by other team members.

The second set of factors framing team improvised adaptation revealed by our findings are the team improvised adaptation enablers. Three factors were identified: clear and common goals, team cohesion, and communication fluidity. Crossan et al. (2005) stated that two influencing factors of team improvisation are teamwork skills, and real-time information and communication. Teams can perform as a team if they have team cohesion. This characteristic has been broadly emphasised as an antecedent to team improvisation (e.g Crossan & Sorrenti, 1997; Magni et al., 2009, 2010; Vera & Crossan, 2005). The same can be said regarding the quality and fluidity of communication (e.g. Cunha et al., 1999; Magni et al. 2009, 2010; Vera & Crossan, 2005). When team members communicate frequently and broadly, the team develops sounder transactive memory systems, or the knowledge of who knows what (Dai, Roundy, Chok, Ding, & Byun, 2016), which promotes team adaptive behaviours (Marques-Quinteiro, Curral, Passos, & Lewis, 2013).

The third factor referred was the clarity of the team goals, and the degree to which they are shared by team members, which is also raised by the literature. Crossan (1998) proposes that for improvisation to work, it is critical to have a common goal. Early studies propose that outcome-focused teams exhibit a greater capacity to adapt their work processes to unpredictable situations than process-focused teams (Woolley, 2009). The originality of our work resides on combining different roles and different factors, creating an integrated framework that favours effective team improvised adaptation processes.

Acquiring knowledge from improvisational processes

Team adaptation literature has emphasised the role of learning in adaptation. For Burke and colleagues (2006), learning is the final stage of the adaptive cycle, in which teams share information and reflect on their past experience (Edmondson, Dillon, & Roloff, 2007). Team refection can be seen as a transition process that leads to adaptation, consisting on gathering and analysing about the self, the team or the environment (Konradt, Otte, Schippers, & Steenfatt, 2016). However, improvisation scholars are not so conclusive regarding the role of learning in improvisation. Cunha et al. (1999) argue that learning is a possible outcome of the improvisational process, and although improvisation can be seen as a special type of short-term learning (Miner et al., 2001), not always results on the acquisition of new knowledge for only serves local and temporary purposes (Moorman and Miner, 1998a). Hence, according to the literature, when teams adapt with time to prepare a plan prior to its execution, they learn as a result of the final process of the adaptive cycle. However, when teams merge design and execution they might only serve proximal purposes and not engage on learning processes. Our findings contribute to this debate by revealing that after the improvised adaptation episode, even if locally confined, teams should reflect and discuss the past event. The reflexivity literature has explored this perspective. When teams reflect, they improve their ability to react more flexibly to unexpected events (Konradt, Schippers, Garbers, & Steenfatt, 2015).

Our study also contributed to the team learning literature by identifying some of the outcomes of the learning process that focus on team improvised adaptation episodes. The result of the learning process is "the development of knowledge [that] contributes to the ability of members to improve their collective understanding of a given situation" (Burke et al., 2006, p. 1198). When teams reflect on the improvisational situation, they acquire a set of new knowledge that will help them in the future. Two of those lessons are solutions to prevent future occurrences, and solutions to strengthen improvisational performance. Cunha and colleagues (1999) propose that the ability to improvise can be trained. Our research shows that by reflecting on the improvisational episode teams can develop mechanisms that allow them to improve improvisational capabilities. One of these mechanisms is a backup system to deal with unpredictable situations.

However, there are other positive consequences of team improvised adaptation processes revealed by our study. One of them is that teams will learn new ways of conducting the tasks and integrate them in their routines. Routines are not indivisible wholes and can be separated in interconnecting parts (Stiles, Trevor, Farndale, Morris, Paauwe, Stahl, & Wright, 2015), therefore, improvisation processes can lead teams to adopt different methods that are subsequently verified to be beneficial and can improve parts of established routines. This finding contributes to team improvisation literature by recognising the long term effect of team improvised adaption processes and its important role on improving established routines in ways that only these process could do. Because of its unique characteristics, improvisation processes force teams to adopt solutions that otherwise would not be attempted.

Limitations

This paper represents a step in exploring the complex phenomenon of team improvised adaptation. Although the goal of our study, one limitation of our design is that we obtained information from the personal perspective of the team members that participated in improvisational episodes. This perspective is subjective and vulnerable to the interpretation of the participant. Future research could cross participants' perspectives with different sources of information, particularly direct observation of improvisation occurrences.

A second limitation regards the positive perspective induced in our research. There is a national cultural tendency to consider improvisation as a positive aspect. The majority of our respondents consider that the capacity of teams to improvise as a reaction to a disruption is a virtue, and they focused on the positive facet of improvisation. However, neither adaptation nor improvisation has exclusively positive results. Both can culminate very negatively and even if resulting positively, they might have negative by-products. The case of the sinking of Costa Concordia is an extreme example in which improvisation led to disastrous results (Giustiniano et al., 2016). Scholars could hereafter focus on the dark side of adaptation and improvisation and reveal negative consequences of both processes and how to overcome them.

Conclusion

What teams do when they adapt to changing circumstance has been thoroughly discussed by team adaptation literature. But not so much when the scarcity of time forces the fusion of design and execution. Why teams need to improvise has also been explored by team improvisation scholars. But not if the habitual routines restrain them from improvising. In this paper we present a comprehensive framework of team improvised adaptation, revealing the structural elements of the team adaptation process when there is an extreme time scarcity. We highlight two constitutive tensions on different stage of the process, and unpack how these tensions can be resolved and lead teams to obtain positive outcomes, and to acquire relevant knowledge for future episodes. In practice, we drew a roadmap for teams that operate on dynamic and fast changing environments, in which the occurrence of improvised adaptation situations is one of the few certainties.

CHAPTER 7.

CONCLUSION

More than ever before, organizations perform in dynamic and unpredictable environments, often subject to contexts of extreme time scarcity. Although not new, such settings become more frequent and more dispersed across industries, as the velocity of information propagation accelerates with the emergence of new and more sophisticated means of communication. If organizations want to maintain high levels of competitiveness, they must not only cope with this new reality, but exploit it in their favour. To do so, organizations must rapidly adapt to changing circumstances in order to preserve or increase performance, and, if necessary, they must be able to develop the new plan as they implement it, i.e., they must be able to improvise. Considering that teams are the fundamental organizational structures (Kozlowski & Bell, 2013), most of this responsibility falls within their territory.

The ability of teams to adapt depends on diverse individual capabilities and also on abilities expressed by the team itself. Member characteristics such as task expertise, learning orientation or openness to experience have been seen to positively contribute to a team's capacity to adapt. Also team characteristics such as collective efficacy or team mental models have been observed to promote adaptation. However, in order to be effective in situations requiring adaptation, teams must adequately assess the situation, formulate a new plan, execute it, and then go over what happened so they can learn from it and inform future performance and future adaptive circumstances. Meanwhile, they develop a number of emergent states that facilitate effective engagement in different phases and different team processes.

