

This file was downloaded from BI Brage,
the institutional repository (open access) at BI Norwegian Business School
<http://brage.bibsys.no/bi>

Series of Dissertations 11/2016
BI Norwegian Business School

Prosper Ameh Kwei-Narh

A mid-range theory of monitoring behaviors, shared task mental models, and team performance within dynamic settings

The articles of this dissertation are not available open access, due to copyright matters:

Article 1

Does task mental model accuracy mediate the relation between monitoring progress towards goals and team performance?

Kwei-Narh, P. A., Valaker, S., Hærem, T., & Lervik, J. E.

Article 2

How monitoring behaviors predict team performance: the role of shared task mental model accuracy

Kwei-Narh, P. A., Hærem, T., & Lervik, J. E.

Article 3

Exploring the role of shared task mental model accuracy and similarity on team performance

Kwei-Narh, P. A.

A complete version of the dissertation (print copy) may be ordered from BI's website:

<http://www.bi.edu/research/Research-Publications>

**A MID-RANGE THEORY OF MONITORING
BEHAVIORS, SHARED TASK MENTAL MODELS, AND
TEAM PERFORMANCE WITHIN DYNAMIC SETTINGS**

by

Prosper Ameh Kwei-Narh

A dissertation submitted to BI Norwegian Business School for the degree of PhD

PhD specialization:
Leadership and Organizational Behavior

Series of dissertations 11/2016

BI Norwegian Business School

Prosper Ameh Kwei-Narh

A mid-range theory of monitoring behaviors, shared task mental models, and team performance within dynamic settings

© Kwei-Narh
2016

Series of Dissertations 11/2016

ISBN: 978-82-8247-116-9
ISSN: 1502-2099

BI Norwegian Business School
N-0442 Oslo
Phone: +47 4641 0000
www.bi.no

Printing: Allkopi

A printed copy of the dissertation may be ordered from our website
www.bi.no/en/Research/Research-Publications/

Dedication

I dedicate this work to my parents: Isaac and Augustina Kwei;
and my family: Ashrei, Ewan, and Benedicta.

“The more a mind takes in the more it expands.”

— Seneca, Letters from a Stoic

Acknowledgements

Almost eight of the years I have been living in Norway have been spent within the confines of the BI Norwegian Business School. BI has taken care of me as a Master's student and thereafter as a PhD candidate and I will never tire of entering the doors of BI. My gratitude to the leadership and staff of the Department of Leadership and Organizational Behavior for all their support and for facilitating an environment for great scholarship and personal development. The PhD process has—more than anything else—crystallized the realization that I cannot do anything alone, and I am grateful for all the assistance I received along the way from distinguished scholars. Most especially, my two supervisors, Dr. Jon Erland Lervik and Dr. Thorvald Hærem; my good friend and mentor Prof. Jan Ketil Arnulf; and Emeritus Prof. Geir Kaufmann for reading through various drafts of my work and providing feedback. My supervisors have stuck with me throughout the process, and I am grateful for the countless pieces of scholarly advice and for the number of times they neglected their families to read my abstract thoughts. Not only these mentors, but when I was at my wits' end, I received encouragement from people whose look and words tell me they think the world of me; thank you, Profs., Astrid Richardsen, Laura Traavik, Lars Glasø, and Øyvind Kvalnes.

My vision of the Department is shaped partly by the amazing office mates I had at different points in time; Sut I Wong, Ingvild, Gordana, Christian, Jo, and Keryn. You folks are amazing and I am grateful for the opportunity to sit with you. When I get out of the office, I run into remarkable colleagues who have always given me a sense of what it means to share in this environment. The phd cohorts 2011–2015, and especially to those who helped me climb the rope at the beginning— Kine, Dominique, Liz, Mirha, Sigmund, and Mathias—God bless you. I have a group of mates who have provided me with an outlet for truly useful discussions and I am grateful for all the good memories of you; Bisrat, Beniamino, Morten, Olga, Steffania, Sumaya, Lene, and Betina. Chris Farstad and Per Magnus, thanks for all the number of innovative ways we can use statistical models!

Due to space limitations, I am unable to list all friends and acquaintances who have influenced me in some way, but Ronny Scherer, what a man! Rarely do I meet someone as knowledgeable and humble as you are, and I am grateful for all the time you spent answering my questions. I am grateful to my football teammates at BI and at Ellingsrud, for the pleasure to enjoy a true love. I am indebted to friends I made along the way at all educational institutions I attended; back home in Ghana, as well as in Trondheim, Oslo, and within my Church for their support and care. By inviting you to witness this dissertation defence, may you accept it as my way of saying thank you for being part of the journey.

In order to pursue formal education I was separated from my family at a very early age but now is the fruition of all the years of sacrifice made by Isaac and Augustina Kwei. My Dad, Isaac N. Kwei, could not witness this day but I know how much my earlier achievements meant

to him. Thank you Dad, for teaching me all the lessons in character, perseverance, and courage. I am grateful to my Mum, Augustina, for all the things that make a mother special to her children. My older siblings; Gloria and Christie, thanks for the number of times you took care of your independent-minded little brother. Philo, I am so proud to watch you become a mature, goal oriented lady. Rest in peace, Amos! Mr Kofi Kwei and Mrs Victoria Kwei, I will forever be grateful that you have been such a stable presence in my life. Thanks for always being there!

Final and monumental thanks to my faithful and buoyant cheerleaders, my family! Throughout my PhD, my family has suffered the most. Especially in these final years as I strove to hand in the dissertation, my children, Ewan and Ashrei, became so used to me being absent that they are more surprised at seeing me arrive early at home. I promise that from the day these words are printed, Dad will be available for quality time together. I know I have an amazing and selfless wife, but this PhD process had given me a confirmation like no other. Thank you, my sweetheart, Bene.

When all is said and done, I am grateful for my faith in my Lord and Savior Jesus Christ, in whom my soul has found rest.

List of articles

- Article 1** **Does task mental model accuracy mediate the relation between monitoring progress towards goals and team performance?**
Kwei-Narh, P. A., Valaker, S., Hærem, T., & Lervik, J. E.
Paper presented at the 2016 Academy of Management Conference, California
- Article 2** **How monitoring behaviors predict team performance: the role of shared task mental model accuracy**
Kwei-Narh, P. A., Hærem, T., & Lervik, J. E.
*Paper presented at the 2016 British Academy of Management Conference
Newcastle*
- Article 3** **Exploring the role of shared task mental model accuracy and similarity on team performance**
Kwei-Narh, P. A.
*Earlier version presented at the 2016 British Academy of Management
Conference, Newcastle*

Summary

This dissertation is an enterprise in building a mid-range theory of teamwork within emergency settings wherein I attempt to explain some contrasting findings in the literature. I focus on a limited number of variables in order to provide a more detailed account that will enrich our understanding of teamwork within these dynamic settings. Specifically, I examined how monitoring behaviors predicts team performance through its effect on shared task mental model accuracy. Whereas there is a general theoretical agreement that monitoring behaviors should predict team performance, the empirical record paints a picture where monitoring behaviors has both a positive and a negative effect on team performance.

To build a mid-range theory that explains the positive relation between monitoring behaviors and team performance, I suggested and evaluated the mediating role of shared task mental model accuracy—the cognitive structure reflecting the extent to which teammates possess an overlapping task relevant knowledge that is accurate according to defined criteria. The argument is that monitoring behaviors should enhance shared task mental model accuracy, based on mechanisms of information elaboration, the connectionist network of knowledge, and the priming of knowledge content through communication. These objectives were implemented in the design of the first two studies; Article 1 examined the indirect relation of teammates' voluntary monitoring behaviors on team performance, and Article 2 introduced a manipulation of monitoring behaviors. Using an emergency response simulation game as the context for the study, two independent data collection activities serve as the source for testing hypotheses related to these studies.

The first study focused only on the progress monitoring aspect of monitoring behaviors, where, similar to some previous studies, progress monitoring did not exhibit a significant direct positive effect on team performance. However, it demonstrated a significant indirect effect on team performance through shared task mental model accuracy. Subsequently, I argued that monitoring behaviors—involving progress and team monitoring—will demonstrate differential effect on team performance because of this particular relation with shared task mental model accuracy. Therefore, I manipulated monitoring behaviors in order to understand the effect on team performance through shared task mental model accuracy (Article 2). This study tested two mediation models; one focused on a cross level mediation relation where individual monitoring behaviors improved shared task mental model accuracy and thus predicting team performance. The other model tested was that in which individual monitoring behaviors enhances the individual task mental model and thus predicting the performance scores, while simultaneously testing the relation among the variables at the team level. Results indicated that in the cross-level model, only team monitoring was marginally significant, while in the latter model, both progress and team monitoring demonstrated a significant indirect effect with performance through shared task mental model accuracy; thus capturing the effect within teams rather than across all teams. Our results also indicated significant cross level effect from individual progress monitoring to team performance.

The third study considers the role of shared task mental models accuracy and similarity in predicting team performance. Shared task mental model similarity reflects the extent to which team members possess a similar cognitive representation for organizing and understanding phenomena. Whereas researchers unanimously recognize shared task mental model accuracy as important predictor of team performance, research has questioned the role of shared task mental model similarity on team performance. I examined both the conceptual and measurement differences between these two properties of shared task mental models and how they can complement each other in predicting team performance within dynamic settings. This is because in dynamic settings both the task strategies and external requirements are constantly changing such that team performance is aided when teammates have both shared task mental model accuracy about their task strategies and do agree on where they should direct their focus. With respect to measurement, I proposed that a similar quality criteria - subject matter expert, as used for assessing shared task mental model accuracy - could be used in assessing shared task mental model similarity.

Through the design and conduct of these three studies, the dissertation contributes to a mid-range theory of how engagement in monitoring behaviors contributes to team performance outcomes. Firstly, the dissertation contributes to our understanding of the stable positive effect between monitoring behaviors and team performance outcomes by indicating the mediating role of shared task mental model accuracy. This dissertation extends this conceptualizing in that the experimental manipulation of monitoring behaviors revealed that the mediation relation at the team level varies according to whether it is team monitoring or progress monitoring. The findings with regard to shared task mental model accuracy and similarity suggest that within dynamic situations, shared task mental model similarity and accuracy complements each other in predicting team performance. Additionally, the third study serves to indicate areas for improving current measurement approaches for shared task mental model similarity.

Table of contents

Acknowledgements.....	V
List of articles	VII
Summary.....	IX
CHAPTER 1	1
INTRODUCTION AND PURPOSE.....	1
THEORETICAL FRAMEWORK.....	4
RESEARCH QUESTIONS	15
RESEARCH SETTING AND DESIGN.....	15
UNIT AND LEVEL OF ANALYSIS.....	19
CHAPTER 2	25
DOES SHARED TASK MENTAL MODEL ACCURACY MEDIATE THE RELATION BETWEEN MONITORING PROGRESS TOWARDS GOALS AND TEAM PERFORMANCE?	27
ABSTRACT.....	29
THEORY.....	31
METHOD	35
RESULTS.....	40
DISCUSSION	45
REFERENCE.....	48
APPENDICES.....	53
CHAPTER 3	59
HOW MONITORING BEHAVIORS PREDICT TEAM PERFORMANCE: THE ROLE OF SHARED TASK MENTAL MODEL ACCURACY	61
ABSTRACT.....	62
THEORY.....	64
METHOD	71
RESULTS.....	76
DISCUSSION	84
REFERENCE.....	89
APPENDICES.....	96
CHAPTER 4	101
THE ROLE OF SHARED TASK MENTAL MODEL ACCURACY AND SIMILARITY IN TEAM PERFORMANCE.....	103

ABSTRACT.....	104
THEORY.....	106
METHOD	112
RESULTS.....	116
DISCUSSION	121
REFERENCE	125
APPENDICES.....	129
CHAPTER 5	134
MAIN FINDINGS AND THEORETICAL CONTRIBUTIONS	134
EXPLAINING THE RELATION BETWEEN MONITORING BEHAVIORS AND TEAM PERFORMANCE; THE ROLE OF STMM ACCURACY	136
EXPLAINING THE RELATION BETWEEN STMM SIMILARITY AND TEAM PERFORMANCE.....	139
GENERAL DISCUSSION	140
LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH.....	141
PRACTICAL IMPLICATIONS	144
CONCLUSION.....	145
REFERENCE.....	147

Chapter 1

Introduction and Purpose

Currently, the organization that does not make use of teams is a rarity. Teams, the group of two or more people who interact cooperatively and adaptively in the pursuit of shared goals (Cannon-Bowers, Salas, & Converse, 1993) can be found at all levels of the organizational hierarchy (Tannenbaum, Mathieu, Salas, & Cohen, 2012), and performing all sorts of tasks (Huczynski & Buchanan, 2013). Teamwork is necessary to improve the quality of task performance (Wuchty, Jones, & Uzzi, 2007) especially in complex environments (Salas, Cooke, & Rosen, 2008) where agile response depends on team members ability to effectively integrate their behavioral and cognitive abilities. Therefore, teamwork models have emphasized how team processes—how teams integrate their behavioral and cognitive abilities—enable team outcomes (Mathieu, Maynard, Rapp, & Gilson, 2008).

Team processes are team members’ “interdependent acts that converts inputs to outcomes through cognitive, verbal, and behavioral acts directed toward organizing taskwork to achieve collective goals” (Marks, Mathieu, & Zaccaro, 2001, p. 357). Examples of team processes are team communication, team leadership, and monitoring behaviors (Marks et al., 2001; Salas, Sims, & Burke, 2005). These team processes are the medium through which team inputs such as personality, cognitive ability, demographic, and cognitive diversity influence team outcomes (Mathieu, Tannenbaum, Donsbach, & Alliger, 2014). Team outcomes—in this dissertation—considers the joint contribution of team members to achieve task performance (Salas et al., 2008).

All the grand models of teamwork - such as the input-process-output (Hackman, 1987), input-mediator-output-input (Ilgen, Hollenbeck, Johnson, & Jundt, 2005), and the temporal framework of teams (Marks et al., 2001) - recognize that team processes are important to team outcomes. However, teamwork often conjures up unexpected negative outcomes (Hackman, 2009) most likely because team process variables relate to emergent team phenomena in different ways (Kozlowski & Chao, 2012; Kozlowski & Ilgen, 2006). Emergent phenomena; for instance, shared mental models, 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). For instance, team communication may positively influence team performance outcomes if it enables better knowledge elaboration through which the team develops accurate shared mental models (Mesmer-Magnus & DeChurch, 2009). In this case, relying on grand theories, according to Weingart and Cronin (2012), is not enough to explain the myriad complex variables during teamwork - such as cases in which team communication does not benefit teamwork (Patrashkova-Volzdoska, McComb, Green, &

Compton, 2003). Weingart and Cronin (2012) argue that mid-range theories that use fewer concepts and variables to explain only a subset of team phenomena will contribute to our understanding of the sometimes perplexing relation between team processes and team outcomes.

This dissertation aims to build a mid-range theory of task-focused teamwork within a dynamic action team setting, such as in emergency team operations. Teamwork involves activities that focus on the task and team member's interactions (Wildman et al., 2012), and therefore teamwork have both task and team-related outcomes (Salas, Shuffler, Thayer, Bedwell, & Lazzara, 2015). The task outcomes relate to how team members engage in activities that enable goal achievements, whereas the team-focused interactions serve as the shared behaviors and attitudes through which the goals are achieved. Although task and team-member member outcomes are not mutually exclusive categories, a disproportionate amount of emergency team's interactions focuses on their tasks rather than on team member aspect. Therefore, I consider task performance outcomes as the outcome of interest noting that the team behaviors are the bedrock for achieving the task outcomes (Kozlowski, 2015; Marks et al., 2001; Salas et al., 2015).

An important aspect of teamwork is monitoring behaviors, a team process variable characterized by teammates tracking their task progress, interpreting information for each other, and providing coaching and support where possible (Marks et al., 2001). Theoretically recognized as one of the most important teamwork behaviors (Salas et al., 2005), the empirical record of the relation between monitoring behaviors and team performance is checkered—having both positive (e.g. Marks & Panzer, 2004; Porter et al., 2003) and insignificant or negative effects (e.g. Barnes et al., 2008; Pitariu, 2007) on team performance. Eventually, the question becomes 'how' and 'why' such a relation exists and how a mid-range theory could deepen our understanding of the underlying processes. In building a mid-range theory, I focus exclusively on the relation between monitoring behaviors and team task performance; and on the role of shared task mental models (from now on STMMs) in this relation.

Monitoring behaviors have a predominant cognitive component in that they direct attention and feedback processes among teammates (Porter, Itir Gogus, & Yu, 2010). Therefore, the relation of monitoring behaviors with task performance depends on how monitoring behaviors affect emergent cognitive structures, considered in this dissertation as STMM accuracy. Through the effect of STMM accuracy on the relation between monitoring behaviors and team performance, we can clarify *how* and *why* we observe varying outcomes between monitoring behaviors and team outcomes, specifically task performance outcomes.

To build a mid-range theory of teamwork within action team settings, I designed and implemented three (3) studies in which I simulated teamwork processes of action teams. The advantage of the lab setting is that it enables control and observation of the variables of interest.

Whereas in Studies 1 and 2, I used questionnaires to objectively assess STMM accuracy, in Article 3, I used team members' and subject matter experts' perceptual evaluation to compute STMM similarity. I observed monitoring behaviors as either a voluntary behavior (Article 1) or when it is manipulated through instructions (Article 2). The clearest distinction between Article 1 and 2 was first, that monitoring behavior as a voluntary activity is different from monitoring behavior as a required role behavior (Porter et al., 2003). Therefore, if the findings hold under both voluntary (Article 1) and manipulated (Article 2) conditions, we obtain a better understanding of the relation between monitoring behaviors and team performance. Article 3 is unique from both Article 1 and 2 in that it consider the issue of mental model content (STMM accuracy) and mental model structure (STMM similarity) in performance within dynamic environments.