Although sound, the study of adaptation has neglected a fundamental temporal dimension: the timing of the trigger that gives rise to the need for adaptation, and the respective time available to execute the new solution, which copes with the emergent disruption. To have time, even a few minutes, to develop a new strategy and then execute it, is fundamentally different than to merge design and execution and develop the new strategy while simultaneously acting. To ignore this temporal element is to limit the possibility of delving into team adaptation processes in an accurate way, and of truly understanding their nature and the way they unravel over time. The improvisation literature has looked at this phenomenon closely. However, it is still in an early stage of conceptual development and, therefore, it has not yet fully addressed improvisation from a process perspective, focusing more on describing it and on defining thorough taxonomies that address different improvisation types.

This thesis contributes to filling this gap by integrating improvisation and adaptation literatures. We start by conceptually refining both constructs, and then move on to focus on the construct that comprises team adaptation and team improvisation simultaneously – *team improvised adaptation*. We analyse this construct from a time informed perspective, identifying temporal factors that contribute to its effectiveness, bearing in mind three different outcomes: team performance, team improvised adaptive performance, and team improvised adaptation learning. In this chapter we discuss the main contributions of this thesis following a dual tier structure. One tier integrates the theoretical and the qualitative studies, in which we discuss our main theoretical propositions and the conceptual implications depicted from our inductive inference (Table 7.1). Within this tier we aim to establish our field of study, and explain and develop the concept of team improvised adaptation from a process perspective. A second tier is dedicated to the integration of the main empirical findings extracted from the three quantitative studies (Table 7.2). We discuss these findings around the three outcomes analysed.

MAIN THEORETICAL IMPLICATIONS: PROPOSITIONS AND INDUCTIVE INFERENCE FINDINGS

Main theoretical propositions

The main contribution of the theoretical study is the development of the *team improv-adaptation space*. This framework expands the current literature of team adaptation, by integrating a temporal dimension that attributes a different meaning to the process, depending on the time available to its execution. Maynard and colleagues (2015) argue that teams facing disruptive situations focus on particular sets of processes depending on the intensity of the trigger. By distinguishing between preemptive and improvised adaptation, we reveal the constituting nature that time (George & Jones, 2000) has on adaptation processes, which marks in a more determinant manner the processes that ought to be implemented. Moreover, this proposition adds to improvisation theory by acknowledging the impact that the nature of the trigger has on the improvisational process. We expand Cunha et al.'s (2014) taxonomy of *ad-hoc* and *covert* improvisation as purposively triggered, and *provocative* and *managed improvisation* as contingently elicited, by specifying the implication that this dichotomy has on the improvisational process.

Table 7.1. Main theoretical implications explaining the team improvised adaptation process

Source	**Main theoretical implication**
Theoretical propositions	*Study 1* - Development of the team improv-adaptation space composed by three different constructs: team purposive improvisation, team preemptive adaptation, and team improvised adaptation. - Proposal that when teams have temporal personality homogeneity, they are more likely to successfully engage in team improvisation processes and, when they have temporal personality heterogeneity, they more likely successfully engage in team preemptive adaptation processes. - Consideration of shared temporal cognitions as an antecedent of team adaptation processes, either preemptive or improvised. - Development of the temporal flow of the team improv-adaptation space, identifying different transition and action phases, and different contexts, team performance processes, leadership sources, and coordination mechanisms, in each phase of each construct of the framework.
Inductive inference	*Study 5* - There is a deployment tension when teams face an unexpected disruption: between an initial inertia to comply with habitual routines, and the need to immediately address the disruptive situation caused by three improvisational pressures – business pressure, time pressure, and unpredictability. - The deployment tension is resolved by the team's will to accept sub-optimal results. - When teams engage in team improvised adaptation processes they feel a development tension: between the need to develop an initial plan, and the need to start acting immediately. - The development tension is resolved by a member decision to start acting. - There are four fundamental improvised adaptation roles: improvisation leader, coordinator, task specialist, improviser. Some of these roles can be played by the same team member. - There are three fundamental team improvised adaptation enablers: clear and common goals, team cohesion, and communication fluidity. Only with these three enablers can a team effectively adopt improvised adaptation processes. - Three main learning outcomes result from a team reflection and discussion phase after an improvised adaptation process: solutions to prevent future occurrences, solutions to strengthen improvisational performance, and positive improvisation by-products.

Table 7.2. Main empirical findings based on three outcomes of the team improvised adaptation process

Outcome	**Antecedents, mediators and moderators**
Team performance	*Study 2* - When teams face a disruption, the adoption of different types of team adaptation leads to different results concerning team performance. - Teams that share temporal cognitions will increase performance through the adoption of team improvised adaptation processes. - When teams facing unforeseen disruptions adopt learning behaviours, the mediation of team improvised adaptation between shared temporal cognitions and team performance is higher. *Study 3* - When teams conduct improvised adaptation processes, if they reflect between tasks they improve performance. This happens because through reflection, teams improve the similarity of shared mental models. *Study 4* - Future-oriented teams perform well when they have to merge design and execution, but do not learn well, implying that they do not improve performance over time. - Diversified future-orientated teams do not perform the immediate task well, because they spend time reconciling temporal perspectives. - Future-oriented teams increase performance through team improvised adaptation processes, when facing disruptive situations.
Team improvised adaptive performance	*Study 3* - Teams that have similar shared mental models improve improvised adaptive performance. - Teams that reflect while acting improve improvised adaptive performance. - Teams that reflect between task episodes improve improvised adaptive performance from one episode to the next.
Team improvised adaptation learning	*Study 3* - Having similar mental models or reflecting between action episodes, allows teams to learn and, therefore, avoid performance decreases when facing unpredictable disruptions under extreme time pressure. - Similarity of shared mental models allows an implicit form of coordination, working as a substitute for the lack of transitional team reflexivity, an explicit form of coordination. This means that the effect of shared mental model similarity on team improvised adaptation learning becomes less important when teams reflect between tasks, because they are now developing similar mental models. *Study 4* - Future-orientation diversified teams more likely learn from improvised adaptation processes improving performance over time, than less diverse teams. However, because they spend time reconciling temporal perspectives, the immediate performance gets jeopardised. - Teams that are future-oriented do not learn well, implying that they do not improve performance over time.