Through the planned series of studies, I hope to make a theoretical contribution to the understanding of the relation between team process and team performance within dynamic environments (Weingart & Cronin, 2012). I propose that a deeper understanding of the relation between monitoring behaviors and team outcome needs to consider how monitoring behaviors enable the development of STMM. Through further monitoring behaviors, the shared mental models become accurate, which is an important consideration for research in identifying the antecedents of shared mental models (DeChurch & Mesmer-Magnus, 2010a).

Another important theoretical consideration is whether for some team constructs there remains a true distinction in these constructs as being either cognitive, behavioral, or affective (e.g. Ilgen et al., 2005). When we consider team monitoring, for instance, Porter and colleagues (2010) recognized it as infused with both cognitive and behavioral processes. Recent theoretical and empirical work (e.g. Smith-Jentsch, Kraiger, Cannon-Bowers, & Salas, 2009) suggests there is an affective dimension to these behaviors, i.e. team monitoring. Our study can assess whether indeed, these distinctions between team processes—i.e.: cognitive, behavioral, or affective—are still legitimate for some constructs, specifically team monitoring.

The deeper examination of monitoring behaviors within this task setting bodes well for understanding multilevel processes within organizational settings (Kozlowski, 2015; Kozlowski & Klein, 2000). Multilevel theorizing seeks to explain the nature and effect of variables when encountered on the individual, team, or organizational level. Whereas we know variables have varying effects on individual, team, and organizational outcomes, studies that directly model these emergent processes are lacking (Kozlowski, 2015). In most cases, these multilevel processes have been conceptualized as top-down processes, where higher-level processes influence lower level processes (Kozlowski, 2015). The other side of this state of affairs is that bottom-up processes are ignored. Considering that multilevel constructs first develop through lower level interactions, attention to the bottom-up characteristics that give form to higher-level processes will broaden the literature. The conceptualization and measurement strategy that I follow will enable contributions to the multilevel processes of teamwork.

The practical contribution of this dissertation is to the team learning and training literature. Concerning the team learning literature, these studies will locate team learning as stimulated by individual member activities that influence the team's attentional processes and information search. This involves the joint reflection around the common tasks, team objectives, and the opportunity to correct ineffective task routines. In addition, Article 3 will explore the role of STMM similarity to team performance beyond the contribution of shared task mental model accuracy. This should enable diagnosis aimed at developing training interventions to address performance deficiency issues in teams within dynamic settings.

Theoretical Framework

Teamwork, team process, and emergent phenomena within action team setting

Teamwork describes “how tasks and goals are accomplished in a team context” (Salas et al., 2015, p. 600). Teamwork taxonomies suggest three major kinds of teams; these being action teams, decision teams, and project teams (Sundstrom, de Meuse, & Futrell, 1990; Sundstrom, McIntyre, Halfhill, & Richards, 2000). Action teams perform time-sensitive tasks requiring higher levels of coordination among members. Decision-making teams focus on the processing of information in order to make decisions, whereas project teams perform tangible tasks while also making decisions (Sundstrom et al., 2000).

Action teams serve as the locus of the discussion of teamwork in this dissertation for theoretical and empirical reasons. Theoretically, action teams—because of the high coordination required for their teamwork—serve as an ‘extreme case’ for observing the phenomenon of monitoring behavior. The advantage of an extreme case is a clearer observation of the distinct elements of the phenomena of interest (Eisenhardt, 1989). Action teams can more naturally engage in monitoring behaviors because they are often pre-trained on their task and teamwork skills (Ellis, Bell, Ployhart, Hollenbeck, & Ilgen, 2005). Secondly, action teams serve as an arena where cognitive variables and emergent states have exhibited stronger relations with team process (DeChurch & Mesmer-Magnus, 2010a). For these reasons, the studies will have access to an essential behavior that is also relevant to the team context.

Action teams are distinct from other teams because their interactions center on tangible physical elements such as technology and machines (Ellis et al., 2005; Sundstrom et al., 1990), and they perform actions which provide immediate feedback to the team (Burke, Salas, Wilson-Donnelly, & Priest, 2004). They are also often composed of members who are specialized in their functions requiring higher levels of team coordination. The tasks that action teams perform are often highly integrated and members are interdependent (Espevik, Johnsen, & Eid, 2011). Task performance is contained in short sessions (or episodes) and often demands prior training (Ellis et al., 2005). Accordingly, action teams are found in combat missions, expeditions, in sports competitions, and in surgical operations (e.g. Vashdi, Bamberger, & Erez, 2013). The

specific meaning of teams in this dissertation is in reference to action teams, although it is conceivable that some variables broadly apply to all kinds of team.

To accomplish the task objectives, team members engage in interdependent actions through which they influence each other to pursue their shared goals. This is referred to as team process (Levi, 2011; Marks et al., 2001). For instance, team processes such as team communication, team leadership, and mutual monitoring (Salas et al., 2005) act as mechanisms through which team members influence each other and the team to attain its performance goals. It is implied that the nature of the team processes determines the fate of teams (Mathieu et al., 2014). However, the relation between these team processes and team performance outcomes is not always positive.

Originating from individual team members, team communication refers to the “reciprocal process of team members’ sending and receiving information that forms and re-forms a team’s attitudes, behaviors, and cognitions” (Salas et al., 2015, p. 603). Communication is very important for teamwork since it is the means by which unique knowledge is shared within the team (Mesmer-Magnus & DeChurch, 2009). Beyond knowledge, communication is important for building interpersonal trust among team members (Rico, Alcover, Sánchez-Manzanares, & Gil, 2009). In spite of the above, characteristics of the teammate as well as the condition of the task influence whether or not communication will be effective (Salas et al., 2015). For instance, cultural homogeneity is related to patterns of communication in which team members agree more about their tasks yet exhibit higher tensions indicative of psychological safety (Nam, Lyons, Hwang, & Kim, 2009). In other settings, communication may be problematic because the tendency towards selective attention means the information may not be properly processed (Schultz & Vandenbosch, 1998).

Another important team process is team leadership or coaching—behaviors that establish goals and directions for achieving these goals (Salas et al., 2015). Team leadership enables goal achievement through its effect on the cognitive, behavioral and motivational states of the team members (Zaccaro, Rittman, & Marks, 2001). Team leaders can be external non-members although for most work teams, team members share the leadership functions (Nicolaidis et al., 2014). Shared leadership is when the interactive influence processes are voluntarily shared among teammates and this predicts team performance (Nicolaidis et al., 2014) by enhancing individual and team learning (Liu, Hu, Li, Wang, & Lin, 2014). Nevertheless, it seems that not all teammates are willing to be directly responsible for their teamwork in a leadership capacity, as indicated by the literature on empowerment. This literature suggests that empowerment could be negative if there is a mismatch in how much the team members expect to be empowered and leaders’ empowerment practices (Humborstad & Giessner, 2015).

These inconsistent predictions—of the relation between team processes and team outcomes—may result because there is enough complexity in each single team process variable

such that when we combine these team process variables with other variables, the resulting models may contain competing processes or unresolved complexities. To resolve these inconsistencies, empirical work has focused on the effect of moderators in the relation between team processes and team effectiveness outcomes (LePine, Piccolo, Jackson, Mathieu, & Saul, 2008). Beyond the search for moderators, it seems specific mid-range theories can be generated to explain narrow mechanisms of the team process-team effectiveness relation (Weingart & Cronin, 2012). Earlier scholars have led the way in this direction, for instance, Hollenbeck and colleagues opined that “in attempting to develop general theories of small-group behavior, the greatest progress has been made when attention was focused on a subdomain of group or team phenomena” (Hollenbeck et al., 1995, p. 292). This dissertation follows in this direction to suggest that the relation between team processes and team outcomes needs to consider how team processes impacts emergent states, and the influence of these emergent states on the outcome of interest (Kozlowski, 2015; Kozlowski & Ilgen, 2006).

According to Kozlowski and Klein (2000, p. 55), “a phenomenon is emergent when it originates in the cognition, affect, behaviors, or other characteristics of individuals, is amplified by their interactions, and manifests as a higher level, collective phenomenon”. The main characteristics of emergent constructs are novelty, coherence, dynamism, and ostensiveness (Goldstein, 1999). Emergent phenomena are novel since they indicate hitherto unseen properties of the situation, in this case, the team. Secondly, emergent properties are also coherent because they possess a distinct identity even in the system from which they evolve. The third property of emergent phenomena is dynamism, which reflects how interactional patterns in the components of the system create different status or effect of the emergent property. The fourth characteristic is that emergent phenomena are ostensive; which denotes that the form of an emergent phenomenon is only apparent after it has developed. I argue that teamwork gives rise to a distinct emergent construct, which acts as a medium to transfer the effect of team processes on team effectiveness.

Developing a mid-range theory of the relation between monitoring behaviors and team outcomes, the role of STMM accuracy

A theory is a set of “interrelated constructs, concepts, definitions, and propositions that present a systematic view of phenomena by specifying relations among variables, with the purpose of explaining and predicting the phenomena” (Kerlinger, 1986, p. 9). Mid-range theories serve to explain only a subset of the phenomena through a detailed analysis of fewer relations (Weingart & Cronin, 2012). In developing a mid-range theory, I focus on the relation between monitoring behaviors (i.e. team process variable-Marks et al., 2001), team performance (i.e. team outcome variable-Salas et al., 2008) and the influence of STMM (i.e., an emergent state/phenomena-Kozlowski & Chao, 2012). This is because as team members interact with one another when they perform monitoring behaviors; they exchange cues and their individual meaning schemes. Through this mutual exchange activity and interaction, they

can create a dynamic, distinct team property—i.e. STMM accuracy. STMM accuracy will rapidly develop (Allen & O’Neill, 2015) and influence the team outcomes because of the information elaboration stimulated through monitoring behaviors. I propose that the way in which monitoring behaviors relate to STMM accuracy, will explain and predict the expected positive relation between monitoring behaviors and team performance.

Team performance as important outcome of teamwork

Team performance: conceptualization and operationalization

Team performance accrues through teammates’ task and team-oriented behaviors (Salas, Rosen, Burke, & Goodwin, 2009) and captures the objective or subjective judgment of how well a team meets valued objectives (DeChurch & Mesmer-Magnus, 2010a). It is argued that subjective performance will contain more information but risks rater bias rather than objective performance (DeChurch & Mesmer-Magnus, 2010a). The focus here is on objective performance, which is typically “operationalized as task performance, completion, or proficiency” (DeChurch & Mesmer-Magnus, 2010a, p. 38). In simulation studies, this is captured as the simulation score, or the number of targets destroyed (e.g. DeChurch & Mesmer-Magnus, 2010a; Porter et al., 2010).

For some tasks, the sum of the individual team members’ score on a criterion of interest can reflect team performance. For instance, a common task in simulation games is to use the space fortress (e.g. Edwards, Day, Arthur, & Bell, 2006), which simulates a complex and dynamic aviation environment involving the coordination of resources and launching missiles at enemy targets. In this simulation, team performance is the average of the scores from each performance occasion. Another popular team simulation task is the dynamic distributed decision-making task and its modifications (e.g. Barnes et al., 2008; Hollenbeck et al., 2002; Pearsall & Ellis, 2006; Porter et al., 2010) where teams have to prevent enemy objects from reaching restricted areas under their control. Here, team performance is about preventing threatening objects from reaching restricted targets and the accuracy of those decisions.

However, for other tasks, the team performance score reflects a composite of individual and a common score. This explains why Salas and colleagues (2009) view team performance as a multilevel process. The team performance in this sense may have a certain component assigned to all members of the team by virtue of the fact that they are part of the team, as for instance used by Porter and colleagues (2010). The team performance measure as operationalized in this dissertation has a significant group component but still maintains a level of individuals’ unique contribution.

The relation between monitoring behaviors and team performance

Effective teams can foresee a teammate's mistakes and they can correct the teammate by providing verbal feedback (Marks & Panzer, 2004; Salas et al., 2005). Team members can also decide the pacing of their activity by monitoring the progress towards goals (Marks et al., 2001). These behaviors—respectively described as team monitoring and backup as well as monitoring progress towards goals—form the core of monitoring behaviors (Marks et al., 2001). Specifically, team monitoring and backup is defined as “assisting team members to perform their tasks, which may occur by (1) providing a teammate verbal feedback or coaching, (2) assisting a teammate behaviorally in carrying out actions, or (3) assuming and completing a task for a teammate” (Marks et al., 2001, p. 367). Likewise, monitoring progress toward goals “is defined as tracking task and progress toward mission accomplishment, interpreting system information in terms of what needs to be accomplished for goal attainment, and transmitting progress to team members” (Marks et al., 2001, p. 367). The term, ‘monitoring behaviors’, is used to refer simultaneously to both monitoring progress towards goals, and team monitoring and backup behaviors.

Monitoring behaviors apply to all kinds of teams, but to perform monitoring, it is necessary that the teammates have a general idea about the correct procedures to perform a team's task. Action teams are trained prior to actual teamwork (Ellis et al., 2005; Sundstrom et al., 1990), thus, they can readily engage in monitoring behaviors. To illustrate, military search and rescue teams composed of a pilot, a gunner, and a navigator know that during mission performance, while the navigator is observing the screen for visuals the gunner must be ready to lock in a target. The pilot and the navigator can inform the gunner to keep watch over a general area or ensure that the gunner has enough ammunition. They can also engage in helping behaviors in case the gunner is hit by an enemy attack, or the gun is jammed, or take over the activity of another member who may be struggling to perform his/her activities.

Monitoring behaviors are important in helping teammates with their task (e.g. Porter et al., 2003), in ensuring focus on the team's goals (e.g. Marks & Panzer, 2004), and in building an effective rapport among the teammates (e.g. Smith-Jentsch et al., 2009). However, the empirical literature has indicated that monitoring behaviors may not always be beneficial to the team outcomes (e.g. Barnes et al., 2008). This is because teammates who receive help may sometimes reduce their effort and the individual who provides help may neglect their own task or suffer from task overload (Barnes et al., 2008). In other instances where teammates constantly assess each other's task progress—as in monitoring progress towards goals—this might heighten the time sensitivity (Karau & Kelly, 1992; Kelly & Loving, 2004). This might lead to shallow information processing and poorer team outcomes.

Considering that monitoring behaviors are necessary for team effectiveness (Salas et al., 2005) and yet engaging in monitoring behaviors conjures up such contrasting effects, we need to focus on understanding exactly what happens within the team when teammates perform

monitoring behaviors, and how engaging in monitoring behaviors affects both the initiator and the recipient of monitoring. Firstly, I consider that the effect of monitoring behaviors on other variables, such as team performance, should be related to the underlying cognitive and behavioral processes that underpin monitoring behaviors (Ackerman, Kanfer, & Goff, 1995; Porter et al., 2010). The cognitive processes that underpin monitoring behaviors are the opportunity to engage in shared interpretations of the information and to engage in the collective integration of knowledge, eventually facilitating the development of STMM accuracy. Secondly, I consider also how these processes impact the initiator and the recipient of monitoring in order to develop a detailed account of why monitoring behaviors have both positive and negative effect on team outcomes (e.g. Barnes et al., 2008; Pitariu, 2007). When monitoring occurs, the initiator of monitoring behaviors is able to relate their individual knowledge to the collective knowledge whereas the recipient of monitoring behaviors will benefit from the assistance of teammates with a correct understanding of the task. These suggest the indirect effects of cognitive mechanisms—considered here as STMM accuracy—on the relation between monitoring behaviors and team performance outcome.

This proposal is not new since Salas and colleagues (2005) recognized that there could be an intervening variable between monitoring behavior and team effectiveness criteria. Whereas previous studies have examined moderators of that relation (e.g. Porter et al., 2003; Porter et al., 2010), we lack studies that examine the mediating role of variables such as STMM in the relation between monitoring behaviors and team outcomes. Mediational variables explain how an independent variable transmits its effect on a dependent variable (Baron & Kenny, 1986; Mathieu, DeShon, & Bergh, 2008; Mathieu & Taylor, 2006). Theoretically, monitoring behaviors have a cognitive component (Porter et al., 2010) which should directly impact the emergent STMM accuracy—a cognitive structure. Furthermore, STMM accuracy will demonstrate their primary relation with monitoring behaviors because of the generally strong relation between team behavioral processes and team cognition (DeChurch & Mesmer-Magnus, 2010a). In that sense, STMM accuracy will be the means through which monitoring behaviors transmit its effect onto team performance. Before concentrating on the mediating relation, I consider below the general construct of shared mental models and its relation to team outcomes.

Shared mental models; antecedents and implications to team outcomes

Building on work from human-machine interactions—where mental models are necessary to describe, explain, and predict system states (Rouse & Morris, 1986)—Cannon-Bowers and colleagues (1993) extended the concept into the organizational sphere. Shared mental models are, “knowledge structures held by members of a team that enables them to form accurate explanations and expectations for the task, and in turn, to coordinate their actions and adapt their behavior to demands of the task and other team members” (Cannon-Bowers et al., 1993, p. 228). Shared, in this present study, refers to the degree of overlap among the team members (Thompson & Fine, 1999). Cannon-Bowers and colleagues (1993) originally

theorized that mental models within teamwork consisted of four interdependent components; equipment, task, team interaction, and a team model, each component capturing some distinct knowledge content.

The equipment model is organized knowledge that is very technical and relates to the functioning and properties of the job tools (equipment), as well as the operating procedures and the advantages and limitations of the technology (Cannon-Bowers et al., 1993; Klimoski & Mohammed, 1994). This kind of mental model is highly stable since it is objective, often codified, and standardized. The task model deals with knowledge about the ‘what’, ‘how’, and ‘what ifs’ of the task to be performed. It pertains to “task procedures, likely contingencies, likely scenarios, task strategies, and environmental constraints” (Cannon-Bowers et al., 1993). Thirdly, the team interaction model refers to knowledge about the roles/responsibilities within the team, whom to contact for what kind of information, how to conduct roles in the team, and how each role/function is tightly knit with other roles in the performance of team tasks (Cannon-Bowers et al., 1993). Fourthly, ‘team models’ denotes the structured knowledge that team members have of their teammates’ knowledge, skills, abilities, preferences, and tendencies.

Further theoretical developments and empirical assessment made by other researchers have led to a general focus on two main components: shared task and team mental models (Mathieu, Heffner, Goodwin, Cannon-Bowers, & Salas, 2005). In this framework, the shared task mental model is the combination of the equipment/tool and task mental models in the original Cannon-Bowers and colleagues’ framework, whereas the shared team mental model is a combination of the team and team interaction mental models. Mathieu and colleagues (2005; 2000), and Lim and Klein (2006) rationalized reducing the components to two (2), because of the obvious overlaps among the four (4) components. Adopting this convention, I use the general term ‘shared mental models’ to simultaneously reference task and team mental models whereas I will use the specific term, (i.e. shared task/team mental models) in reference to the selected category. However, I will be focusing on shared task mental models (STMMs), which is expected to be the main mediator of the relation between monitoring behaviors and team performance. This is because teamwork within dynamic settings is predominantly focused on task issues, thus, we would expect shared task mental models to form more quickly and to contain more information when the group task is complex and requires a high degree of response coordination (Thompson, Levine, & Messick, 1999).

STMMs when formed are either similar, accurate, or similar and accurate (Cannon-Bowers et al., 1993; Mohammed, Klimoski, & Rentsch, 2000). The mental model similarity suggests an identical structural representation of the mental model across team members (Gross & Kluge, 2012; Mohammed et al., 2000). This informs us that team members perceive a causal, co-occurring, dependent, or contingent linkage in a number of knowledge concepts or constructs (Mohammed et al., 2000). Meanwhile, accuracy reflects the extent to which the mental models are correct (Marks, Zaccaro, & Mathieu, 2000) by relating the mental model to an objective indicator of task performance or of team process evaluation (Lim & Klein, 2006).

Accuracy presupposes the existence of similarity, but not all similar mental models are accurate (Betts & Hinsz, 2013).

In relation to the above similarity and accuracy of mental models, the first question is how does a team develop shared mental models (Mohammed, Ferzandi, & Hamilton, 2010) and what factors affect the mental model similarity or accuracy. Previous studies that examined the antecedents of shared mental models considered factors such as cognitive composition (Edwards et al., 2006), expertise or experience (Thomas-Hunt, Ogden, & Neale, 2003), and training (Cooke et al., 2003; Stout, Cannon-Bowers, Salas, & Milanovich, 1999). The team mental models of team members with high cognitive abilities emerged faster and have a greater influence on team performance than low cognitive ability members (Edwards et al., 2006). This is because cognitive ability enables the team to evaluate and integrate different information. Likewise, team members with more expertise developed better mental models than teams with lower expertise (Thomas-Hunt et al., 2003).

Secondly, the nature of the team interactions can affect the emergence of mental models (Cannon-Bowers et al., 1993; Thompson & Fine, 1999). In terms of interactions, I consider both the ‘what’; i.e. the topic of the interaction, and the ‘who’; the role of the team members in the interaction. ‘What’ teammates talk about has an implication on the emergence of shared mental models because interaction serves as a mechanism for knowledge elaboration and gaining insight (De Dreu, Nijstad, Bechtoldt, & Baas, 2011; Levine & Moreland, 1999; van Knippenberg, De Dreu, & Homan, 2004). The indication is that teammates often focus on commonly known knowledge and may fail to share and build up their unique individual knowledge into shared team knowledge (Gigone & Hastie, 1993; Stasser & Titus, 1985). Thus, if teammates fail to discuss their unique knowledge, they may not engage in the information elaboration mechanisms necessary for shared mental model development.

Extending that discussion, shared mental model will develop when teammates can obtain and devote attention to cues during their interactions. Attention is effortful processing of information and because it is a selective process (Hinsz, Tindale, & Vollrath, 1997), individuals will devote attention to salient aspects of their teammates’ behaviors. This may explain why leaders have an important role in shared mental model development (Dionne, Sayama, Hao, & Bush, 2010). This is because leaders, or active team members, constantly sends out cues that are attended to and processed by team members (Pearsall & Ellis, 2006). This means that teammates who do not engage in behaviors that are more salient do not provide their teammates with enough cues to form the basis of an emergent mental model.

Consider the case where team members have varying characteristics (Harvey, 2015) some of which are easily noticed (such as physical attributes), and some—psychological or background specialization—that must either be inferred or are revealed over the course of time (van Knippenberg & Schippers, 2007). It is more straightforward to perceive salient identities on the first encounter with a teammate and therefore easier to develop accurate mental models.

However, for unobservable identities—such as deep level task preferences, abilities, and skills—accuracy develops over a longer time. Teammates need to interact with one another over multiple occasions and across varying situations in order to form a truly accurate picture of one another (Thompson et al., 1999). Thus to develop mental models within newly formed teams, we need to rely on communication through which cues and quality information necessary for building mental models are present. This is elaborated on the relation between monitoring behavior and shared task mental model and why I relied on the email communication within the team.

Mental models benefit team outcomes depending on what form of mental model similarity or accuracy exists. Similarity indices reflect the underlying assumption teammates possess of the relation between constructs (in this case task-relevant knowledge) using the considerations described by Mohammed and colleagues (2000)—causal, co-occurring, dependent, or contingent. For instance, assume in a three-member team, Member A judges two concepts to be similar because he/she thinks there is a causal relation among the concepts, whereas Member B and C judges the two concepts to be related because they occur together. We may obtain a high mental model similarity index that does not reflect the individual teammates' underlying assumption regarding the relation between the concepts (Healey, Vuori, & Hodgkinson, 2015). In that sense, mental model similarity may differentially influence team outcomes (e.g. Mathieu, Rapp, Maynard, & Mangos, 2009; Sander, van Doorn, van der Pal, & Zijlstra, 2015). Such a dynamism in shared mental model similarity has led Sander and colleagues (2015) to question the importance of shared mental model similarity in predicting team outcomes, for example, adaptation.

Consider the form of mental model accuracy when the functional roles are different. An accurate team mental model in such an instance will reflect teammates' correct information about the functional roles and specializations of teammates, which in turn will affect the nature of interactions that they engage with each other. Thus, the mental model accuracy can be a means of coordination (Rico, Sánchez-Manzanares, Gil, & Gibson, 2008). For instance, a team correctly determines that one team member is able to bring in needed informational and political resources outside the teams' reach. Teammates are most likely to defer to him/her when the team needs access to that particular information. What this creates may be a long list of requests that this focal individual needs to meet, or the team may actually have a devoted channel/specialized courier of task-relevant information. To the extent that this scenario enhances teammates' understanding of one another and their ability to anticipate each other, there will be positive effects on team performance (Cannon-Bowers et al., 1993; Cannon-Bowers, Tannenbaum, Salas, & Volpe, 1995). This discussion above illustrates the context-dependent nature of mental models, and its implications for team outcomes.

An unresolved issue with STMM properties of accuracy and similarity is the extent to which they are truly unique; are they unique because of the elicitation approach (e.g. DeChurch & Mesmer-Magnus, 2010b), or they are unique due to a fundamental difference in the mental

model representation (Rouse & Morris, 1986). It is likely that both situations can be the reason why STMM accuracy and similarity are unique. With respect to the elicitation strategy—that is how we access the mental representation—accuracy is obtained by matching the content of the team member’s mental models with the content of a subject matter expert or an objective criteria. STMM similarity, on the other hand, is obtained as the extent of overlap in the structural representation within the team members. Thus, there may exist an uneven criterion by which we assess shared mental model similarity and accuracy. Another issue—the nature of mental model representation—is that we can only estimate an ‘approximation’ of the content of mental models from our elicitation methods (Rouse & Morris, 1986). The best analogy in this direction is the difference between hook and line fishing and fishing with a net. When we elicit mental models for accuracy, it is akin to a hook and line fishing—we are only aiming for and catching a single fish at a time. On the other hand, when we elicit for similarity, it is like fishing with a net—we are dealing with the whole range of associative knowledge network relevant for the task. Are there instances when we need mutually exclusive mental models—i.e. STMM accuracy or similarity, or instances when we need both (Smith-Jentsch, Campbell, Milanovich, & Reynolds, 2001)?

To some extent, STMM accuracy and similarity actually serve complementary function in settings that are dynamic as to simultaneously require excellent task understanding—STMM accuracy—as well as shared focus on the most relevant elements that can impinge on the task performance—STMM similarity regarding possible scenarios that can affect the task. Consider, for instance, the dynamic operations of action teams in settings such as Air Traffic Control and Emergency Operations. Team members in these settings have unique capabilities and roles (Korb, Geißler, & Strauß, 2015), yet they all have to share similar recognition of elements of their task which can change at any time and which will impact their team performance (Uitdewilligen, Waller, & Pitariu, 2013). In this settings, having both STMM accuracy and similarity is a necessity for the team’s performance.

Nevertheless, it seems the measurement approaches to STMM similarity could be improved in order to ensure STMM similarity is not relegated to insignificance, as authors such as Sander and colleagues (2015) argue. Thus, exploring ways in which measurement approaches to STMM similarity can be streamlined as well as exploring the joint contribution of STMM accuracy and STMM similarity is the specific aim of Article 3.

The relation between monitoring behaviors and STMM accuracy

Engaging in monitoring behaviors is an avenue for intensive discussion and feedback among the team members, thus facilitating information exchange and elaboration (van Knippenberg et al., 2004). Through this information exchange and elaboration, monitoring behaviors should enable teammates to develop mutually shared mental models, which are mental representations about the team task content or the team domain (Fiske & Taylor, 2013).

Although the extant literature has recognized the strong cognitive dimension of monitoring behaviors (e.g. Porter et al., 2010), this knowledge has as yet not been infused into an understanding of how these monitoring behaviors influence STMMs.

The characteristic of monitoring behaviors where teammates engage in either progress or team monitoring should facilitate shared information processing activities through devoting attention and engaging in information elaboration (Fiske & Taylor, 2013; Thompson et al., 1999). In addition, monitoring behaviors contain cues about where teammates should devote attention. Considering the robust effect of priming mechanisms on knowledge structures (Bargh & Chartrand, 2014; Chartrand & Bargh, 1996), this means that monitoring behaviors will enable the priming of relevant knowledge and further elaboration of this knowledge through team discussions.

The information-processing approach to cognition suggests that STMMs emerge through processes of attention, encoding, storage, and retrieval (Fiske & Taylor, 2013; Thompson & Fine, 1999). I suggest that monitoring behaviors will affect all these processes. In attention, we select the important element of the stimulus or internal representation and we devote effort to processing that element (Fiske & Taylor, 2013). Encoding starts when a stimulus is registered, and the stimulus is transformed into a mental representation. Through devoting attention, we can deeply understand the features of the stimulus or internal representation and thus build up a working or long-term memory of that representation. Given the right circumstances or cues, we can easily retrieve these internal representations (Fiske & Taylor, 2013). In addition, the connectionist paradigms (Rogers & McClelland, 2014; Rumelhart & McClelland, 1986) also consider how different mental representations relate to each other and serves as the basis for the ensuing discussion below. The discussion that follows examines how monitoring behaviors will affect STMM accuracy through processes that underpin mental representation and the connection among mental representations.

Firstly, attention is a central mechanism through which STMMs develop. Attention directs the cognitive system to what information to select as well as enabling which information to recollect in various tasks (Lutz & Huitt, 2003). As previously described, through monitoring behaviors teammates direct each other's attention towards the need to pace themselves to achieve goals, and interpret information to decide an important aspect of the team task. All these are elements that enhance attention and improve the content of STMM.

Secondly, monitoring behaviors will enhance STMM accuracy because monitoring behaviors involve information elaboration as teammates interpret information for each other (Levine & Moreland, 1999; Thompson & Fine, 1999; Thompson et al., 1999). As teammates engage in team monitoring, for instance, they exchange information, ask each other questions and engage in reciprocal exchanges that facilitate information elaboration. Information elaboration enables the encoding processes and a development of additional insight about the knowledge storage.

Finally, an unheralded effect of monitoring behaviors is that it is a powerful priming mechanism, which will facilitate the use, recall and elaboration of mental model content. Think of an instance when a discussion with a colleague suddenly provides you with insight into a seemingly unrelated concern. According to the priming hypothesis, external stimuli passively and subtly activate relevant mental representations and we can be oblivious to this activation (Bargh & Ferguson, 2000; Chartrand & Bargh, 1996; Kay, Wheeler, Bargh, & Ross, 2004). The essence is that monitoring behaviors are means by which teammates cue each other, which consciously and unconsciously affect their knowledge representation. STMMs are constantly activated as teammates engage in monitoring behaviors by making the mental representations accessible (Fiske & Taylor, 2013) and this also gives STMMs the dynamism to influence the team outcomes (DeChurch & Mesmer-Magnus, 2010a).

Considering all of these issues, I foresee important contributions in pursuing the research questions outlined below in order to develop a mid-range theory that deepens our understanding of the relation between monitoring behaviors, shared task mental model (STMM) accuracy, and team outcomes. I also consider the complementary role of STMM accuracy and similarity in understanding performance in dynamic settings.

Research questions

In an attempt to address the various gaps outlined in the preceding sections, this dissertation intends to emphasize the following research questions:

- **Article 1:** Does STMM accuracy mediate the relation between progress monitoring and team performance?
- **Article 2:** How does the mediated relation between progress monitoring and team performance differ from the mediated relation between team monitoring and team performance?
- **Article 3:** What is the unique and complementary role of STMM accuracy and similarity to team performance?

Research setting and design

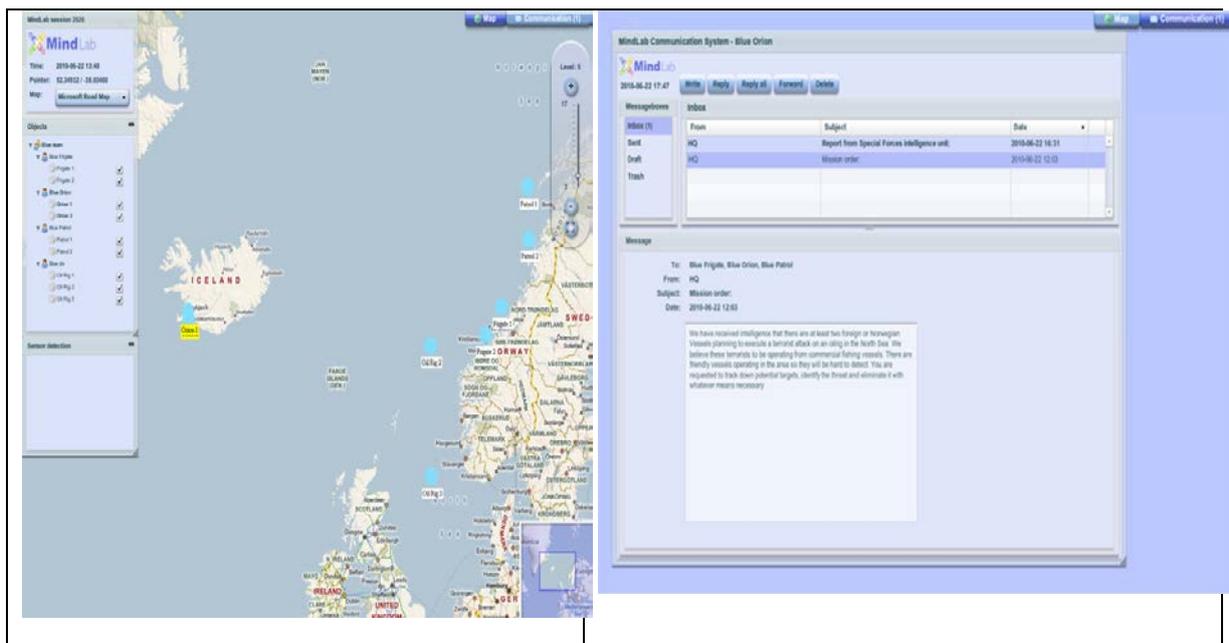
To answer the research questions stated above, the context of the study was emergency teams performing time sensitive operations in a simulated environment. Emergency response teams provide a typical action team context, where task interdependence is high (Brehmer & Dörner, 1993; Sundstrom, 1999), teammates are exposed to the general training that enables them to engage in monitoring behaviors (Ellis et al., 2005), and intra-team communication can

enable the development of shared task mental models within the short period of teamwork (Allen & O'Neill, 2015). The team context in this study is akin to a virtual team since communication via messages was the only means of team interaction. This communication medium enables the researcher to have unobtrusive yet direct access to the dynamic mechanisms during teamwork, thus facilitating the mapping of bottom-up emergent phenomena (Brehmer & Dörner, 1993; Kozlowski, 2015).