A second contribution refers to the team temporal personality as antecedent to improvisation and adaptation processes. McGrath (1991) warns that temporal diversity might create coordination barriers. Yet, Bartel and Miliken (2004) argue that this diversity might be positive when teams face situations requiring the conciliation of short-term and long-term perspectives, as in adaptive situations, in which teams must find new ways in the short-run, bearing in mind the long-run team objectives. Building on these perspectives, we proposed that temporal heterogeneity favours team preemptive adaptation processes. However, heterogeneity does not help team improvisational processes. Mohammed and Nadkerni (2011) observed that temporally heterogeneous teams spend time reducing temporal conflicts. This time spent does not allow them to cope with the temporal scarcity implied by improvisation. Additionally, coordination is vital when time is scarce and design and execution merge, because temporal homogeneity facilitates coordination (Bartel & Miliken, 2004), and it also promotes team improvised adaptation processes. These propositions expand the knowledge of antecedents to adaptation and improvisation, and also contribute to the theoretical conversation around temporal heterogeneity and homogeneity in teams. We also add to the debate on the role of shared temporal cognitions in team adaptation (e.g. Santos, Passos, & Uitdewilligen, 2016a) by acknowledging their impact on both adaptation facets of the improv-adaptation space.

Finally, this work develops the temporal flow of the team improv-adaptation space, in which, based on Marks and colleagues' (2001) work, different transition and action phases are identified. Burke and colleagues (2006), and later Rosen et al. (2011), state that when facing disruptive situations that require adaptation, teams must go over a sequence of phases comprising several team performance processes and emergent states. Refining this perspective, this work considers different contexts, team performance processes, leadership sources, and coordination mechanisms, in each phase of each construct of the framework. For example, we claim that the main leadership source in preemptive adaptation processes is formal in each phase of the process; however, improvised adaptation starts with a formal source of leadership in transition phase one, but moves to an emergent or shared source during the action phase, and goes back to a formal leadership source in transition phase 3, when teams reflect on past performance; as for purposive improvisation, we argue that after an initial transition phase in which the main leadership source is formal, teams move to an emergent source during the rest of the improvisational process, due to its subversive character.

Theoretical implication of the inductive inference

The qualitative paper delves into the team improvised adaptation process and describes why and how teams engage in such processes when facing disruptive and time pressing situations. Improvisation is often elicited by unforeseen events that demand immediate action when pre-planned routines fail to cope with the changes (e.g., Hadida et al., 2015). However, for teams to engage in adaptive processes, they must first make a meaningful interpretation of the cue as requiring adaptation (Burke et al., 2006). The authors acknowledge that habitual routines jeopardise a team's ability to make such interpretations. In this vein, our work identifies a *deployment tension* between an inertia linked with the tendency to resort to habitual routines, and a set of improvisational pressures. Particularly, we have uncovered three improvisational pressures: the unpredictable character of the situation that departs from habitual routines; a business pressure related, for example, with the need to satisfy a client's request; and a time pressure derived from a tight schedule to execute the task at hand. By revealing a mechanism by which teams can resolve this tension, this thesis advances knowledge on the understanding of the main reasons why teams engage in improvisation processes when facing disruptions. As proposed by Vera and Crossan (2004), the link between improvisation and performance is ambiguous; therefore, under the uncertainty of success and the need to act, if teams are able to accept sub-optimal results, they will resolve this deployment tension. One of the main reasons for this acceptance is the recognition by the team that doing nothing, or trying to implement old routines, will have a worst result than trying to improvise a new solution, even if they predict poorer results than those of the original plan.

Secondly, this thesis shows how teams dynamically adopt different team performance processes during the action phase of team adaptation, when design and execution merge. This work identifies a second tension that takes place during the action phase, between a static development and a dynamic development – a *development tension*. The diverse phases and respective team processes of preemptive adaptation are sequential (Burke et al., 2006; Rosen et al., 2011). However, the lack of time to plan forces a compaction of these processes. Our findings indicate that although time is scarce, teams need a moment to analyse, plan, and assign tasks. A new tension arises between the need for such a moment and the need to immediately start executing, which is resolved by a team member's decision to initiate action even though the plan is still incipient.

A third relevant contribution relates to improvisation literature, and how this thesis adds knowledge to the way improvised adaptation processes effectively unfold over time. Cunha et al. (1999) acknowledge the role of the leader in team improvisation; Edmondson (2003) argues that unpredictable situations require a particular emphasis on coordination as improvisation progresses; Crossan and Sorrenti (1997) reveal the importance of task expertise on improvisation; and Pavlou and El Sawy (2010) discuss how improvisational capabilities are key to these processes. We add to this discourse by identifying four fundamental roles that must be played by team members while improvising: *improvisation leader*, *coordinator*, *task specialist*, and *improviser*. Each of these roles reflects a key function of the improvised adaptation process and, as stated by Mendonça and Wallace (2007), different roles can be executed by the same team member, who in later episodes might assume another different role.

Researchers have suggested that teamwork skills and real-time communication were determinant for effective improvisation (e.g., Crossan et al., 2005), and also that a common goal would allow improvisation to work (e.g., Crossan 1998). Our findings reveal that all these factors combine to enable effective team improvised adaptation processes. We have observed that cohesive teams, who communicate fluently and frequently during action, and who possess a clear and common goal, possess the necessary pillars that sanction an effective unfolding of adaptation processes under extreme temporal limitations. This thesis contributes to the improvisation literature by combining the different roles and different enablers, which creates an integrated team improvised adaptation framework.

A last important contribution relates to team learning as an outcome of team improvised adaptation processes. Several researchers see adaptation as a state that results from the adaptive process (e.g. Burke et al., 2006; Marques-Quinteiro et al., 2013). As such, adaptation assumes a less ephemeral condition than in improvisation, which might only serve temporary purposes (Moorman & Miner, 1998a), not reflecting any sort of knowledge acquisition. In this sense, the final phase of adaptation is team learning, seen as a process of reflection in which members ask questions, seek feedback, and discuss errors (Edmondson, 1999). However, as Moorman and Miner (1998a) argue, even if triggered by a contingency, improvisation alone does not ensure learning. Aligned with the adaptation literature, this work has revealed that in order to learn from improvisation, teams must reflect and discuss past performance. The research conducted adds to this discussion by revealing three main learning outcomes that are products of this reflective process: *solutions to prevent future occurrences*, *solutions to strengthen improvisational performance*, and *positive* *improvisation by-products*. If teams are able to identify regular sources of unpredictability, this knowledge can help them partially prevent future incidents. Also, with the experience of improvised adaptation episodes, teams can develop mechanisms to improve improvisational capabilities. For example, they can create a backup system that is deployed whenever a disruption requires immediate action. Moreover, some positive by-products can be gained from improvised adaptation. One of the most relevant is the will to integrate new procedures in standard organizational routines. Stiles and colleagues (2015) refer to routines as sets of separated and interconnected parts. As such, improvisation processes can uncover new procedures that might integrate current routines and improve them. This finding adds to team improvisation literature because it reveals long-term consequences that, due to their uniqueness, could only be exposed by improvisational processes.