The experimental task is a multi-player simulation deployed in real time and online, which in some respects is similar to other simulations deployed for action teams (e.g. Brehmer & Dörner, 1993; Hollenbeck et al., 2002). Essentially the lab consists of two parts: a map and email interface (See Figure 1 below). The map captures the geographic presentation of oil rigs distributed across the coastline of Norway, with various vessels using the high seas for different purposes. Some of these vessels are potential threats to the security of the oil rigs. Specialist teams, located at various strategic locations—Iceland, Bodo, and Stavanger—can carry out missions to ensure the security of the oil rigs. All units of the specialist teams are equipped with radars that allow them to notice objects as they cruise on the seas. However, all specialized units can only perform specific functions (detect an object, conduct information search to assess risk, and attack vessels which are risky). The teams' overall mission is to neutralize potentially threatening vessels. The email function allows for intra-team communication as well as the opportunity for the team to receive information from Intelligence Headquarters. Players can only receive messages from the Headquarters; they cannot send messages to headquarters. Detailed description of the simulation is provided in the articles that follow.

Figure 1

Map and Email Interface



I used variations of a repeated measures design as captured in scenario measurements. In repeated measures design, the intention is to obtain a number of data points on the same individual such that the individual acts as their own control (Sullivan, 2008). Repeated measures also enable us to model phenomena, such as mental models, which emerge over the course of team interactions (DeChurch & Mesmer-Magnus, 2010b). In addition, a repeated measure design within this setting captures the essence of the team interactions as occurring over different episodes with different demands present in each episode (Marks et al., 2001). The challenge to repeated measures design is the possibility of a learning effect (Shadish, Cook, & Campbell, 2002), where the performance of an activity at an earlier point in time influences performance of an activity at a later point in time. To counteract this learning effect, modifications were made on successive scenarios while retaining the main demands of the task.

In Articles 2 and 3, I manipulated progress monitoring by deploying a 2x2 experimental design and I used instructions to manipulate the experimental groups and to sensitize them about engaging in monitoring behaviors. The use of instructions to manipulate desired behaviors is a standard tool in psychological experiments (Oppenheimer, Meyvis, & Davidenko, 2009; Thaler, 1985). Simple words can have strong effects on the behaviors of participants (Thaler, 1985); for instance, to ensure desired behaviors, Oppenheimer and colleagues (2009) suggested that participants are ‘made to read instructions’. The instructions were part of a PowerPoint presentation in the training session after which participants received a printed copy of the instruction to serve as a reminder. I developed the instruction by taking the central element of the definition of monitoring behaviors and phrasing them as a ‘cheat sheet’ for the participants as illustrated below.

An initial pilot test of the design involved four groups (3 experimental and a control group). Of the experimental group, one group exclusively performed ‘Progress Monitoring’, another group exclusively performed ‘Team Monitoring’, and a third group performed both Progress Monitoring and Team Monitoring. The control group did not receive any instruction. An ANOVA indicated that there was main difference between experimental groups who exclusively performed either Progress Monitoring or Team Monitoring. Groups who were not given instruction to monitor performed more progress monitoring than team monitoring, whereas groups who were instructed to perform both progress and team monitoring may have engaged in confounded behaviors. Theoretically, it is feasible that there is no difference between control condition and progress monitoring conditions but there is a difference between control and Team monitoring condition. This is because progress monitoring captures task interactions, which is a default interaction in action team settings (Kozlowski, Gully, McHugh, Salas, & Cannon-Bowers, 1996), and team monitoring is an extra-role behavior (Porter et al., 2003). Thus, teammates conduct progress monitoring almost by default within the task setting. The main study, therefore, used only the instructions that distinguished monitoring behaviors along the line of Progress Monitoring and Team Monitoring as illustrated below:

Progress monitoring: The instruction presented to participants read; “You are all dependent on each other to perform this task. From our experience, the team that obtains high scores is those where the team members check up on each other’s performance by asking to see

whether their teammates have successfully conducted an info search, have detected the specific enemy vessels, or have attacked the right enemy. To increase the chances that your team will perform very well, you are encouraged to request information from your teammates about their task progress throughout the teamwork”.

Team monitoring: The instruction to participants is as follows: “We have observed that the teams that obtained the highest performance are those who constantly provide help to each other in terms of feedback. It is important to watch to ensure that your teammates position themselves at the appropriate location to perform the right procedures. To increase the chances that your team will perform very well, you are encouraged to provide the necessary feedback that will help your team member perform well”.

The following variables are included in the studies: observed measure of team performance, questionnaire measures of task knowledge from which I computed task mental models accuracy and similarity, and monitoring behaviors that were coded from email exchanged during the experimental session. The simulation software records all communication and messages, and these recorded messages serve as the source for assessing monitoring behaviors. I used the same strategy and coding scheme to code all monitoring behaviors in Studies 1 and 2.

In Article 1, with the assistance of my supervisors and a team of subject matter experts who were members of the research lab, we developed and validated task mental model items for use in the study. We used the theoretical modeling approach to develop items constituting the scale by relying on theory and data to describe the most important content of task knowledge in our setting (Rouse & Morris, 1986). Since mental models serve to describe, to explain, and to predict aspects of the task (Rouse & Morris, 1986), the questionnaires were developed with this motivation.

After pilot testing these items, I treated them as formative items where the rationalization is that it is the indicators that ‘causes’ the construct, and not the other way round, as implied in reflective scale (Fornell & Bookstein, 1982, cited in Diamantopoulos & Winklhofer, 2001). In addition, I considered the multiple components of shared task mental models, and the fact that some elements may be independent of each other hence a reflective model will be inappropriate (Coltman, Devinney, Midgley, & Venai, 2008). Afterward, I assessed and documented the new scale’s properties (Hair, Sarstedt, Pieper, & Ringle, 2012; Ringle, Wende, & Becker, 2015) and used it in both Article 1 and Article 2.

Article 3 involved developing paired ratings as a means to assess shared task mental model similarity. This also involved pilot testing the pairs of statements obtained through an exhaustive task analysis with the assistance of my supervisors and subject matter experts (SME’s) drawn from the research lab. These SME’s also served as a quality control to select the most central pairs and to compute the within-group agreement metrics.

The sample for these studies was mostly, young undergraduate business students at the BI Norwegian Business School. I recruited participants through an announcement of the study on their courses and participation was voluntary. The data collection was in two waves, the first in spring 2014 ($N_{level 1} = 66*3$, $N_{level 2} = 22*3$; NB: $*3 = 3$ scenarios) where I recruited 66 students

and measurements was conducted on 3 scenarios. The second wave of data collection was in autumn 2014 where I recruited 132 students into the main experimental conditions. Article 1 is based on the spring 2014 dataset whereas Articles 2 and 3 are based on the autumn 2014 dataset ($N_{\text{level 1}} = 132 * 3$, $N_{\text{level 2}} = 44 * 3$).

Unit and level of analysis

The unit of analysis for all the hypothesized relations is a mixture of individual and team levels. This allows us to have clarity about the nature of relations at the individual and emergent team levels and to assess bottom up processes. Through random specification of relationships (e.g. Lüdtke et al., 2008; Marsh et al., 2009) and limiting direct aggregation of variables to the team level, I minimize the effect of measurement error underestimation (Lüdtke et al., 2008). Analyzing the data using both individual and team levels allows a closer understanding of the nature of emergence (Kozlowski, 2015) within this task setting, a useful contribution to the multilevel theorizing.

Multilevel Analyses and Multilevel Mediation Modelling

I adopted a multilevel modeling approach in all the analyses, and specific tests of mediation models to test the hypothesized relations in the first and second studies. Multilevel modeling is preferred in cases where observations are non-independent (Bauer, Preacher, & Gil, 2006; Snijders & Bosker, 1999), and the non-independence in my studies is created by virtue of team membership and scenario measurements. In multilevel analysis, the variances are decomposed into the individual level and group level effects (Snijders & Bosker, 1999), which gives us a clearer picture of the nature of the variables at multiple levels (e.g. individual and team) and the relation between variables within the same level and/or across multiple levels. The within-group effect represents the effect of an individual's relative score within his or her team on the outcome, whereas the between-group effect represents the effect of the mean level of the predictor on the team mean outcome (Raudenbush & Bryk, 2002).

Multilevel models can account and adjust for biases in standard error and statistical tests when observations are non-independent (Kenny, Korchmaros, & Bolger, 2003). We can use the multilevel specification to test effects that are fixed; i.e., the average level of an effect across teams or individuals. In addition, multilevel models can capture the correlations among the lower level observations through the estimation of random intercepts and slopes (Bauer et al., 2006). Random intercepts reflect differences in the overall level of the outcome variable across upper-level units, whereas random slopes reflect differences in the effects of predictors across upper-level units (Bauer et al., 2006). This flexibility in multilevel modeling is especially appropriate for examining bottom-up relations (Kozlowski, 2015), such as those described in this dissertation.

The typical multilevel specification is given as (Snijders & Bosker, 1999):

$$Y_{ij} = \gamma_{00} + \gamma_{10} x_{ij} + U_{0j} + R_{ij}$$

where γ_{00} = average intercept,

γ_{10} = regression coefficient for X, the group level variable,

U_{0j} = main effect of the groups,

R_{ij} = residuals,

i, and j subscripts: i = individual, j = group.

The first two research questions are focused on estimating multilevel mediation models. Mediation is a special case of intervening mechanism (Mathieu & Taylor, 2006) which explains how an independent variable affects an outcome variable. To a large extent, mediation seeks to establish causal mechanisms (Baron & Kenny, 1986), and I, therefore, use the less restrictive term; ‘indirect effect’ where the focus is on the linking mechanism operating between the independent and dependent variables (Mathieu & Taylor, 2006). Indirect effect means the independent variable and the dependent variable may not be directly related (Mathieu & Taylor, 2006). In order to establish truly mediated relation, Mathieu and Taylor (2006) suggested three conditions. Firstly, we must have an experiment where there is either a randomized design or a quasi-experimental design. Secondly, there must be temporal precedence in the underlying phenomena, and thirdly, it must be theoretically and empirically sound to hypothesize and conclude that the independent variable precedes the mediator and outcome variables.

Considering the intention to look at multilevel processes which are bottom-up and dynamic, the mediated relation at both the individual level and the team levels are important (Kozlowski, 2015). This is because, for both statistical and theoretical reasons (Krull & MacKinnon, 2001), individual level effects are not the same as team level effects. Whereas individual level effects capture individual psychological differences in phenomena (Krull & MacKinnon, 2001) and within team dynamics (Kozlowski, 2015), team level aggregated effects may capture influences that serve as the climate under which teammates perform (Krull & MacKinnon, 2001). Although it is anticipated that emergent constructs exist at the team level, these emergent constructs have a reciprocal relation with individual variables (Kozlowski, 2015). Thus modeling the effects across levels and within levels provides an interesting consideration of variations across individuals and variations across contexts.

In assessing the bottom-up multilevel mediation models proposed here, I rely on conventions (e.g. Preacher, Zhang, & Zyphur, 2011) where the lowest level of the construct is represented as Level 1 (individual level) and the team level is presented as Level 2. I focus on how individual monitoring behaviors, captured in initiating activities, affects team performance outcomes through its effect on STMM accuracy. This means that monitoring behaviors are conceptualized as Level 1, STMM accuracy are Level 2 (however task mental model accuracy

is the Level 1 correlate), and team performance is Level 2 (performance score of the individual the Level 1 correlate). This means all the variables in the dissertation—apart from STMM similarity—exist at the individual level and aggregation is latently specified in order to reduce measurement error (Lüdtke et al., 2008; Marsh et al., 2009).

The multilevel mediational model is specified by Bauer and colleagues (2006) as:

$$M_{ij} = d_{Mj} + a_j X_{ij} + e_{Mij}$$

$$Y_{ij} = d_{Yj} + b_j M_{ij} + c'_j X_{ij} + e_{Yij}$$

Where: M = mediator variable; Y = outcome Variable; X = independent variable; e_{Mij} and e_{Yij} = residuals of M and Y respectively; d_{Mj} and d_{Yj} = the intercepts of M and Y ; a_j = the effect of X on M ; b_j = the effect of M on Y ; and c'_j = the direct effect of X on Y ; i and j subscripts: i = individual, j = group

A single equation can be formed from these formulas to estimate the variance and covariance of the regression paths in order to compute the indirect effect (Bauer et al., 2006) and this indirect effect represents an effect size if the X and Y measurement scales have a meaningful value (Hayes, 2009).

Approaches to testing mediation models include the causal steps, the differences in coefficients, and the product of coefficients (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). The causal steps (Baron & Kenny, 1986) method suggests three necessary steps. Firstly, there must be a significant relation between the independent variable and the presumed mediator. In addition, there must be a significant relation between the mediator and the dependent variable. Thirdly, when the mediator is included in the estimation, a previously significant relation between the independent and dependent variable is no longer significant (Baron & Kenny, 1986). An alternative method is the difference in coefficients tests of the intervening variable effect by “comparing the relation between the independent variable and the dependent variable before and after adjustment for the intervening variable” (MacKinnon et al., 2002, p. 5). The third general category of mediation approaches tests the product of coefficient by “dividing the estimate of the intervening variable effect by its standard error and comparing this value to a standard normal distribution” (MacKinnon et al., 2002, p. 7). Because of the weakness in the causal methods (Hayes, 2009), I use the more robust product of coefficients approaches in testing the indirect effects.

Appendix

Table A1

An illustration of the monitoring conditions implemented on the 2nd data collection.

		Progress monitoring	
		0	1
Team monitoring and back up	0		x
	1	x	

Table A2

All variables included throughout the dissertation and measurement approach (incl. control variables)

Directly observed/count variables	Variables measured by questionnaires
Monitoring behaviors (Articles 1, 2, and 3)	Shared task mental model accuracy (8 items, Article 1, 2, and 3)
Team Performance (Articles 1, 2&3)	Shared task mental model similarity (14-paired ratings, Article 3)
	Mutual understanding (8 items, Article 1, & 2)
	NASA Task load index (6 items, Articles 1, & 2)
	Experience in strategic positions or playing strategy games (9 items, Article 3)

Table A3

Article overview with respective samples and variables

	<i>Article 1:</i>	<i>Article 2:</i>	<i>Article 3:</i>
Sample	Spring 2014	Autumn 2014	Autumn 2014
Observed/counted variables	Team performance Progress monitoring	Team performance Progress monitoring Team monitoring	Team performance
Questionnaires	Shard task mental model accuracy	Shared task mental model accuracy	Shared task mental model similarity
Control variables	NASA task load index Mutual understanding	NASA task load index , Mutual understanding	Experience playing computer games
Sample size (x3 scenarios)	N _{level 1} = 66, N _{level 2} = 22	N _{level 1} = 132, N _{level 2} = 44	N _{level 1} = 132, N _{level 2} = 44

The papers of this dissertation (pages 24-133) are not available open access, due to copyright matters.

Article 1

Does task mental model accuracy mediate the relation between monitoring progress towards goals and team performance?

Kwei-Narh, P. A., Valaker, S., Hærem, T., & Lervik, J. E.

Article 2

How monitoring behaviors predict team performance: the role of shared task mental model accuracy

Kwei-Narh, P. A., Hærem, T., & Lervik, J. E.

Article 3

Exploring the role of shared task mental model accuracy and similarity on team performance

Kwei-Narh, P. A.

Chapter 5

Main Findings and Theoretical Contributions

The overall purpose of this Ph.D. dissertation was to build a mid-range theory of teamwork, concentrating on the relation between team process, team emergent state, and team outcomes. Based on theoretical considerations, I chose to evaluate the relation between monitoring behaviors (team process) and team performance (outcome) and how this relation could be explained through the mediating role of STMM accuracy (STMM-an emergent state). I specifically considered how this relation varied across individual and team levels. I also considered ways in which the property of the emergent STMM (accuracy and similarity) complements each other in diagnosing and implementing strategies for enabling team effectiveness. Three articles are included in this dissertation to address the main purpose. The first article (Chapter 2) presents the initial examination of the relation between progress monitoring and team performance through STMM accuracy. This study assessed the extent to which voluntary engagement in progress monitoring influenced the team's performance through STMM accuracy. Results of this study replicated existing findings where progress monitoring did not directly predict team performance; however, the indirect relation through STMM accuracy was significant, as hypothesized.

Based on existing research—which indicated that monitoring behaviors engage cognitive and behavioral resources (Porter et al., 2010)—I hypothesized that monitoring behaviors would imply different pattern of relation with team performance (Ackerman et al., 1995), but a positive relation would be established through the mediating role of STMM accuracy (Chapter 3). For this reason, I conducted an experiment which manipulated participants engagement either in progress or in team monitoring. In line with the prior hypotheses, this study revealed that progress monitoring had an indirect effect on team performance but the indirect effect exists as differences between individuals in the same team. This means that the indirect effect of progress monitoring on team performance through STMM accuracy was significant only in differentiating high performing team members from poorly performing team members. On the other hand, team monitoring had an indirect effect on team performance by differentiating higher performing individuals and teams from lower-performing individuals and teams.

The third study (Chapter 4) investigated whether STMM accuracy and similarity capture unique yet complementary aspects of team cognition and what the implications are for diagnosing (in)effective teams. I created an assessment of STMM similarity and accuracy using subject matter experts as a methodological improvement (Mohammed et al., 2010). Results

from the multilevel regressions using both the regression estimates and R^2 —Raudenbush and Bryk (2002), Snijders and Bosker (1994)—indicate that STMM similarity and accuracy each uniquely predicted variances in team average scores as well as the team’s scores. The results also suggest the complementary role of STMM accuracy and similarity in predicting team performance. Thus, we must not only be interested in teaching teams about the most important content of the task but we must directly influence how they organize their knowledge.

In general, Articles 1 and 2 contributed to the need for studies which capture the emergence of shared mental models (DeChurch & Mesmer-Magnus, 2010b) by modeling bottom-up processes (Kozlowski, 2015). Whereas previous studies have indicated cognitive abilities, training, and expertise are necessary for the emergence of shared mental models, our studies indicated that monitoring behaviors are important in developing STMM accuracy during teamwork. The finding is very relevant because monitoring behaviors is a behavior that may not need expensive organizational intervention, as would have been needed to run training programs. Teammates—who we show engaged in monitoring behaviors either voluntarily or on instruction—pushed their team members to develop STMM accuracy through progress monitoring. Our studies indicate that having a dedicated member responsible for progress monitoring enables within team learning, rather than the average progress monitoring of the team, which is negatively related to team performance. This finding pushes theorists and practitioners alike to consider and evaluate the specific team member that can aid the team’s developing STMM accuracy.

This dissertation contributes to the mental model measurement methodology by infusing a quality criterion to measures of task mental model similarity ratings (Mohammed et al., 2010). As generally operationalized, STMM similarity considers the similarity in the structural representation of the knowledge content among team members (DeChurch & Mesmer-Magnus, 2010b). It has been variously reported that strong shared mental model similarity may be related to group-think (Cannon-Bowers et al., 1993) and memory consistent errors (Betts & Hinsz, 2013). Thus, the link between shared mental model similarity and outcomes such as team performance and adaptation has been questioned (Sander et al., 2015). However, a truism of shared mental models is that what you measure is what you get (DeChurch & Mesmer-Magnus, 2010b; Mohammed & Hamilton, 2012). Therefore, without linking the mental representation of teammates to an expert’s criteria, we may be tapping into a mental model representation that may not truly reflect the team’s actual task relevant representation. That means that we can have subsets of mental model representations, such that it is important to capture the mental model representation that is objectively relevant to the task performance when we infuse a quality criterion into our measures.

In the following, I will discuss what the findings imply for building a mid-range theory of the relation between monitoring behaviors, STMM accuracy and similarity, and team performance. Consider that a theory is by definition a set of “interrelated constructs, concepts, definitions, and propositions that present a systematic view of phenomena by specifying

relations among variables, with the purpose of explaining and predicting the phenomena" (Kerlinger, 1986, p. 9). Mid-range theories serve to explain only a subset of the phenomena through a detailed analysis of fewer relations (Weingart & Cronin, 2012). Seeing this intention, I examine below how the findings can provide a detailed explanation of the relation between monitoring behaviors and team performance outcomes.

Explaining the relation between monitoring behaviors and team performance; the role of STMM accuracy

The relation between monitoring behaviors and team performance provides an interesting observation. I consider separately how each component of monitoring behaviors—progress and team monitoring—affect team performance. Firstly, progress monitoring benefits the individual initiator and the team and creates a within team dynamic whose effects varies from team to team. The sender of the information—by using explicit communication is able to integrate new knowledge and reflect more on their own knowledge. This improves the sender's holistic understanding of their task, as reflected in their task mental accuracy and helping their team's STMM accuracy. With respect to the influence of progress monitoring on the recipient, the observed effect may reflect an interaction of progress monitoring with the nature of the task, as well as a residual effect on the recipients meaning creation (sensemaking) processes. With respect to the nature of the task, our setting—like most action team task settings (e.g. DeChurch & Mesmer-Magnus, 2010a; Korb et al., 2015; Mathieu et al., 2009)—is very sensitive to time and demands extreme concentration levels from teammates. Teammates have to meet a complex and continuous stream of dynamic situations such that progress monitoring is optimal so long as it does not detract the recipients' attention from these constantly changing task demands. Too much progress monitoring will detract from the attention needed for elements of the task, as well as the time needed to complete a task. This is revealed by the insignificant average effect of progress monitoring both on STMM accuracy and team performance (whereas the cross-level effect from individual to the STMM accuracy and team performance was significant).

This detractive capability of progress monitoring has important implication for the 'sensemaking' that occurs as individuals understand their task performance requirements (Lutz & Huitt, 2003) when their teammates engage in progress monitoring for 'sensegiving'. Sensemaking is a conversational and narrative process through which people create and maintain a subjective world (Balogun & Johnson, 2005; Brown, 2000; Weick & Roberts, 1993). There is a difference between sensegiving for others and sensemaking for oneself, where "sensegiving-for-others' is the process of disseminating new understandings to audiences to influence their 'sensemaking-for-self' (Gioia & Chittipeddi, 1991, p. 444). Sensegiving, through progress monitoring, suggests that a teammate is supplying a workable interpretation to their team members through their interactions as well as facilitating a negotiated meaning for the group (McComb, 2007; Thompson & Fine, 1999). For some teams, progress monitoring

may have contained cues that detract team member's from their own sensemaking as well as the team's collective meaning creation (Faraj & Xiao, 2006). However, as indicated by the predictive ability of progress monitoring for STMM accuracy, this collective meaning is likely because some team members were not detracted from attending to the central component of their task. It may also be that the effect of progress monitoring on STMM accuracy depends on who is engaging in the monitoring. As indicated by the cross-level effect of progress monitoring on team performance and STMM accuracy, some particular teammates enhance the effects of progress monitoring on STMM accuracy and team performance more than other teammates.

From the first two empirical studies included in this dissertation, it seems that the ideal meaning creation process is when individual's own search process guides the meaning creation process. Thus, this individual can focus on a particular aspect of their task in order to facilitate the meaning creation. However, when they receive progress monitoring requests from teammates, such a request may interfere with the stream of meaning creation initiated by the individual. This interference may occur for some individuals and not for others, such that the progress monitoring may help some members to improve their own meaning creation, whereas for others it might interfere with their meaning creation. This may explain why the indirect effect of progress monitoring on team performance was significant for the average team member, but not for the average team. The individual level effect captures the effect of initiating progress monitoring, whereas the team level effect captures the average effect of receiving and initiating progress monitoring.

The relation between team monitoring and team performance is an interesting finding since this finding substantiates the observation that 'orientations to others' is important in organizing under dynamic conditions (Vogus, Rothman, Sutcliffe, & Weick, 2014). Being oriented towards others—a necessary feature in team monitoring—helps in high-reliability action teams because it enables teammates to notice and respond swiftly to challenges that the teammates are facing. We see that as teammates provide coaching and advice to each other, it facilitates the team performance because teammates can avoid errors as they understand their task more accurately. This effect is more significant when we compare teams to each other and when we compare individuals to each other. Thus, the benefit of team monitoring accrues to differentiate teams that engage in team monitoring from those that do not engage in team monitoring.

Additionally, the cumulative effect of information elaboration may explain the relation between team monitoring and team performance. Team monitoring has a significant effect on team level performance because when teammates interpret information or coach another teammate, the initiator of team monitoring facilitates their own information elaboration processes. This is because the teammates can reflect on their own task knowledge in a different way as they engage in team monitoring. In addition, the recipient of team monitoring is able to engage in a guided reflection (Konradt, Schippers, Garbers, & Steenfatt, 2015) where a teammate with a deeper understanding of an aspect of the task guides the recipient on which

aspect of the task is the most important. Thus—through monitoring behaviors—the individual who initiates team monitoring and the recipient of team monitoring engage in deeper information elaboration and reflection, which enables better team performance (Konradt et al., 2015; Smith-Jentsch, Cannon-Bowers, Tannenbaum, & Salas, 2008). It seems that at first, this effect may be small (no significant cross-level effect of individual team monitoring on STMM accuracy or team performance), a similar finding reported by Porter and colleagues (2010). However, when you consider the effect as a whole, team monitoring displays a multiplicative effect on the team performance (a classic effect of the team setting such that the team output exceeds the additive capability of individual team members).

It is not only the recipient and the initiator of team monitoring that benefit from the information elaboration and reflection stimulated by team monitoring but other teammates who attend to the on-going interaction in the monitoring behaviors. To illustrate, teams in our simulation consists of three members; Orion, Patrol, and Frigate. Imagine Orion requests and receives help from Frigate; Patrol will benefit from that interaction—which at the time may not be relevant to Patrol—if Patrol considers and attends to that interaction within the team. As described in processes of shared cognition development (e.g. Levine & Moreland, 1999) and in the social cognitive theory of self-regulation (Bandura, 1991), a teammate may develop better insight into their own task by observing how other teammates perform or interact with their task. The team acts as a reference category for the individual to regulate their behavior such that—as teammates engage in team monitoring and build up a negotiated agreement over what is important for their task performance—this agreement influences other teammates who originally may not be part of the discussion. It also saves the team time and frustration from dealing with duplicated requests, since an earlier discussion may have contained the answer to the challenges another teammate may later face.

Indeed, as an aspect of monitoring behaviors, team monitoring simultaneously reflects both cognitive and behavioral mechanisms (Porter et al., 2010). However, team processes are infused with cognitive, behavioral, and affective processes (Ilgen et al., 2005; J. Mathieu et al., 2008) and it is likely that some constructs may contain a bit of all processes, i.e., cognitive, behavioral, and affective. Findings contained in this dissertation, alongside other empirical work elsewhere (e.g. Smith-Jentsch et al., 2009), motivates the conclusion that team monitoring does capture a bit of the cognitive, behavioral, and affective components of team processes. Since the cognitive and behavioral aspect is already established (e.g. Porter et al., 2010), below, I focus only on how team monitoring reflects affective processes and the implication for team performance.

Team monitoring, as theoretically defined (e.g. Marks et al., 2001) and operationally defined in this dissertation and other studies (e.g. Barnes et al., 2008; Porter et al., 2003; Porter, Itir Gogus, & Yu, 2011) overlaps with the construct of prosocial motivation (Grant, 2008; Grant & Berry, 2011). Prosocial motivation is the desire to expend effort to benefit others as demonstrated by sensitivity to others needs and concern for their failure (Grant, 2008). When

team members exhibit prosocial motivation, they demonstrate a commitment to their group (Vogus et al., 2014) as well as receptivity to the perspectives and information that their teammates bring along (Grant & Berry, 2011). Together, these processes are means of building positive affect within the team.

Furthermore, team monitoring satisfies an important social need, the need for relatedness (Deci & Ryan, 2008) which is the need to care for and to be cared for by others. Following on from social identity theory (Tajfel, 1982) helping behaviors, assistance, and coaching are the beginning of the journey towards forging a strong team identity, where each team member transitions from seeing themselves as performing their exclusively assigned task to seeing themselves performing a task integrated with the rest of their teammates (Levine & Moreland, 1999; McComb, 2007). Increased team monitoring in the form of giving and accepting feedback increases teammates familiarity (Smith-Jentsch et al., 2009) which has the effect of producing liking and trust among teammates. This suggests that team monitoring involves affect and helps build affect within the team. Such an insight is an important development in our understanding of team monitoring as involving both cognitive, behavioral, and affective aspects.

Explaining the relation between STMM similarity and team performance

Although previous studies—for instance, Sander and colleagues (2015)—have questioned the importance of STMM similarity to team adaptation, an aspect of team performance, I argue that STMM similarity is important for team performance, especially in response to new information which demands novel ways of knowledge integration. At both the individual and team level, knowledge integration is either through assimilation or accommodation (Fiske & Taylor, 2013; McComb, 2007). In assimilation, the new information is included into our knowledge structure, whereas in accommodation, we broaden our knowledge structure to deal with a hitherto unknown knowledge. At the team level, STMM similarity is important for both accommodation and assimilation processes (McComb, 2007). Better STMM similarity will enable better team performance through faster knowledge integration than poorer STMM similarity because the new knowledge will be fused into a compatible knowledge structure (Gentner & Markman, 1997). STMM similarity also deals with how the team orients themselves to new information (Rentsch et al., 2012) such that teammates' agreements enable them to attach the same meaning and importance to necessary features in their task.

As Article 3 (Chapter 4) indicated, once we consider the underlying structural relations among the variables, we will unearth the potential to use STMM similarity in predicting a team's performance, uniquely of the contribution of STMM accuracy. I conceptualized and evaluated STMM similarity using agreement indices similar to other researchers (e.g. Levesque et al., 2001). Recent theoretical propositions (Healey et al., 2015) suggests that mental model

agreements could have a surface dimension and a deeper dimension. Mismatches between dimensions may be the reason that STMM similarity may not yield the same outcomes to team performance, as STMM accuracy would have yielded.

Healey and colleagues (2015) suggest that mental models formed through reasoning and deliberation (C-system representations) could compete with automatic, intuitive and affective mental models (X-system representations). This could create either illusory concordance, where there is a similar C-system mental model but dissimilar X-system representations, or surface discordance, where teammates have X-system representations but dissimilar C-system representations (Healey et al., 2015). As Article 3 has focused on measuring STMM similarity after deliberative processes in each scenario, it used a C-system representation of STMM. However, because the perceptual ratings of STMM similarity were related to team performance, I can speculate using Healey and colleagues' framework that there was full concordance in the teams' evaluation of the most important dimensions of their tasks. This may explain why the perceptual agreements significantly relate to the team performance (DeChurch & Mesmer-Magnus, 2010a).

In Chapter 4, I suggested and found support for the role of STMM accuracy and similarity on team performance. STMM *accuracy* describes the correctness of task mental model content (Edwards et al., 2006) and STMM *similarity* describes the degree of overlapping or converging structural representation of the STMMs (Mohammed et al., 2010; Mohammed et al., 2000). In dynamic settings, STMM accuracy is important for the core content of the task whereas the team must maintain agreement about the how different aspect of the task is important in order to organize and understand the central elements of their teams task, a precondition for effective team performance.

General Discussion

In sum, the three articles included in this dissertation make the following contributions. Firstly, findings contribute to the action team literature by providing a detailed exposition of the relation between monitoring behaviors, STMM accuracy, and team performance. The extant literature has reported both positive and negative effects between monitoring behaviors and team performance (e.g. Barnes et al., 2008; Pitariu, 2007; Porter et al., 2010). My proposal is that since monitoring behaviors have a predominant cognitive orientation, the effect of monitoring behavior on team performance is through emergent cognitive phenomena, specifically STMM accuracy. The findings indicate that there exists an indirect effect of monitoring behaviors on team performance through STMM accuracy.

When we examined the finer details of this effect, the studies indicated that whereas progress monitoring demonstrates an indirect effect on team performance through STMM accuracy, the effect varies according to the individuals on the team. In other words, the effect

differentiates high performing team members from low performing team members. Our results suggest an information processing mechanism especially with respect to the effect of progress monitoring on team performance. Our results from Article 2 also indicate that it is better for the team performance that a dedicated teammate is in charge of progress monitoring than when all the team members perform progress monitoring at random.

The findings in Article 2, when we examined the relation between team monitoring and team performance, seem to suggest that beyond the well-known cognitive and behavioral mechanisms underlying team monitoring (Porter et al., 2010), there could also be an affective process (Grant & Berry, 2011; Vogus et al., 2014). This affective process overrides the resource demanding nature of team monitoring (Barnes et al., 2008) such that team monitoring differentiates high performing individuals and teams from one another. Team monitoring demonstrates high benefits to the team because of the reciprocity it engenders among the teammates, such that teammates provide unsolicited help (Smith-Jentsch et al., 2009), are more willing to devote attention to each other, and readily take another teammates perspective (Grant & Berry, 2011).

Another important contribution of this dissertation is to our understanding of multilevel phenomena. Multilevel phenomena are widespread within organizational contexts, but few studies have devoted attention to accessing these phenomena directly in order to describe how individual level relations and variables morphs into a team level variable/relation (Bell & Kozlowski, 2012; Kozlowski, 2015; Kozlowski, Chao, Grand, Braun, & Kuljanin, 2013). The first two studies contained in this dissertation have sought to contribute to our understanding of multilevel processes by modeling individual and team level phenomena and seeking to understand how the pattern of relation differs across levels. Our findings address Kozlowski and colleagues (2012; 2000) argument that some phenomena are isomorphic in that the same constituent pattern existing at a lower level (e.g. individual) exists at a higher level (e.g. team). We can extend Kozlowski's theorizing to a consideration of relations, where the relation between variables at the individual level may not be the same as the relation between variables at the team level. Specifically, our results indicate that the relation between progress monitoring and team performance through STMM accuracy at the individual level is not the same as that same relation at the team level. Such non-isomorphism has important implication for how we consider progress monitoring within autonomous teams, where any team member may be responsible for monitoring behaviors (Langfred, 2004).

Limitations and suggestions for future research

When the entire dissertation is considered, a number of limitations stand out. Firstly, the participant samples were homogenous. These are averaged age Norwegian business school students with considerable parity in gender representation. The extant research has indicated gender disparities in performance on cooperative and competitive tasks, such that females

perform better on cooperative tasks whereas males perform better on competitive tasks (Van Vugt, De Cremer, & Janssen, 2007). Thus, the gender parity in the second and third studies is especially important in preventing skewed observations. Because of the relatively young age of the sample, the results could reflect cohort/generational bias. However, age disparities rarely influence performance in decision-making tasks such as is contained in this study (Blanco et al., 2016). Age differences in decision-making tasks exist when the task involves using strategies that depend on accumulated experience (Blanco et al., 2016), but not much experience is needed to engage in this simulation. In addition, most of these students are familiar with decision-making tasks since the average Norwegian student begins their semi-professional work life very early (51.1 per cent of 15 -24 years old begin some job-related activities; Statistics Central Bureau- Norway, 2014). It will be interesting to see whether future studies can replicate these findings in a less homogenous sample. A larger sample size with a more robust implementation of the experimental design would be an interesting study to conduct in the future.

Additionally, it is difficult to compare an emergent property developed in the lab setting to an emergent team property developed within a more naturalistic setting. We know that emergent properties rapidly develop and remain stable in a laboratory setting (Allen & O'Neill, 2015). What we do not know is whether the form of emergent properties in the lab has the same robustness as within a naturalistic setting. However, the essence of an emergent STMMs are to describe, predict, and to explain (Rouse & Morris, 1986). Therefore, as long as the STMMs can perform such a function, then the question about STMM robustness may not be vital. STMM is very specific to the context in which it developed (Cannon-Bowers et al., 1993) and the concern is about how the team can use it to engage in anticipatory behaviors. Thus, comparison of STMM across multiple study settings (lab and field) but identical team tasks may be a suitable objective for future studies.