MAIN EMPIRICAL FINDINGS: ANTECEDENTS, MODERATORS AND MEDIATORS

The main focus of this thesis is on team improvised adaptation processes, particularly on the identification of factors that lead teams to be effective when adopting such processes. To determine whether teams were effective, we decided to analyse three main outcomes: team performance, team improvised adaptive performance, and team improvised adaptation learning. The following sections discuss the main findings relating team improvised adaptation with each of these outcomes. However, a clear definition of our conceptualization of each outcome is first required.

Team performance has been described as one of the facets of team effectiveness, and defined as the extent to which teams meet the quality and quantity standards decided by the beneficiaries of the outcome (Hackman, 1987). This is also our conceptualization of team performance, an absolute value attributed to the result of a team's enactment, and validated by its beneficiaries. In this study we applied subjective and objective measures of team performance. As subjective measures, in study 2, we used Aubé and Rousseau's (2005) scale to evaluate team performance with a focus on team goal achievement, work quality, and productivity. As an objective measure, we used the absolute result of the brick challenge in experiment two, which fed study 4, and partially fed study 3.

Team improvised adaptive performance is conceptualized as a relative outcome, in line with the work of Denrell and March (2001), and LePine et al. (2000). In experiment one in study 3 we define it as the degree to which teams maintain or improve team performance when they have to adopt team improvised adaptation processes, and we measure it as the outcome difference between a task without adaptation and a similar task with adaptation. We compared the result obtained with the result of all other teams to give meaning to the attained outcome.

Team improvised adaptation learning follows Edmondson and colleagues' (2007) learning curve perspective, and is conceptualized as an outcome progression, consisting of improvements in team performance, when time is limited and teams respond to a disruption by planning and executing simultaneously. We measure it in experiment two (studies 3 and 4) through outcome trajectories over the 3 last consecutive tasks of the experiment.

Team performance

It is fairly well accepted by adaptation scholars that teams adapt to maintain or increase performance because they face a disruption that impacts the regular enactment of team processes, jeopardising the likelihood of good performance if some changes are not adopted (e.g., Burke et al., 2006, Maynard et al., 2015). However, some researchers have noted that maladaptation is a possible result of adaptive processes. Also the improvisation literature has been prone to highlight the danger of 'bad' improvisation leading to negative results (e.g., Vera & Crossan, 2005). This thesis contributes to this debate by identifying a number of factors that enhance the likelihood of positive outcomes as a result of improvised adaptation processes.

One first contribution is the discovery of distinct impacts on team performance resulting from the adoption of different types of team adaptation. We have seen that improvisation increases the likelihood of positive outcomes of adaptation processes. This finding opens the door to further investigation on the nature of such different impacts. Since the pressure caused by the scarcity of time drives teams to adopt radical alternatives, further away from current routines (Cunha et al., 1999; Moormon & Miner, 1998), our suggestion is that the differences mostly relate to innovation. Moreover, since the flexibility is an outcome of improvisation (Cunha et al., 1999), the range of possibilities for knowledge development and longer-term benefits is also potentiated by improvised adaptation processes.

One of the main contributions of this thesis is the integration of time within the team literature, following George and Jones (2000) perspective of time as ontological to organization theory. In this vein, we analysed the effects of shared temporal cognitions on team improvised adaptation and team performance. Several scholars have established a positive relationship between shared temporal cognitions and team adaptation (e.g., Randall et al., 2011; Santos et al., 2016a), and also team performance (e.g., Gevers et al., 2006). This thesis goes further by revealing the mediating role of team improvised adaptation between shared temporal cognitions and performance. Teams that share temporal cognitions have the ability to develop temporal synchronization (Bartel & Milliken, 2004), which allow them, for example, to meet deadlines and increase performance (Gevers et al., 2006). Under extreme time limitations, the ability to temporally synchronize promotes the adoption of improvisation processes, leading to increased team performance. However, we did not find this relationship through preemptive adaptation. One explanation might relate with a bad decision to take time to plan when that time was not available; a second reason might be that under preemptive adaptation, teams feel less time pressure, reducing the positive impacts of the implicit coordination that results from sharing temporal cognitions.

When teams operate in dynamic and unpredictable environments, team learning behaviours increase the likelihood of team performance (Edmondson, 1999). For example, as a learning behaviour, reflexivity is key to team performance when teams face new tasks and need to adapt (Schippers et al., 2003). Our results have shown that the adoption of team learning behaviours moderates the relationship between shared temporal cognitions and team improvised adaptation, meaning that teams that share temporal cognitions will more likely improvise if they also adopt learning behaviours, and, hence, increase performance. When designing and implementing a plan simultaneously, asking questions, seeking feedback, and experimenting will increase communication and potentiate coordination, leading to an adequate adaptation and increased performance. This finding was confirmed in study 3 by the observation that teams conducting improvised adaptation processes would increase performance if they reflected between consecutive tasks. Our argument is that this happens because while reflecting, teams improve the similarity of shared mental models, and our results also point to a positive effect of shared mental models similarity on team performance, when teams are engaged in team improvised adaptation processes.

However, the effects of shared mental models similarity on team performance are not free from controversy. For example, Mathieu et al. (2000) did not find these effects; on the other hand, Lim and Klein (2006) claim that intense time pressure nourishes the positive effects of shared mental models similarity on team performance. Our findings unveil boundary conditions for the effect of shared mental model similarity on team performance.

These conditions reflect a situation in which, in order to adapt to a disruption under severe time limitations, teams are forced to plan and execute at the same time. Under such conditions, shared mental models similarity contribute to increased performance.

A second temporal element considered in this thesis to evaluate team performance in situations of improvised adaptation was team temporal personality. We focused our research on temporal perspectives, particularly on future orientation, composed at the team level through elevation and diversity methods. Therefore, we analysed temporal personality elevation and temporal personality diversity. Scholars have asserted that future-orientation elevation improves performance (e.g., Boniwell & Zimbardo, 2004; Shell & Husman, 2001). However, less in known regarding the teams' willingness to act immediately in the pursuit of future goals. In this matter, Taylor and Wilson (2016) argue that future-oriented teams avoid procrastination and, hence, are more available to merge design and execution. Our findings reveal the mediating role that team improvised adaptation has between future-orientation and team performance, which implies that under extreme time constraints future-oriented teams are well equipped to promote immediate change leading to improved performance. On the other hand, our results show that teams with diversified perspectives on future-orientation, find difficulties adapting under tight time schedules. They spend too much time reconciling temporal perspectives (McGrath, 1991) which eventually leads to maladaptation and poor performance.