It is a challenging undertaking in most research to test relations where a lower level construct predicts a higher level construct (Kozlowski, 2015; Lachowicz et al., 2015). Furthermore, estimating relation between behavior and cognition often reveal weak coefficients. Thus, this dissertation, which conceptualizes a cross-level linkage between a behavioral construct and a cognitive construct at different levels exponentially increases the complexity. For this reason, I have focused on team behaviors that involve using cognitive resources to reduce the complexity and achieve a fit between conceptualization and the underlying processes between cognition and behavior. It may be that future studies need to follow this monitoring behavior as a 'practice' using a more process-oriented design in order to provide further evidence of the link between a behavioral construct and a cognitive phenomenon (Marshall, 2008).

This dissertation cannot ignore the philosophical question of whether knowledge precedes action or action precedes knowledge. In other words, does a team member monitor progress because they possess more knowledge—in which case they already have higher task mental model accuracy—or do they understand their task better as they engage in monitoring

behaviors with other teammates? I have motivated my research with the latter reason in the sense that teammates engaged in monitoring behaviors during the task whereas STMM accuracy focused on the whole scenario experience. However, it is possible that the team member who possesses better STMM accuracy is more likely to subsequently monitor their teammates because they observe and notice when teammates are not doing the right thing. As observed in cognitive interference (Sarason, Pierce, & Sarason, 1996), building STMMs depends on teammates who share relevant rather than irrelevant knowledge (Cannon-Bowers et al., 1993; Rouse & Morris, 1986). It could also be that individual cognitive capacity or personality variables differentiate those who monitor from those that do not monitor (Pearsall & Ellis, 2006). Future studies will have to control for individuals' cognitive capacity and personality profiles that may predict an orientation to engage in either form of monitoring behaviors; progress monitoring or in team monitoring.

One of the advantages of a laboratory experiment is that it enhances control and increases the relevance of the variables measured. When repeated measurements are included, this further enables assessment of the trajectory of processes that develop over time (Kozlowski et al., 2013). However, the major challenge for laboratory experiments when participants engage in repetitive tasks is boredom and exhaustion. After the second scenario, we observed a drop in all the variables of interest, and this is an observation for other experimental studies (Mohammed & Hamilton, 2012). I anticipated and controlled for the effect of task load, and whereas this variable did not reveal any significant effect, there was a noticeable drop in performance scores in the third scenario across all three studies. I cannot discount the influence of boredom and fatigue on the participants in this series of studies. In spite of this, the consequence of these findings in modern high-paced organizations filled with so much stress and fatigue (Barnes, Lucianetti, Bhave, & Christian, 2015; Fritz, Lam, & Spreitzer, 2011; Hobfoll, 1998; Scott & Judge, 2006) is that these results may have broader applications than anticipated. It will be interesting if future studies can either replicate or make findings under conditions where boredom and fatigue will have less effect.

Another limitation of this dissertation is that I could have added a representation of structure to reveal the nature of STMMs similarity in this setting. This is achieved by using network approaches such as Pathfinder (DeChurch & Mesmer-Magnus, 2010b; Mohammed et al., 2010) to augment the questionnaire approach I adopted. The advantage of a structural representation is that it reveals the association of each concept to every other concept, such that we do not just obtain a global measure of similarity but a fine-grained understanding of the relation between the various constructs simultaneously. Although the rating scales with *Rwg* statistics are common (e.g. DeChurch & Mesmer-Magnus, 2010b; Levesque et al., 2001) and address the main aims of this study, the information about the network structure is an interesting study on its own. This would have yielded insight that has broad implications for understanding representational schemes in a dynamic decision-making context, an obvious need for further research.

Another possible limitation is that the simulation was overhauled to improve its features between the first data collection and the second data collection. With improved features, we could map teammate's locations relative to the location of a critical action (for instance, to attack an enemy target). Team performance was broadened to include these additional measures, which was not the same as the team performance on Article 1. Although we replicated the main hypothesized relations on both Article 1 and Article 2, it is important to consider that team performance contained additional components in Article 2.

Narrow operationalization of constructs—in this case STMM accuracy—is a potential risk to construct validity and challenges the linkage of the constructs I used in this dissertation to general theories (Shadish et al., 2002). Construct validity is the extent to which an operationalization measures the construct it is supposed to measure (Bagozzi, Yi, & Phillips, 1991; Shadish et al., 2002). According to Shadish and colleagues, “construct validity involves making inferences from the sampling particulars of a study to the higher-order construct they represent” (Shadish et al., 2002, p. 65). My studies may thus suffer from ‘inadequate explication of constructs’ (Shadish et al., 2002), which occurs when constructs are measured too narrowly. For instance, my measurement of STMM accuracy might be too narrow and could have been broadened to include other task relevant considerations, such as general taskwork behaviors (e.g. Lim & Klein, 2006) .

Related to construct validity, there could be random and systematic errors, which could potentially bias interpretations. Random errors can either attenuate or inflate parameter estimates in statistical analyses (Bagozzi et al., 1991). In this direction, multilevel analyses serve an important function, and specifying relationships as random ensures better statistical estimations and lower random errors (Lüdtke et al., 2008; Marsh et al., 2009). However, multilevel analyses may not reveal systematic errors that exist in the study—for instance due to features of the setting, or the confounding of constructs with other important variables in the study. As Shadish and colleagues (2002, pp. 68,82) observed, “it is never possible to establish a one-to-one relationship between the operations of a study and corresponding constructs”, and “disagreements about how well a given study represents various constructs are common”. Therefore, I do acknowledge potential construct validity issues within this dissertation, noting however, that I have tried as much as possible to reduce the errors within the possible limits. These limitations need to be borne in mind when applying the findings of the dissertation.

Practical implications

The results presented in this dissertation have practical implications specifically for teams in both organizational and crisis management settings, e.g. emergency response teams. Firstly, our studies address the core mechanism of informal learning (Noe et al., 2014) in the workplace. Most learning theories have noted that individuals often learn together, and may be regarded as a form of guided participation (Rogoff, 1991). In addition, equal contribution and

evaluation of ideas between peers may lead to changes in perspective (Kruger, 1993) which trigger learning. The process by which teammates resolve task demands together as they engage in joint reflection and guided participation is the means through which monitoring behaviors facilitate the correctness of their task mental models. Since learning is by definition a change in mental models, this implies that teammates enable each other to learn through information elaboration and developing insight.

Another important practical implication is how we conduct leadership within autonomous teams. We suggest a mixture of shared leadership (Nicolaidis et al., 2014) and directed leadership (McIntyre & Foti, 2013). Our results indicate that to ensure higher team performance, it is better to have a single teammate in charge of progress monitoring—i.e., tracking the team’s progress and ensuring everyone is staying on course. However, each teammate must consider how to offer help, especially when solicited by their teammates. Teammates must understand that when they interpret information to another member, they are not only helping the recipient directly but they are indirectly helping themselves to develop better insight into their task. In addition, they are creating an environment to understand each other readily and to benefit from the norms of reciprocity that develop when teammates share knowledge.

Another practical application is to the orientation of new teammates in order for them to perform well. It is assumed that when teammates know each other’s task and they engage in progress monitoring then the team can ensure effective performance. As our study indicates, progress monitoring has a more limited implication to team performance, most likely because some tasks can be performed without the individual sharing in the team’s knowledge (STMM). On the other hand, team monitoring facilitates team performance because engaging in it suggests an affective consideration of the teammate. Through team monitoring, team members communicate to their teammates that they have a shared interest, exploring their own vulnerabilities and challenges in dealing with the task. Thus, team orientations for new teammates should consider ways in which the teammates can explore their insecurities about the task before and during task performance. Considering our study used participants who have low familiarity with their teammates, this result can have far-reaching implications for newly-formed action teams who have to deal with unanticipated tasks within dynamic settings.

Conclusion

The three articles presented in this dissertation indicate that a detailed understanding of variables residing at different levels can reveal surprising findings. The findings reported here indicate that monitoring behaviors affect team outcomes in various ways because they instigate different processes. Whereas progress monitoring strongly instigates individual level cognitive processes, team monitoring instigates team level processes and is more relevant for team performance than progress monitoring. Additionally, the dissertation highlights the role of STMM accuracy and similarity in facilitating team performance within dynamic settings. In

these settings, task performance does not depend only on understanding the task—reflected in STMM accuracy—but in the teammates sharing the agreement on the most important elements of the task—reflected in their STMM similarity. Going forward, I hope that training practitioners can find useful insight into the skills that is needed for monitoring behaviors since team members often voluntarily perform monitoring behaviors.

Reference

- Ackerman, P. L., Kanfer, R., & Goff, M. (1995). Cognitive and noncognitive determinants and consequences of complex skill acquisition. *Journal of Experimental Psychology: Applied*, 1(4), 270-304. doi:10.1037/1076-898X.1.4.270
- Allen, N. J., & O'Neill, T. A. (2015). The Trajectory of Emergence of Shared Group-Level Constructs. *Small Group Research*, 46(3), 352-390. doi:10.1177/1046496415584973
- Azen, R., & Budescu, D. V. (2003). The dominance analysis approach for comparing predictors in multiple regression. *Psychological Methods*, 8(2), 129-148. doi:10.1037/1082-989X.8.2.129
- Bagozzi, R. P., Yi, Y., & Phillips, L. W. (1991). Assessing Construct Validity in Organizational Research. *Administrative Science Quarterly*, 36(3), 421-458. doi:10.2307/2393203
- Balogun, J., & Johnson, G. (2005). From intended strategies to unintended outcomes: The impact of change recipient sensemaking. *Organization Studies*, 26(11), 1573-1601. doi:10.1177/0170840605054624
- Bandura, A. (1991). Social cognitive theory of self-regulation. *Organizational Behavior and Human Decision Processes*, 50(2), 248-287. doi:[http://dx.doi.org/10.1016/0749-5978\(91\)90022-L](http://dx.doi.org/10.1016/0749-5978(91)90022-L)
- Bargh, J. A. (2014). The Historical Origins of Priming as the Preparation of Behavioral Responses: Unconscious Carryover and Contextual Influences of Real-World Importance. *Social Cognition*, 32(Supplement), 209-224. doi:10.1521/soco.2014.32.supp.209
- Bargh, J. A., & Chartrand, T. L. (2014). The mind in the middle: A practical guide to priming and automaticity research. In H. T. Reis & C. M. Judd (Eds.), *Handbook of research methods in social and personality psychology* (2nd ed. ed., pp. 311-344). New York: Cambridge University Press.
- Bargh, J. A., & Ferguson, M. J. (2000). Beyond behaviorism: On the automaticity of higher mental processes. *Psychological Bulletin*, 126(6), 925-945. doi:10.1037/0033-2909.126.6.925
- Barnes, C. M., Hollenbeck, J. R., Jundt, D. K., DeRue, D. S., & Harmon, S. J. (2011). Mixing Individual Incentives and Group Incentives: Best of Both Worlds or Social Dilemma? *Journal of Management*, 37(6), 1611-1635. doi:10.1177/0149206309360845
- Barnes, C. M., Hollenbeck, J. R., Wagner, D. T., DeRue, D. S., Nahrgang, J. D., & Schwind, K. M. (2008). Harmful help: The costs of backing-up behavior in teams. *Journal of Applied Psychology*, 93(3), 529-539. doi:10.1037/0021-9010.93.3.529
- Barnes, C. M., Lucianetti, L., Bhawe, D. P., & Christian, M. S. (2015). "You Wouldn't Like Me When I'm Sleepy": Leaders' Sleep, Daily Abusive Supervision, and Work Unit Engagement. *Academy of Management Journal*, 58(5), 1419-1437. doi:10.5465/amj.2013.1063
- Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51(6), 1173-1182. doi:10.1037/0022-3514.51.6.1173
- Bauer, D. J., Preacher, K. J., & Gil, K. M. (2006). Conceptualizing and testing random indirect effects and moderated mediation in multilevel models: New procedures and recommendations. *Psychological Methods*, 11(2), 142-163. doi:10.1037/1082-989X.11.2.142, 10.1037
- Bear, D. J., Morrison, C. L., Vickers, M., Paradise, A., Czarnowsky, M., Soyars, M., & King, K. (2008). *Tapping the potential of informal learning: An ASTD research study*. Alexandria, VA: American Society for Training and Development.
- Bell, B. S., & Kozlowski, S. W. J. (2012). Three conceptual themes for future research on teams. *Industrial and Organizational Psychology*, 5(1), 45-48.

- Bertalanffy, L. v. (1968). *General system theory : foundations, development, applications* (Rev. ed. ed.). New York: Braziller.
- Betts, K. R., & Hinsz, V. B. (2013). Strong shared representations promote schema-consistent memory errors in groups. *Group Processes & Intergroup Relations*, *16*(6), 734-751. doi:10.1177/1368430213486206
- Biemann, T., Cole, M. S., & Voelpel, S. (2012). Within-group agreement: On the use (and misuse) of rWG and rWG(J) in leadership research and some best practice guidelines. *The Leadership Quarterly*, *23*(1), 66-80. doi:<http://dx.doi.org/10.1016/j.leaqua.2011.11.006>
- Biesanz, J. C., Falk, C. F., & Savalei, V. (2010). Assessing Mediation Models: Testing and Interval Estimation for Indirect Effects. *Multivariate Behavioral Research*, *45*(4), 661-701. doi:10.1080/00273171.2010.498292
- Blanco, N. J., Love, B. C., Ramscar, M., Otto, A. R., Smayda, K., & Maddox, W. T. (2016). Exploratory decision-making as a function of lifelong experience, not cognitive decline. *Journal of Experimental Psychology: General*, *145*(3), 284-297. doi:10.1037/xge0000133
- Bliese, P. D. (2000). Within-group agreement, non-independence, and reliability: Implications for data aggregation and analysis. In K. J. Klein & S. W. J. Kozlowski (Eds.), *Multilevel theory, research, and methods in organizations* (pp. 349-381). San Francisco: Jossey-Bass.
- Bolstad, C., Schneider, M., Graham, J., & Gonzalez, C. (2004). Collaborative Tools and Shared Mental Models. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, *48*(3), 610-613. doi:10.1177/154193120404800371
- Bolstad, C. A., & Endsley, M. R. (1999). Shared Mental Models and Shared Displays: An Empirical Evaluation of Team Performance. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, *43*(3), 213-217. doi:10.1177/154193129904300318
- Brehmer, B., & Dörner, D. (1993). Experiments with computer-simulated microworlds: Escaping both the narrow straits of the laboratory and the deep blue sea of the field study. *Computers in Human Behavior*, *9*(2-3), 171-184. doi:[http://dx.doi.org/10.1016/0747-5632\(93\)90005-D](http://dx.doi.org/10.1016/0747-5632(93)90005-D)
- Brown, A. D. (2000). Making Sense of Inquiry Sensemaking. *Journal of Management Studies*, *37*(1), no-no. doi:10.1111/1467-6486.00172
- Burke, C. S., Salas, E., Wilson-Donnelly, K., & Priest, H. (2004). How to turn a team of experts into an expert medical team: guidance from the aviation and military communities. *Qual Saf Health Care*, *13 Suppl 1*, i96-104. doi:10.1136/qhc.13.suppl_1.i96
- Burtscher, M. J., Kolbe, M., Wacker, J., & Manser, T. (2011). Interactions of Team Mental Models and Monitoring Behaviors Predict Team Performance in Simulated Anesthesia Inductions. *Journal of Experimental Psychology-Applied*, *17*(3), 257-269. doi:10.1037/a0025148
- Cannon-Bowers, J. A., & Salas, E. (2001). Reflections on shared cognition. *Journal of Organizational Behavior*, *22*(2), 195-202. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=5524980&site=ehost-live>
- Cannon-Bowers, J. A., Salas, E., & Converse, S. (1993). Shared mental models in expert team decision making. In N. J. Castellan (Ed.), *Individual and group decision making* (pp. 221-246). New Jersey: Lawrence Erlbaum.
- Cannon-Bowers, J. A., Tannenbaum, S. I., Salas, E., & Volpe, C. E. (1995). Defining competencies and establishing team training requirements. In R. A. Guzzo & E. Salas (Eds.), *Team effectiveness and decision making in organizations* (pp. 333-380). San Francisco, Cal.: Jossey-Bass.
- Chartrand, T. L., & Bargh, J. A. (1996). Automatic activation of impression formation and memorization goals: Nonconscious goal priming reproduces effects of explicit task instructions. *Journal of Personality and Social Psychology*, *71*(3), 464.