Team improvised adaptive performance

There is a clear distinction in the literature between team performance before any disruption, and team adaptive performance seen as team performance after a change in the task context (e.g. Maynard et al., 2015; Marques-Quinteiro et al., 2013). However, to look at adaptive performance from this perspective, fails to distinguish performance that is attributed to the team's ability to execute the given task, from performance that is due to the team's adaptability. In order to accurately isolate performance due to adaptability, it is fundamental to compare performance pre- and post-disruption. Contrasting these two types of performance provides a deeper perspective of the nomological network involving these types of performance (LePine et al., 2000). This is the concept of team improvised adaptive performance which is embedded in this thesis and which, by itself, contributes to refining the concept of adaptive performance as a result of a team's capacity to adapt.

Chirstian et al. (2017) propose that implicit coordination promotes adaptive performance. This happens because teams have little time to exert explicit coordination mechanisms and implicit coordination will reduce the time spent coordinating. Our findings corroborate this perspective by showing that shared mental models similarity has a positive effect on team improvised adaptive performance. In fact, having similar mental models allows team members to implicitly coordinate since they all share knowledge regarding relevant aspects of the task.

A second relevant aspect relates to the way teams exert reflexivity when faced with disruptive situations. Two kinds of reflexivity can be considered: transitional reflexivity, which is conducted during transitional phases; and in-action reflexivity, executed during action phases. Our results have shown that transitional reflexivity improves improvised adaptive performance from one task to the next. This finding is in line with previous research (e.g., Schmutz & Eppich, 2017). However, most interesting are the findings regarding in-action reflexivity. Schmutz and Eppich (2017) propose that briefly stopping and reflecting during action risks losing time, but optimizes execution leading to better adaptive results. During action, teams reflect on whether what they are doing is adequate to handle the situation (Konradt et al., 2015). However, all these proposals paid little attention to the timing of the disruptive trigger and to the time available to perform the task. This means that the trade-off between the time spent reflecting during action, and the gains from this reflection, still lacks proper investigation. The findings of this thesis contribute to better understanding the merits of this trade-off, since they indicate that although time is used reflecting, the gains clearly overcome the losses. The results show that when teams are subject to extreme temporal restrictions, adopting in-action reflexivity has positive effects on team improvised adaptive performance.

Team improvised adaptation learning

Improvisation does not always lead to learning (Moorman & Miner, 1998), but teams *can* learn from improvisational processes. As seen earlier, in this thesis we have identified a set of learning outcomes that can derive from improvised adaptation processes. However, it is still relevant to determine the conditions that potentiate learning, i.e., how can teams learn from improvised adaptation processes? Our results reveal that having similar shared mental models improves performance trajectories over time, meaning that teams learn; and the same is true for transitional reflexivity.

However, the interaction between these two factors reveals a noteworthy relationship. Santos and colleagues (2016b) found that implicit forms of coordination may be a substitute for more explicit forms. In fact, our results indicate that similar shared mental models favour implicit forms of coordination, and this works as a substitute for when teams fail to exert transitional reflexivity, which is an explicit form of coordination. This implies that the effect of shared mental model similarity on team improvised adaptation learning becomes less important when teams reflect between tasks. Our suggestion is that when teams reflect between tasks, they are developing shared mental models similarity, which in turn will allow implicit forms of coordination and increase performance over time, i.e. increase learning. Moreover, the results have shown that the lack of either type of coordination mechanism, implicit or explicit, has dramatic results on team learning and performance trajectories.

Improvisation has a paradoxical nature that manifests in diverse ways. As a synthesis between planning and action, but not replacing either, improvisation resolves a paradoxical tension between these two poles of organizational life (Clegg et al., 2002). Also, improvisation relies on creativity and intuition, contrasting with the concepts of control inherent to organizations, leading to a paradoxical situation (Leybourne, 2007). Although diversity regarding team personality has different consequences in different team performance outcomes: for example, diversity creates balance but also generates conflict (Karau & Kelly, 2004), Mohammed and Nadkarni (2011) argue that personality diversity in teams helps in resolving situations that imply the synthesis of paradoxes. Therefore, it is arguable that personality diversity has positive impacts on team improvised adaptation. In fact, our results show that future-orientation diversity promotes team learning when experiencing improvised adaptation processes. The paradoxical tensions that emerge from improvisational processes are synthesized by the different temporal perspectives, in a combination that favours the integration of short-term and long-term objectives. In a similar vein, Eisenhardt (2004) proposes that temporal diversity favours teams that face complex, dynamic, and uncertain environments. But these teams are not free from friction and conflict (Jansen & Kristof-Brown, 2005). In fact, although teams improve performance over time, in part due to their temporal personality diversity, our findings point to more difficulty adopting team improvised adaptation processes and achieving high levels of immediate performance. Mohammed and Nadkarni's (2011) argument that personality diversity helps synthesise paradoxes does not resist the test of extreme time scarcity, and the merging of planning and action.

We have earlier discussed the positive impact of future-orientation on team performance, under the condition of extreme time scarcity. However, we have also observed that future-oriented teams fail to improve performance over time, meaning that they find it difficult to learn from improvised adaptation processes. This can be explained by the aversion that future-oriented individuals have regarding novelty (Zimbardo & Boyd, 1999), which might lead them to go back to the original routine, once the disruptive situation is handled. This thesis contributes to reconciling opposing perspectives about the effects of temporal personality diversity and temporal personality elevation, by identifying boundary conditions for these effects, based on the timing of the disruptive trigger and respective scarcity of time.

METHODOLOGICAL CONTRIBUTIONS

This thesis utilized a diversified set of methodologies that complemented each other, providing a unique approach to the analysis of the construct of team improvised adaptation, and the way it unravels over time. Particularly, three main methodological contributions can be extracted from our work: the development of two experimental studies that materialized team improvised adaptation situations; the manipulations of shared mental models similarity; and the overall combination and articulation of theoretical development, grounded theory, experimental methods, longitudinal designs, and crossectional studies.

For studies 3 and 4 two different experiments were utilized that were purposely developed for this thesis, and are based on brick building tasks, which is adequate for the sort of experiment intended (e.g. Daniels, Neale, & Greer, 2017). Experiment one consists of two sets of two exercises, comprising a non-adaptation control exercise, and a similar exercise requiring improvised adaptation. With this design we were able to measure team performance and team improvised adaptive performance. For this experiment we manipulated shared mental models similarity and team in-action reflexivity. We also utilized a set of psychometric instruments before the start of the experiment. The main contribution of this experiment is the fact that it can be used to study team improvised adaptation in experimental settings, utilizing diverse manipulated variables, as well as other constructs adopting diverse measurement methods. Experiment two has the same basic design of experiment one, however it was intended to measure not only team performance and team improvised adaptive performance, but also team improvised adaptation learning, from a performance curve perspective. To this end, we developed an experiment with a longitudinal design. The experiment consists of one set of 2 tasks and one set of four tasks. As for experiment one, each set has a control task without the need for improvised adaptation, followed by one (in the first set), and three (in the second set) similar tasks that demand improvised adaptation. The first set has the same intent as experiment one, but the second set was developed to allow the measurement of team improvised adaptation learning. The tasks were similar, although the nature of the disruption was changed. Teams had to adapt in each task to a different trigger, either in the team dynamics or in the task itself. With this design, we were able to analyse the evolution of performance over time, under severe time limitations, and in the presence of disruptions that required adaptation. In this experiment we manipulated shared mental models similarity and transitional reflexivity. As for experiment one, also here diverse manipulations can be used, as well as diverse measurement methods for diverse variables. Combined, these two experiments allow a thorough investigation of the team improvised adaptation phenomenon.

Diverse techniques have been used to measure shared mental models, and no consistent methodology has yet been found (Mohammed et al., 2010). The main reason for this lack of consensus is the fact that the construct is heavily context-dependent, and has been studied in a diversified set of environments. DeChurch and Mesmer-Magnus (2010a) identified three main characteristics that allow the measurement of mental models similarity: the elicitation method, structure representation, and representation of emergence. The *elicitation method* is a technique that examines the essential elements of a task, and elicitation is conducted with several methods, such as similarity ratings, concept maps, rating scales, or card sorting tasks (Mohammed, Klimoski, & Rentsch, 2000). The *structure representation* refers to the identification of how the knowledge about a task is organized in the mind of team members. For example, similarity ratings and concept maps can capture this structure. The third characteristic, *representation of emergence*, refers to how individual's mental models are considered as team mental models (Kozlowski & Klein, 2000). This aspect reflects the level of similarity and is often assessed through team level indices, such as Rwg for example, in order to evaluate agreement among the group.

To our knowledge, no published work reports the manipulation of shared mental models for experimental purposes. However, we are acquainted with a work-in-progress that attempts to manipulate shared mental models performed by Santos, Uitdewilligen, Passos, and Marques-Quinteiro (2017), consisting of having team members collectively develope a mind-map around the concept of team performance. To perform experiment one, we developed a simple procedure to manipulate and measure shared mental models similarity. The objective of the procedure is to develop, among team members, a common understanding about relevant aspects of the task (Mohammed et al., 2010). We focused on the particular activities they had to execute and the duration and timing of those activities. The manipulation consists of asking the team to collectively develop a detailed workflow of each task, including their expectations regarding the duration of each sub-task. A set of possible sub-tasks is shown to the team in order to deploy the process, but each team is free to develop new sub-tasks. With this collective work, team members get to share an understanding about significant elements of the task, including its structure and temporal elements. The manipulation check entails asking each team member to individually draw a detailed workflow of the task, including the duration of each sub-task. Then, shared mental models similarity is evaluated according to the resemblance of the different members' workflows. This resemblance is measured with the attribution of ratings by the researchers regarding how similar the workflows are, according to the number of differences regarding the sub-tasks, their order, and the respective durations. The main contributions of this technique are the possibility of manipulating mental models similarity in an amount of time that fits the requirements of most laboratory studies; and allowing the isolation of the effects of shared mental models similarity in a controlled environment.

To conduct this thesis, we performed a number of studies using diverse methodologies: a theoretical model using a proposition-based style; a set of crossectional studies to distinguish and validate two independent constructs, and a measurement instrument for each construct, using exploratory factor analysis, confirmatory factor analysis, and structural equation modelling; two experimental studies in a laboratory setting, purposely developed for the thesis, in one of which we applied a longitudinal design; and a qualitative study based on a grounded theory method to extract theory from a set of fifty semi-structured interviews. The contribution of this methodological approach is the combination of such a diversified set of methods that complement each other to obtain a sounder perspective of the constructs being studied. The theoretical approach allows the conceptual definition of the field of study, opening the door for the elaboration of more specific empirical studies; the quantitative methods allow the testing of causal relationships, contributing to the development of an extended nomological network; and the inductive inference, inherent to the grounded theory methodology, delved into the construct in order to produce an emergent theory that explains how the construct works in a deep connection with the reality depicted in the data.

PRACTICAL IMPLICATIONS

Present-day organizations often operate in unpredictable and unstable environments that demand special features from organizational actors. Some of these features are reported in this thesis, which are pertinent to organizational teams, particularly to their leaders, as determinant elements on the team's ability to perform at optimal levels, mostly when teams are subject to severe temporal limitations. Furthermore, this thesis offers contributions to human resources managers, and to the respective development of human resources practices, aiming to train and develop organizational teams, and prepare them to face unpredictability and speed of change. An overarching practical implication of this thesis is that in order to thrive in such environments, teams must master the process of improvised adaptation. To do so, this work offers a set of contributions that can be divided into three main elements: team composition, team training and development, and team practices.

Team composition is the combination of member attributes in a team, having a powerful influence on team processes and outcomes (Kozlowski & bell, 2013). Two important dimensions for team composition are individuals and team characteristics such as size, demographics, abilities and skills, and personalities; and a second dimension relates to the way these characteristics are distributed within the team, elevation and dispersion being two frequently analysed configurations (Moreland & Levine, 1992). Operating in mutable and fast environments requires future-oriented teams. These teams will more easily engage in improvised adaptation processes, and it is more likely that they achieve better results. However, some temporal personality diversity must be added to the team to increase its capacity to learn from improvised adaptation episodes and improve performance over time. Teams that are diversified in future-orientation, tend to learn more and improve performance from one episode to the next.

Human resource managers might face a dilemma when deciding to compose a team to face dynamic environments since those teams that perform well in such contexts might have difficulties learning from them. The opposite is also true: teams that learn well might not perform as well when subject to improvised adaptation episodes. Nonetheless, several solutions can be implemented. One option is to have a balance between future-orientation and diversity. This solution does not maximise either of the objectives but might reach an adequate level in both. However, the effectiveness of a team to adapt and improvise does not exclusively depend on its temporal personality composition. Improvisation can be trained and developed (Cunha et al., 1999), which means that human resource managers can compose their organizational teams in a diversified way, while ensuring an elevated level of future orientation, and develop training programs to develop teams' capacity to perform under mutable and time stressful situations.

Another important dimension of team composition relates to the different roles that must be played by team members during an improvised adaptation episode. Under such settings, teams need a leader. This leader might be a formal one, but might also emerge among other team members. Often experience and task expertise dictate the emergence of an informal leader in improvised adaptation situations. Because time scarcity increases the difficulty of the task and contexts are changed, teams need someone that dominates all technical variables of the task. This element will allow a faster adaptation to the limitations of the new situation. But to thrive, teams also need the improviser: a dynamic person, not risk averse, creative and tending to act intuitively, resourcefully, and that frequently finds original ways to sort out problems. However, the semi-chaotic nature of the event requires coordination, which must be ensured by someone in the team, the coordinator, who is able to keep calm under stress, keep the end-game in mind, and communicate with other team members. These four roles must be played, but some team members can play several roles. When composing a team, managers must consider these roles and choose individuals that can perform them.