- Chen, Z., Takeuchi, R., & Shum, C. (2013). A Social Information Processing Perspective of Coworker Influence on a Focal Employee. *Organization Science*, 24(6), 1618-1639. doi:10.1287/orsc.2013.0820
- Chin, W. W. (1998). The partial least squares approach for structural equation modeling. In G. A. Marcoulides (Ed.), *Modern methods for business research* (pp. 295-336). Mahwah, N.J.: Lawrence Erlbaum.
- Cohen, J. (1960). A coefficient of agreement for nominal scales. *Educational and Psychological Measurement*, 20(1), 37-46. doi:10.1177/001316446002000104
- Coltman, T., Devinney, T. M., Midgley, D. F., & Venaik, S. (2008). Formative versus reflective measurement models: Two applications of formative measurement. *Journal of Business Research*, 61(12), 1250-1262. doi:<http://dx.doi.org/10.1016/j.jbusres.2008.01.013>
- Cooke, N. J., Kiekel, P. A., Salas, E., Stout, R., Bowers, C., & Cannon-Bowers, J. (2003). Measuring team knowledge: A window to the cognitive underpinnings of team performance. *Group Dynamics: Theory, Research, and Practice*, 7(3), 179-199. doi:10.1037/1089-2699.7.3.179
- Cramton, C. D. (2001). The Mutual Knowledge Problem and Its Consequences for Dispersed Collaboration. *Organization Science*, 12(3), 346-371. Retrieved from <http://www.jstor.org/stable/3086013>
- De Dreu, C. K. W., Nijstad, B. A., Bechtoldt, M. N., & Baas, M. (2011). Group Creativity and Innovation: A Motivated Information Processing Perspective. *Psychology of Aesthetics Creativity and the Arts*, 5(1), 81-89. doi:10.1037/a0017986
- DeChurch, L. A., & Mesmer-Magnus, J. R. (2010a). The Cognitive Underpinnings of Effective Teamwork: A Meta-Analysis. *Journal of Applied Psychology*, 95(1), 32-53. doi:10.1037/a0017328
- DeChurch, L. A., & Mesmer-Magnus, J. R. (2010b). Measuring Shared Team Mental Models: A Meta-Analysis. *Group Dynamics-Theory Research and Practice*, 14(1), 1-14. doi:10.1037/a0017455
- Deci, E. L., & Ryan, R. M. (2008). Self-determination theory: A macrotheory of human motivation, development, and health. *Canadian Psychology/Psychologie canadienne*, 49(3), 182-185. doi:10.1037/a0012801
- DeShon, R. P., Kozlowski, S. W. J., Schmidt, A. M., Milner, K. R., & Wiechmann, D. (2004). A Multiple-Goal, Multilevel Model of Feedback Effects on the Regulation of Individual and Team Performance. *Journal of Applied Psychology*, 89(6), 1035-1056. doi:10.1037/0021-9010.89.6.1035
- Diamantopoulos, A., & Winklhofer, H. M. (2001). Index Construction with Formative Indicators: An Alternative to Scale Development. *Journal of Marketing Research*, 38(2), 269-277. doi:10.2307/1558630
- Dionne, S. D., Sayama, H., Hao, C., & Bush, B. J. (2010). The role of leadership in shared mental model convergence and team performance improvement: An agent-based computational model. *The Leadership Quarterly*, 21(6), 1035-1049. doi:<http://dx.doi.org/10.1016/j.leaqua.2010.10.007>
- Druskat, V. U., & Pescosolido, A. T. (2002). The content of effective teamwork mental models in self-managing teams: Ownership, learning and heedful interrelating. *Human Relations*, 55(3), 283. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=6465456&site=ehost-live>
- Druskat, V. U., & Wheeler, J. V. (2003). Managing from the boundary: The effective leadership of self-managing work teams. *Academy of Management Journal*, 46(4), 435-457. doi:10.2307/30040637
- Dubé, L., & Robey, D. (2009). Surviving the paradoxes of virtual teamwork. *Information Systems Journal*, 19(1), 3-30. doi:10.1111/j.1365-2575.2008.00313.x

- Edmondson, A. C., Dillon, J. R., & Roloff, K. S. (2007). 6. Three Perspectives on Team Learning Outcome Improvement, Task Mastery, and Group Process. *Academy of Management Annals*, *1*(1), 269-314. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=35980420&site=ehost-live>
- Edwards, B. D., Day, E. A., Arthur, W., Jr., & Bell, S. T. (2006). Relationships among team ability composition, team mental models, and team performance. *Journal of Applied Psychology*, *91*(3), 727-736. doi:10.1037/0021-9010.91.3.727
- Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of management review*, *14*(4), 532-550.
- Ellis, A. P., Bell, B. S., Ployhart, R. E., Hollenbeck, J. R., & Ilgen, D. R. (2005). An evaluation of generic teamwork skills training with action teams: Effects on cognitive and skill-based outcomes. *Personnel Psychology*, *58*(3), 641-672.
- Enders, C. K., & Tofighi, D. (2007). Centering predictor variables in cross-sectional multilevel models: A new look at an old issue. *Psychological Methods*, *12*(2), 121-138. doi:10.1037/1082-989X.12.2.121, 10.1037
- Espevik, R., Johnsen, B. H., & Eid, J. (2011). Outcomes of Shared Mental Models of Team Members in Cross Training and High-Intensity Simulations. *Journal of Cognitive Engineering and Decision Making*, *5*(4), 352-377. doi:10.1177/1555343411424695
- Espevik, R., & Olsen, O. K. (2013). A new model for understanding teamwork onboard: the shipmate model. *International maritime health*, *64*(2), 89-94.
- Espinosa, J. A., & Clark, M. A. (2014). Team Knowledge Representation: A Network Perspective. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, *56*(2), 333-348. doi:10.1177/0018720813494093
- Falk, C. F., & Biesanz, J. C. (2016). Two Cross-Platform Programs for Inferences and Interval Estimation About Indirect Effects in Mediational Models. *SAGE Open*, *6*(1). doi:10.1177/2158244015625445
- Faraj, S., & Xiao, Y. (2006). Coordination in Fast-Response Organizations. *Management Science*, *52*(8), 1155-1169. doi:10.1287/mnsc.1060.0526
- Field, A. (2005). *Discovering statistics using SPSS: (and sex, drugs and rock 'n 'roll)*. London: Sage.
- Fiske, S. T., & Taylor, S. E. (2013). *Social cognition : from brains to culture* (2nd ed. ed.). Los Angeles: SAGE.
- Foltz, P. W., & Martin, M. J. (2012). Automated communication analysis of teams. In E. salas, G. F. Goodwin, & S. C. Burke (Eds.), *Team effectiveness in complex organizations; Cross-disciplinary perspectives and approaches*. New York: Routledge.
- Fritz, C., Lam, C. F., & Spreitzer, G. M. (2011). It's the Little Things That Matter: An Examination of Knowledge Workers' Energy Management. *Academy of Management Perspectives*, *25*(3), 28-39. doi:10.5465/AMP.2011.63886528
- Fuster, J. n. M. (1997). Network memory. *Trends in neurosciences*, *20*(10), 451-459.
- Gentner, D., & Markman, A. B. (1997). Structure mapping in analogy and similarity. *American Psychologist*, *52*(1), 45-56. doi:10.1037/0003-066X.52.1.45
- Gigone, D., & Hastie, R. (1993). The common knowledge effect: Information sharing and group judgment. *Journal of Personality and Social Psychology*, *65*(5), 959-974. doi:10.1037/0022-3514.65.5.959
- Gioia, D. A., & Chittipeddi, K. (1991). Sensemaking and sensegiving in strategic change initiation. *Strategic Management Journal*, *12*(6), 433-448. doi:10.1002/smj.4250120604

- Goldstein, J. (1999). Emergence as a Construct: History and Issues. *Emergence*, 1(1), 49. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=3180006&site=ehost-live>
- Grant, A. M. (2008). Does intrinsic motivation fuel the prosocial fire? Motivational synergy in predicting persistence, performance, and productivity. *Journal of Applied Psychology*, 93(1), 48-58. doi:10.1037/0021-9010.93.1.48
- Grant, A. M., & Berry, J. W. (2011). The Necessity of Others is the Mother of Invention: Intrinsic and Prosocial Motivations, Perspective Taking, and Creativity. *Academy of Management Journal*, 54(1), 73-96. doi:10.5465/AMJ.2011.59215085
- Gross, N., & Kluge, A. (2012). "Why should I share what I know?" -Antecedents for enhancing knowledge-sharing behavior and its impact on shared mental models in steel production. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, 56(1), 403-407. doi:10.1177/1071181312561091
- Gurtner, A., Tschan, F., Semmer, N. K., & Nägele, C. (2007). Getting groups to develop good strategies: Effects of reflexivity interventions on team process, team performance, and shared mental models. *Organizational Behavior and Human Decision Processes*, 102(2), 127-142. doi:<http://dx.doi.org/10.1016/j.obhdp.2006.05.002>
- Hackman, J. R. (1987). The design of work teams. In J. W. Lorsch (Ed.), *Handbook of Organizational Behavior* (pp. 315-342). Englewood Cliffs, NJ: Prentice Hall.
- Hackman, R. J. (2009) *Why teams don't work/Interviewer: D. Coutu*. Collaboration (Vol May 2009), Harvard Business Review.
- Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a Silver Bullet. *Journal of Marketing Theory and Practice*, 19(2), 139-152. doi:10.2753/MTP1069-6679190202
- Hair, J. F., Sarstedt, M., Pieper, T. M., & Ringle, C. M. (2012). The Use of Partial Least Squares Structural Equation Modeling in Strategic Management Research: A Review of Past Practices and Recommendations for Future Applications. *Long Range Planning*, 45(5-6), 320-340. doi:<http://dx.doi.org/10.1016/j.lrp.2012.09.008>
- Hart, S. G., & Staveland, L. E. (1988). Development of NASA-TLX (Task Load Index): Results of empirical and theoretical research. In H. P. & N. Meshkati (Eds.), *Human mental workload* (pp. 139-183). Amsterdam: North Holland.
- Harvey, S. (2015). When Accuracy Isn't Everything: The Value of Demographic Differences to Information Elaboration in Teams. *Group & Organization Management*, 40(1), 35-61. doi:10.1177/1059601114561786
- Hayes, A. F. (2009). Beyond Baron and Kenny: Statistical Mediation Analysis in the New Millennium. *Communication Monographs*, 76(4), 408-420. doi:10.1080/03637750903310360
- Healey, M. P., Vuori, T., & Hodgkinson, G. P. (2015). When teams agree while disagreeing: Reflexion and reflection in shared cognition. *Academy of Management Review*, 40(3), 399-422. doi:10.5465/amr.2013.0154
- Heck, R. H., & Thomas, S. L. (2015). *An Introduction to Multilevel Modeling Techniques: MLM and SEM Approaches Using Mplus* (Vol. 3). New York: Routledge, Taylor & Francis.
- Henry, R. A. (1995). Improving Group Judgment Accuracy: Information Sharing and Determining the Best Member. *Organizational Behavior and Human Decision Processes*, 62(2), 190-197. doi:<http://dx.doi.org/10.1006/obhd.1995.1042>
- Hinsz, V. B., Tindale, R. S., & Vollrath, D. A. (1997). The emerging conceptualization of groups as information processors. *Psychological Bulletin*, 121(1), 43-64. doi:10.1037/0033-2909.121.1.43

- Hobfoll, S. E. (1998). *Stress, culture, and community : the psychology and philosophy of stress*. New York: Plenum Press.
- Hoffman, R. R., Shadbolt, N. R., Burton, A. M., & Klein, G. (1995). Eliciting Knowledge from Experts: A Methodological Analysis. *Organizational Behavior and Human Decision Processes*, 62(2), 129-158. doi:<http://dx.doi.org/10.1006/obhd.1995.1039>
- Hollenbeck, J. R., Colquitt, J. A., Ilgen, D. R., LePine, J. A., & Hedlund, J. (1998). Accuracy decomposition and team decision making: Testing theoretical boundary conditions. *Journal of Applied Psychology*, 83(3), 494-500. doi:10.1037/0021-9010.83.3.494
- Hollenbeck, J. R., Ilgen, D. R., Sego, D. J., Hedlund, J., Major, D. A., & Phillips, J. (1995). Multilevel theory of team decision making: Decision performance in teams incorporating distributed expertise. *Journal of Applied Psychology*, 80(2), 292-316. doi:10.1037/0021-9010.80.2.292
- Hollenbeck, J. R., Moon, H., Ellis, A. P. J., West, B. J., Ilgen, D. R., Sheppard, L., . . . Wagner, J. A., III. (2002). Structural contingency theory and individual differences: Examination of external and internal person-team fit. *Journal of Applied Psychology*, 87(3), 599-606. doi:10.1037/0021-9010.87.3.599
- Huczynski, A. A., & Buchanan, D. A. (2013). *Organizational behaviour*. Harlow, England: Pearson.
- Human, L. J., Biesanz, J. C., Parisotto, K. L., & Dunn, E. W. (2012). Your Best Self Helps Reveal Your True Self: Positive Self-Presentation Leads to More Accurate Personality Impressions. *Social Psychological and Personality Science*, 3(1), 23-30. doi:10.1177/1948550611407689
- Humborstad, S. I. W., & Giessner, S. R. (2015). The Thin Line Between Empowering and Laissez-Faire Leadership: An Expectancy-Match Perspective. *Journal of Management*. doi:10.1177/0149206315574597
- Ilgen, D. R., Hollenbeck, J. R., Johnson, M., & Jundt, D. (2005). Teams in organizations: From input-process-output models to imoi models. *Annual Review of Psychology*, 56(1), 517-543. doi:10.1146/annurev.psych.56.091103.070250
- James, L. R., Demaree, R. G., & Wolf, G. (1984). Estimating within-group interrater reliability with and without response bias. *Journal of Applied Psychology*, 69(1), 85-98. doi:10.1037/0021-9010.69.1.85
- Janiszewski, C., & Wyer Jr, R. S. (2014). Content and process priming: A review. *Journal of Consumer Psychology*, 24(1), 96-118. doi:<http://dx.doi.org/10.1016/j.jcps.2013.05.006>
- Kanfer, R., & Ackerman, P. L. (1989). Motivation and cognitive abilities: An integrative/aptitude-treatment interaction approach to skill acquisition. *Journal of Applied Psychology*, 74(4), 657-690. doi:10.1037/0021-9010.74.4.657
- Karau, S. J., & Kelly, J. R. (1992). The effects of time scarcity and time abundance on group performance quality and interaction process. *Journal of Experimental Social Psychology*, 28(6), 542-571. doi:[http://dx.doi.org/10.1016/0022-1031\(92\)90045-L](http://dx.doi.org/10.1016/0022-1031(92)90045-L)
- Katz, A., & Te'eni, D. (2007). The Contingent Impact of Contextualization on Computer-Mediated Collaboration. *Organization Science*, 18(2), 261-279. doi:doi:10.1287/orsc.1060.0237
- Kay, A. C., Wheeler, S. C., Bargh, J. A., & Ross, L. (2004). Material priming: The influence of mundane physical objects on situational construal and competitive behavioral choice. *Organizational Behavior and Human Decision Processes*, 95(1), 83-96. doi:<http://dx.doi.org/10.1016/j.obhdp.2004.06.003>
- Kellermanns, F. W., Floyd, S. W., Pearson, A. W., & Spencer, B. (2008). The contingent effect of constructive confrontation on the relationship between shared mental models and decision quality. *Journal of Organizational Behavior*, 29(1), 119-137. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=27818622&site=ehost-live>

- Kelly, J. R., & Loving, T. J. (2004). Time pressure and group performance: Exploring underlying processes in the Attentional Focus Model. *Journal of Experimental Social Psychology, 40*(2), 185-198. doi:[http://dx.doi.org/10.1016/S0022-1031\(03\)00094-5](http://dx.doi.org/10.1016/S0022-1031(03)00094-5)
- Kenny, D. A., Korchmaros, J. D., & Bolger, N. (2003). Lower level mediation in multilevel models. *Psychological Methods, 8*(2), 115-128. doi:10.1037/1082-989X.8.2.115
- Kerlinger, F. N. (1986). *Foundations of behavioral research*. New York: Holt, Rinehart and Winston.
- Kleingeld, A., van Mierlo, H., & Arends, L. (2011). The effect of goal setting on group performance: A meta-analysis. *Journal of Applied Psychology, 96*(6), 1289-1304. doi:10.1037/a0024315
- Klimoski, R., & Mohammed, S. (1994). Team Mental Model: Construct or Metaphor? *Journal of Management, 20*(2), 403. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=9512136550&site=ehost-live>
- Konradt, U., Schippers, M. C., Garbers, Y., & Steenfatt, C. (2015). Effects of guided reflexivity and team feedback on team performance improvement: The role of team regulatory processes and cognitive emergent states. *European Journal of Work and Organizational Psychology, 24*(5), 777-795. doi:10.1080/1359432X.2015.1005608
- Korb, W., Geißler, N., & Strauß, G. (2015). Solving challenges in inter- and trans-disciplinary working teams: Lessons from the surgical technology field. *Artificial Intelligence in Medicine, 63*(3), 209-219. doi:<http://dx.doi.org/10.1016/j.artmed.2015.02.001>
- Kozlowski, S. W., Gully, S. M., McHugh, P. P., Salas, E., & Cannon-Bowers, J. A. (1996). A dynamic theory of leadership and team effectiveness: Developmental and task contingent leader roles. *Research in personnel and human resources management, 14*, 253-306.
- Kozlowski, S. W. J. (2015). Advancing research on team process dynamics: Theoretical, methodological, and measurement considerations. *Organizational Psychology Review, 5*(4), 270-299. doi:10.1177/2041386614533586
- Kozlowski, S. W. J., & Chao, G. T. (2012). The dynamics of emergence: cognition and cohesion in work teams. *Managerial and Decision Economics, 33*(5-6), 335-354.
- Kozlowski, S. W. J., Chao, G. T., Grand, J. A., Braun, M. T., & Kuljanin, G. (2013). Advancing Multilevel Research Design: Capturing the Dynamics of Emergence. *Organizational Research Methods, 16*(4), 581-615. doi:10.1177/1094428113493119
- Kozlowski, S. W. J., & DeShon, R. P. (2004). A psychological fidelity approach to simulation-based training: Theory, research, and principles. In E. Salas, L. R. Elliot, S. G. Schflett, & M. D. Coovert (Eds.), *Scaled worlds: Development, validation, and applications* (pp. 75-99). Burlington, VT: Ashgate Publishing.
- Kozlowski, S. W. J., & Ilgen, D. R. (2006). Enhancing the Effectiveness of Work Groups and Teams. *Psychological Science in the Public Interest, 7*(3), 77-124. doi:10.1111/j.1529-1006.2006.00030.x
- Kozlowski, S. W. J., & Klein, K. J. (2000). *Multilevel theory, research, and methods in organizations: foundations, extensions, and new directions*. San Francisco, Calif.: Jossey-Bass.
- Kruger, A. C. (1993). Peer collaboration: conflict, cooperation, or both? *Social Development, 2*(3), 165-182. doi:10.1111/j.1467-9507.1993.tb00012.x
- Krull, J. L., & MacKinnon, D. P. (2001). Multilevel Modeling of Individual and Group Level Mediated Effects. *Multivariate Behavioral Research, 36*(2), 249-277. doi:10.1207/S15327906MBR3602_06
- Lachowicz, M. J., Sterba, S. K., & Preacher, K. J. (2015). Investigating multilevel mediation with fully or partially nested data. *Group Processes & Intergroup Relations, 18*(3), 274-289. doi:10.1177/1368430214550343