One of the learning outcomes of team improvised adaptation processes is the development of solutions to strengthen improvisational performance. *Team training* programs can be developed to simulate real situations that demand this sort of processes. These simulations will get team members acquainted with improvisation and adaptation practices, but will also help them develop a common understanding of the temporal aspects of a given task, which is key to ensuring an effective deployment of improvised adaptation processes. Simulation-based training improves declarative knowledge, planning, task coordination, collaborative problem solving, and communication in novel task environments (Aguinis & Kraiger, 2009). However, in order to train teams for unpredictable situations, a traditional approach must be avoided. According to Aguinis and Kraiger (2009), traditional training designs prepare teams to avoid errors; in contrast, improvised adaptation training must focus on managing errors, encouraging trainees to reflect on those errors, understand them, and devise ways to predict them in the future. When teams face unpredictable situations and do not have time to prepare a full plan, they will make mistakes. Training must allow team members to immediately identify those mistakes, identify the depth of their impact, decide on whether the mistake must be corrected, and if so, devise new approaches to correct the mistake. Only an extended exposure to such situations can truly prepare a team to handle errors. Therefore, the training program must be designed to induce errors and allow team members to manage them. One element is key, whether in a real situation or in training – psychological safety (Edmondson, 1999). For a team to collectively identify errors, team members must feel safe to point out those errors, no matter who provokes them. It is a team leader's responsibility to develop this dimension in training settings and transfer it to real situations.

Team members can also improve the similarity of mental models by collectively examining relevant aspects of the task. For example, teams can identify sub-tasks, their sequence, their interdependencies, what is fundamental and what is only ornamental, to define clear deadlines and the duration of each sub-task. By doing so, teams will develop similar mental models, thereby creating the conditions to rapidly produce new solutions when contextual changes so dictate. Blickensderfer, Cannon-Bowers and Salas (1997) propose *team self-correction training* to develop team mental models. This technique involves four stages: event review, error identification, feedback exchange, and planning for the future. Given the specific unique nature of improvised adaptation situations, the combination of team self-correction training with simulation-based training optimises the intended results of both methods. As such, teams should adopt the four stages of self-correction training after each simulation-based training session. Team members should go over what happened during the training session; identify the errors, their sources, and possible ways to predict and avoid them; collectively discuss how each team member performed and how the team performed as a whole; and devise future training sessions based on the learnings from the previous session. Just like teams, training programs must not be monolithic structures but adaptive ones. Each session must be informed by the results of the discussion about the previous session.

My experience as a sportsman informs me that it is common for sports teams to adopt such methods, with excellent results. However, over my experience as a manager throughout the last twenty years, I have rarely seen the application of similar techniques in business settings. From what I have seen, often the explanation of this gap relies not on the evaluation of its utility by managers and organizations, but more on the frenetic pace of modern business environments, which relegates to a secondary position management practices that are not directly related to performance achievement. However, if organizations want to perform at high levels under extreme time scarcity and unpredictability, they must change the way they look at training.

Finally, to cope with unpredictability and change, a set of *team practices* must be implemented. First of all, team leaders can promote performance improvement by encouraging team members to adopt explicit team learning behaviours. Guided team reflexivity and feedback (Konradt et al., 2015) are some of these behaviours. When teams adopt learning behaviours, they develop shared temporal cognitions, promoting the likelihood of engagement in improvised adaptation processes, leading to higher performance. Team reflexivity is one learning behaviour that is particularly effective. Collectively reflecting between tasks is a successful way to analyse past improvised adaptation episodes, and explore alternatives to adapt and improvise in future unpredictable circumstances.

Unfortunately, the dynamic of modern business environments limits the time available to reflect and, often, organizational teams do not employ transitional reflexivity, moving from action episode to action episode without reflecting on the previous experience. Team leaders should pay particular attention to this matter since the success of future situations is strongly dependent on the team's capacity to learn from previous experiences. However, teams can reduce the impact of this time limitation by promoting the development of shared mental models similarity. Reflexivity is not the only factor that contributes to this development. Tenure and experience of team members are important elements in the development of shared mental models, and planning and guided leadership can also make a strong contribution (Mohammed et al., 2010).

When a team faces a disruption and does not have much time to handle the situation, a tension between the tendency to keep to habitual routines and a pressure to start acting might create a problematic situation for the team. At this stage, it is important that teams are willing to sacrifice the original objective and accept sub-optimal results. This acceptance will resolve the tension and allow teams to engage in improvised adaptation processes. However, the scarcity of time might lead them to immediately start acting without spending a brief moment reflecting. This is not recommended since quickly analysing the new situation, defining the firsts steps of a new plan, and initiating the distribution of the first tasks might save valuable time. This procedure will avoid potential major mistakes and increase the likelihood of good performance.

That being said, at a certain point, teams must start acting. Someone in the team must assume the initiating decision, usually the leader (formal or informal). At this stage teams must start looking for external resources and iteratively continue to develop the plan and distribute tasks. To do so, teams must exercise reflexivity during the task. They must evaluate ongoing performance and incrementally explore alternative paths. Three elements will ensure the smoothness of the process, and the team leader has a determinant role ensuring those elements: a clear and common goal that guides action and defines performing boundaries; a high level of team cohesion, since in such situations team members will have to trust each other's actions and adopt a "yes-and" style of operating; and fluid communication guaranteeing effective coordination, so that everyone contributes to the dynamic task distribution, and the dynamic plan development.

LIMITATIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

Taken as a whole, the limitations of this thesis present some differences from the limitations of each study, depicted in the respective chapter. The main reason for these differences relates to the complementarity among some of the studies, which use different methodologies. In this section we highlight these limitations and suggest future directions of research.

The first two studies in this thesis partly aimed at distinguishing different constructs within the team improv-adaptation space. Study 2 in particular empirically validates the two constructs of the team adaptation temporal framework, and examines the different impacts these two constructs have on team performance. Then, the next three studies turn their attention to team improvised adaptation processes, disregarding the other two constructs of the improv-adaptation space. A lot is yet to be studied regarding the different effects that the three processes have on different aspects of team performance. Future research could study different dimensions of team performance such as quality, accuracy, and speed of execution; or focus on other outcomes studied in this thesis, such as team learning, and how do the different processes of the improv-adaptation space contribute to the amplification of the knowledge repertoire of teams, both in the short- and in the long-run.

A second limitation of the thesis is the use of cross-sectional self-report data in study 2, which might be vulnerable to common method bias. However, we considered our findings not to be biased for two main reasons: the results extracted from a single source are only biased for very high levels of common method variance, which was not the case (Fuller et al., 2016); and the results of the Harman's single-factor test advocate for the integrity of the results. Moreover, this study analyses the effects of shared temporal cognitions and team learning behaviours on team improvised adaption and on team performance; and study 3 uses close constructs – shared mental models, team reflexivity, and team improvised adaptive performance – revealing results that are in line with the results of study 2, and uses objective measures that fully avoid common method bias.

Part of this thesis focuses on the effect of team learning behaviours on the effectiveness of team improvised adaptation processes. However, we did not delve into the operationalization of such behaviours, except to isolate the effects of team reflexivity during task execution and between tasks. Although team reflexivity can be considered a learning behaviour, it is not the only one. We have referred to guided team reflexivity and feedback as other learning behaviours. Future studies could analyse whether the adoption of such learning behaviours would affect a team's ability to effectively conduct team improvised adaptation processes and achieve high levels of performance. For example, team improvised adaptation training can be conducted with simulation-based sessions, consisting of trial and error activities; by having leaders challenge the team's habits and established routines (Barret, 1998); or through information provision and guidance (Kozlowski et al., 2001). Nothing is said in this thesis regarding the effect of different methods of training on the team's capacity to engage in effective improvised adaptation situations. It is a subject that deserves future research since it might help human resource managers devise adequate training programs to prepare their teams for unpredictable and time pressing contexts.

This thesis also explores the role of in-action and transitional reflexivity on team adaptive improvisation processes. However, the combined role of these two variables has never been investigated, because they have never been manipulated in the same experiment. Early research has seen that transitional reflexivity improves performance in future episodes, and in-action reflexivity has a positive impact on a team's ability to adapt (Konradt et al., 2015). How these two variables interact remains to be seen. Do in-action and transitional reflexivity interact to promote improvised adaptation? Does one substitute the other? Researchers should pay some attention to these questions in future research.

Although we adopted a longitudinal design to study the performance trajectory of teams and investigate their learning curve over time, this thesis uses short intervals between tasks. Larger periods of time between performance events could be utilized in future research, so teams have more time to absorb the learnings from previous episodes. Moreover, this thesis used a laboratory setting to conduct this analysis. There are advantages to the use of such settings, but future research should be conducted in real organizational scenarios to test this thesis' findings, which will increase the trustworthiness of the results.

Finally, as we referred to in study 2, teams are part of a larger organizational setting, in articulation with other organizational teams. This thesis has focused on single teams. However, a whole line of investigation has focused on multi-team systems, as teams of teams (e.g., De Vries, Hollenbeck, Davison, Walter, & Van Der Vegt, 2016; Marks, DeChurch, Mathieu, Panzer, & Alonso, 2005). When teams conduct improvised adaptation processes, they are changing other teams' contexts. Additionally, often organizations accommodate teams that rely on their ability to adapt, such as new product development teams (Akgün et al., 2007), and also teams that need to adopt these processes less frequently. How do these teams interact within the same organization when they face such different contexts? Future research should address these relationships and try to understand how team improvised adaptation processes impact other teams in the organization.

CONCLUDING REMARK

More than ever, organizational teams operate in turbulent, fast changing, and unpredictable environments. Their ability to adopt improvised adaptation processes marks their effectiveness when performing in such dynamic contexts. Teams must be prepared to handle time scarcity, business pressure, and unpredictability; they must be able to plan and execute simultaneously; but most importantly, teams have to take time to reflect and learn from improvised adaptation episodes. In today's world, everything that a team knows from the past has a limited influence on what is to come. However, we have one certainty regarding the future. As Luís de Camões stated five hundred years ago: the single constant is change.

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APPENDICES

APPENDICES

APPENDIX A – SCALES USED IN STUDY 2

Team adaptation temporal framework

Team preemptive adaptation

1. The team prepares in advance how to overcome obstacle that might emerge during task performance.
2. To deal with contextual changes, team members prepare a response before reacting to those changes.
3. Before performing its work in different contexts, the team develops new ideas on its implementation.
4. The team devises alternative plans in very short time as a way to cope with new task demands.
5. The team discusses, in advance, innovative ways to deal with unexpected events.

Team improvised adaptation

1. The team deals with unanticipated events on the spot.
2. When unexpected problems appear, the team reacts in the moment.
3. When problems occur, the team immediately tries new approaches.
4. The team promptly identifies opportunities for new work processes if an unpredicted situation emerges.
5. Team members think on their feet when they have to respond to contextual changes.

Team learning behaviours

1. We regularly take time to figure out ways to improve our team's work processes.
2. This team tends to handle differences of opinion privately or off-line, rather than addressing them directly as a group.
3. Team members go out and get all the information they possibly can from others—such as customers, or other parts of the organization.
4. This team frequently seeks new information that leads us to make important changes.
5. In this team, someone always makes sure that we stop to reflect on the team's work process.
6. People in this team often speak up to test assumptions about issues under discussion.
7. We invite people from outside the team to present information or have discussions with us.

Shared temporal cognitions

1. In my team we have the same opinions about meeting deadlines.
2. In my team we have similar thoughts about the best way to use our time in our work.
3. In my team we agree on how to allocate the time available.
4. In my team we have similar ideas about the time it takes to perform certain tasks.

Team performance

1. The members of this team attain their assigned performance goals.
2. The members of this team produce quality work.
3. This team is productive.

APPENDIX B – SCALES USED IN STUDY 4

Team improvised adaptation

1. The team deals with unanticipated events on the spot.
2. When unexpected problems appear, the team reacts in the moment.
3. When problems occur, the team immediately tries new approaches.
4. The team promptly identifies opportunities for new work processes if an unpredicted situation emerges.
5. Team members think on their feet when they have to respond to contextual changes.

Team temporal personality – temporal perspective

Present-orientation

1. I believe that getting together with one's friends to party is one of life's important pleasures.
2. When listening to my favourite music, I often lose all track of time.
3. Ideally, I would live each day as if it were my last.
4. I make decisions on the spur of the moment.
5. It is important to put excitement in my life.
6. I feel that it's more important to enjoy what you're doing than to get work done on time.
7. It is more important for me to enjoy life's journey than to focus only on the destination.
8. I take risks to put excitement in my life.
9. I often follow my heart more than my head.
10. I prefer friends who are spontaneous rather than predictable.

Future-orientation

1. I believe a person's day should be planned ahead each morning.
2. If things don't get done on time, I don't worry about it. (reverse-worded)
3. When I want to achieve something, I set goals and consider specific means for reaching those goals.
4. Meeting tomorrow's deadlines and doing other necessary work comes before tonight's play.
5. I meet my obligations to friends and authorities on time.
6. Before making a decision, I weigh the costs against the benefits.
7. I make lists of things I must do.
8. I am able to resist temptations when I know there is work to be done.
9. I keep working at a difficult, uninteresting task if it will help me get ahead.
10. There will always be time to catch up on my work. (reverse-worded)