- Langfred, C. W. (2004). Too Much of a Good Thing? Negative Effects of High Trust and Individual Autonomy in Self-Managing Teams. *Academy of Management Journal*, 47(3), 385-399. doi:10.2307/20159588
- LeBreton, J. M., James, L. R., & Lindell, M. K. (2005). Recent Issues Regarding rWG, rWG, rWG(J), and rWG(J). *Organizational Research Methods*, 8(1), 128-138. doi:10.1177/1094428104272181
- LeBreton, J. M., & Senter, J. L. (2008). Answers to 20 Questions About Interrater Reliability and Interrater Agreement. *Organizational Research Methods*, 11(4), 815-852. doi:10.1177/1094428106296642
- LePine, J. A., Piccolo, R. F., Jackson, C. L., Mathieu, J. E., & Saul, J. R. (2008). A meta-analysis of teamwork processes: Tests of a multidimensional model and relationships with team effectiveness criteria. *Personnel Psychology*, 61(2), 273-307. doi:10.1111/j.1744-6570.2008.00114.x
- Levesque, L. L., Wilson, J. M., & Wholey, D. R. (2001). Cognitive divergence and shared mental models in software development project teams. *Journal of Organizational Behavior*, 22(2), 135-144. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=5524976&site=ehost-live>
- Levi, D. (2011). *Group dynamics for teams*. Los Angeles: SAGE.
- Levine, J. M., & Moreland, R. L. (1999). Knowledge transmission in work groups: Helping newcomers to succeed. In L. L. Thompson, J. M. Levine, & D. M. Messick (Eds.), *Shared Cognition in Organizations: The Management of Knowledge* (pp. 267-298). London: Lawrence Erlbaum Associates.
- Levy, O. (2005). The influence of top management team attention patterns on global strategic posture of firms. *Journal of Organizational Behavior*, 26(7), 797-819. doi:10.1002/job.340
- Lim, B.-C., & Klein, K. J. (2006). Team mental models and team performance: a field study of the effects of team mental model similarity and accuracy. *Journal of Organizational Behavior*, 27(4), 403-418. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=20786121&site=ehost-live>
- Lindell, M. K., Brandt, C. J., & Whitney, D. J. (1999). A Revised Index of Interrater Agreement for Multi-Item Ratings of a Single Target. *Applied Psychological Measurement*, 23(2), 127-135. doi:10.1177/01466219922031257
- Liu, S., Hu, J., Li, Y., Wang, Z., & Lin, X. (2014). Examining the cross-level relationship between shared leadership and learning in teams: Evidence from China. *The Leadership Quarterly*, 25(2), 282-295. doi:<http://dx.doi.org/10.1016/j.leaqua.2013.08.006>
- Locke, E. A. (1996). Motivation through conscious goal setting. *Applied and Preventive Psychology*, 5(2), 117-124.
- Locke, E. A., & Latham, G. P. (2013). *New developments in goal setting and task performance*. New York: Routledge.
- Luo, W., & Azen, R. (2013). Determining Predictor Importance in Hierarchical Linear Models Using Dominance Analysis. *Journal of Educational and Behavioral Statistics*, 38(1), 3-31. doi:10.3102/1076998612458319
- Lutz, S. T., & Huitt, W. G. (2003). *Information processing and memory: Theory and Applications. Educational Psychology Interactive*.
- Lüdtke, O., Marsh, H. W., Robitzsch, A., Trautwein, U., Asparouhov, T., & Muthén, B. (2008). The multilevel latent covariate model: A new, more reliable approach to group-level effects in contextual studies. *Psychological Methods*, 13(3), 203-229. doi:10.1037/a0012869
- 10.1037/a0012869.supp (Supplemental)

- MacKinnon, D. P., Lockwood, C. M., Hoffman, J. M., West, S. G., & Sheets, V. (2002). A Comparison of Methods to Test Mediation and Other Intervening Variable Effects. *Psychological methods*, 7(1), 83. Retrieved from <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2819363/>
- Marks, M. A., Mathieu, J. E., & Zaccaro, S. J. (2001). A Temporally Based Framework and Taxonomy of Team Processes. *The Academy of Management Review*, 26(3), 356-376. doi:10.2307/259182
- Marks, M. A., & Panzer, F. J. (2004). The Influence of Team Monitoring on Team Processes and Performance. *Human Performance*, 17(1), 25-41. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=12286774&site=ehost-live>
- Marks, M. A., Zaccaro, S. J., & Mathieu, J. E. (2000). Performance implications of leader briefings and team-interaction training for team adaptation to novel environments. *Journal of Applied Psychology*, 85(6), 971-986. doi:10.1037/0021-9010.85.6.971
- Marsh, H. W., Lüdtke, O., Robitzsch, A., Trautwein, U., Asparouhov, T., Muthén, B., & Nagengast, B. (2009). Doubly-Latent Models of School Contextual Effects: Integrating Multilevel and Structural Equation Approaches to Control Measurement and Sampling Error. *Multivariate Behavioral Research*, 44(6), 764-802. doi:10.1080/00273170903333665
- Marshall, N. (2008). Cognitive and Practice-based Theories of Organizational Knowledge and Learning: Incompatible or Complementary? *Management Learning*, 39(4), 413-435. doi:10.1177/1350507608093712
- Mathieu, J., Maynard, M. T., Rapp, T., & Gilson, L. (2008). Team Effectiveness 1997-2007: A Review of Recent Advancements and a Glimpse Into the Future. *Journal of Management*, 34(3), 410-476. doi:10.1177/0149206308316061
- Mathieu, J. E., DeShon, R. P., & Bergh, D. D. (2008). Mediation Inferences in Organizational Research: Then, Now, and Beyond. *Organizational Research Methods*, 11(2), 203-223. doi:10.1177/1094428107310089
- Mathieu, J. E., Heffner, T. S., Goodwin, G. F., Cannon-Bowers, J. A., & Salas, E. (2005). Scaling the quality of teammates' mental models: equifinality and normative comparisons. *Journal of Organizational Behavior*, 26(1), 37-56. doi:10.1002/job.296
- Mathieu, J. E., Heffner, T. S., Goodwin, G. F., Salas, E., & Cannon-Bowers, J. A. (2000). The influence of shared mental models on team process and performance. *Journal of Applied Psychology*, 85(2), 273-283. doi:10.1037/0021-9010.85.2.273
- Mathieu, J. E., Rapp, T. L., Maynard, M. T., & Mangos, P. M. (2009). Interactive Effects of Team and Task Shared Mental Models as Related to Air Traffic Controllers' Collective Efficacy and Effectiveness. *Human Performance*, 23(1), 22-40. doi:10.1080/08959280903400150
- Mathieu, J. E., Rapp, T. L., Maynard, T. M., & Mangos, P. M. (2010). Interactive Effects of Team and Task Shared Mental Models as Related to Air Traffic Controllers' Collective Efficacy and Effectiveness. *Human Performance*, 23(1), 22-40. doi:10.1080/08959280903400150
- Mathieu, J. E., Tannenbaum, S. I., Donsbach, J. S., & Alliger, G. M. (2014). A Review and Integration of Team Composition Models: Moving Toward a Dynamic and Temporal Framework. *Journal of Management*, 40(1), 130-160. doi:10.1177/0149206313503014
- Mathieu, J. E., & Taylor, S. R. (2006). Clarifying conditions and decision points for mediational type inferences in Organizational Behavior. *Journal of Organizational Behavior*, 27(8), 1031-1056. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=22930111&site=ehost-live>
- Maynard, M. T., & Gilson, L. L. (2013). The Role of Shared Mental Model Development in Understanding Virtual Team Effectiveness. *Group & Organization Management*. doi:10.1177/1059601113475361

- McCoach, B. D. (2010). Hierarchical Linear Modelling. In G. Hancock & R. Mueller (Eds.), *The Reviewer's Guide to Quantitative Methods in the Social Sciences* (pp. 123-140). New York: Taylor & Francis.
- McComb, S. A. (2007). Mental model convergence: The shift from being an individual to being a team member. *Research in Multi Level Issues*, 6, 95-147.
- McIntyre, H. H., & Foti, R. J. (2013). The impact of shared leadership on teamwork mental models and performance in self-directed teams. *Group Processes & Intergroup Relations*, 16(1), 46-57. doi:10.1177/1368430211422923
- Mesmer-Magnus, J. R., & DeChurch, L. A. (2009). Information sharing and team performance: A meta-analysis. *Journal of Applied Psychology*, 94(2), 535-546. doi:10.1037/a0013773
- Mohammed, S., & Dumville, B. C. (2001). Team mental models in a team knowledge framework: expanding theory and measurement across disciplinary boundaries. *Journal of Organizational Behavior*, 22(2), 89-106. doi:10.1002/job.86
- Mohammed, S., Ferzandi, L., & Hamilton, K. (2010). Metaphor No More: A 15-Year Review of the Team Mental Model Construct. *Journal of Management*, 36(4), 876-910. doi:10.1177/0149206309356804
- Mohammed, S., & Hamilton, K. (2012). Studying team cognition: The good, the bad, and the practical. In A. Hollingshead & M. S. Poole (Eds.), *Research Methods for Studying Groups* (pp. 132-153). New York: Taylor and Francis.
- Mohammed, S., Klimoski, R., & Rentsch, J. R. (2000). The Measurement of Team Mental Models: We Have No Shared Schema. *Organizational Research Methods*, 3(2), 123. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=4594448&site=ehost-live>
- Molden, D. C. (2014). Understanding Priming Effects in Social Psychology: An Overview and Integration. *Social Cognition*, 32(Supplement), 243-249. doi:10.1521/soco.2014.32.supp.243
- Mortensen, M., & Hinds, P. J. (2001). Conflict and shared identity in geographically distributed teams. *International Journal of Conflict Management*, 12(3), 212-238. doi:doi:10.1108/eb022856
- Muthén, L. K., & Muthén, B. O. (1998-2012). *Mplus user's guide* (7th ed.). Los Angeles, CA: Muthén & Muthén.
- Nam, C. S., Lyons, J. B., Hwang, H.-S., & Kim, S. (2009). The process of team communication in multi-cultural contexts: An empirical study using Bales' interaction process analysis (IPA). *International Journal of Industrial Ergonomics*, 39(5), 771-782. doi:<http://dx.doi.org/10.1016/j.ergon.2009.03.004>
- Nicolaides, V. C., LaPort, K. A., Chen, T. R., Tomassetti, A. J., Weis, E. J., Zaccaro, S. J., & Cortina, J. M. (2014). The shared leadership of teams: A meta-analysis of proximal, distal, and moderating relationships. *The Leadership Quarterly*, 25(5), 923-942. doi:<http://dx.doi.org/10.1016/j.leafqua.2014.06.006>
- Noe, R. A., Clarke, A. D. M., & Klein, H. J. (2014). Learning in the Twenty-First-Century Workplace. *Annual Review of Organizational Psychology and Organizational Behavior*, Vol 1, 1, 245-275. doi:10.1146/annurev-orgpsych-031413-091321
- Oppenheimer, D. M., & Kelso, E. (2015). Information Processing as a Paradigm for Decision Making. *Annual Review of Psychology*, 66(1), 277-294. doi:doi:10.1146/annurev-psych-010814-015148
- Oppenheimer, D. M., Meyvis, T., & Davidenko, N. (2009). Instructional manipulation checks: Detecting satisficing to increase statistical power. *Journal of Experimental Social Psychology*, 45(4), 867-872. doi:<http://dx.doi.org/10.1016/j.jesp.2009.03.009>
- Orasanu, J., & Salas, E. (1993). Team decision making in complex environments. In G. A. Klein, R. Calderwood, & C. Zsombok (Eds.), *Decision making in action: models and methods* (pp. 327-345). Norwood, N.J.: Ablex Pub.

- Patrashkova-Volzdoska, R. R., McComb, S. A., Green, S. G., & Compton, D. W. (2003). Examining a curvilinear relationship between communication frequency and team performance in cross-functional project teams. *IEEE Transactions on Engineering Management*, 50(3), 262-269. doi:10.1109/TEM.2003.817298
- Pearsall, M. J., & Ellis, A. P. J. (2006). The Effects of Critical Team Member Assertiveness on Team Performance and Satisfaction. *Journal of Management*, 32(4), 575-594. doi:10.1177/0149206306289099
- Phelps, C., Heidl, R., & Wadhwa, A. (2012). Knowledge, Networks, and Knowledge Networks: A Review and Research Agenda. *Journal of Management*, 38(4), 1115-1166. doi:10.1177/0149206311432640
- Pitariu, A. H. (2007). *Monitoring in teams*. (3280349 Ph.D.), University of South Carolina, Ann Arbor. Retrieved from <https://ezproxy.library.bi.no/login?url=http://search.proquest.com/docview/304808703?accountid=142923>, http://95.172.89.218/bi?url_ver=Z39.88-2004&rft_val_fmt=info:ofi/fmt:kev:mtx:dissertation&genre=dissertations+%26+theses&sid=ProQ:ABI%2FINFORM+Global&atitle=&title=Monitoring+in+teams&issn=&date=2007-01-01&volume=&issue=&spage=&au=Pitariu%2C+Adrian+H.&isbn=9780549212065&jtitle=&bttitle=&rft_id=info:eric/&rft_id=info:doi/ ABI/INFORM Complete database.
- Porter, C. O. L. H., Hollenbeck, J. R., Ilgen, D. R., Ellis, A. P. J., West, B. J., & Moon, H. (2003). Backing up behaviors in teams: The role of personality and legitimacy of need. *Journal of Applied Psychology*, 88(3), 391-403. doi:10.1037/0021-9010.88.3.391
- Porter, C. O. L. H., Itir Gogus, C., & Yu, R. C.-F. (2010). When Does Teamwork Translate Into Improved Team Performance? A Resource Allocation Perspective. *Small Group Research*, 41(2), 221-248. doi:10.1177/1046496409356319
- Porter, C. O. L. H., Itir Gogus, C., & Yu, R. C.-F. (2011). Does Backing Up Behavior Explain the Efficacy—Performance Relationship in Teams? *Small Group Research*, 42(4), 458-474. doi:10.1177/1046496410390964
- Preacher, K. J., Zhang, Z., & Zyphur, M. J. (2011). Alternative methods for assessing mediation in multilevel data: The advantages of multilevel SEM. *Structural Equation Modeling*, 18(2), 161-182.
- Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models : applications and data analysis methods* (2nd ed. ed. Vol. 1). Thousand Oaks: Sage Publications.
- Rentsch, J. R., & Davenport, S. W. (2006). Sporting a new view: Team member schema similarity in sports. *International Journal of Sport and Exercise Psychology*, 4(4), 401-421. doi:10.1080/1612197X.2006.9671805
- Rentsch, J. R., Delise, L. A., & Hutchison, S. (2012). Cognitive similarity configurations in teams : in search of the Team MindMeld TM. In E. Salas, G. F. Goodwin, & C. S. Burke (Eds.), *Team effectiveness in complex organizations : cross-disciplinary perspectives and approaches* (pp. 241-266). New York: Routledge.
- Rentsch, J. R., & Klimoski, R. J. (2001). Why do 'great minds' think alike?: antecedents of team member schema agreement. *Journal of Organizational Behavior*, 22(2), 107-120. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=5524974&site=ehost-live>
- Reports, N. O. (2000). *The grounding of fast coastal passenger MS Sleipner grounding 26 November 1999*. In M. o. J. a. t. Police (Series Ed.) N. O. Reports (Ed.) (pp. 31).
- Resick, C. J., Mitchelson, J. K., Dickson, M. W., Allison, L. K., & Clark, M. A. (2010). Team Composition, Cognition, and Effectiveness: Examining Mental Model Similarity and Accuracy. *Group Dynamics-Theory Research and Practice*, 14(2), 174-191. doi:10.1037/a0018444

- Resick, C. J., Murase, T., Randall, K. R., & DeChurch, L. A. (2014). Information elaboration and team performance: Examining the psychological origins and environmental contingencies. *Organizational Behavior and Human Decision Processes*, 124(2), 165-176. doi:<http://dx.doi.org/10.1016/j.obhdp.2014.03.005>
- Rico, R., Alcover, C.-M., Sánchez-Manzanares, M., & Gil, F. (2009). The joint relationships of communication behaviors and task interdependence on trust building and change in virtual project teams. *Social Science Information*, 48(2), 229-255. doi:10.1177/0539018409102410
- Rico, R., Sánchez-Manzanares, M., Gil, F., & Gibson, C. (2008). Team implicit coordination processes: A team knowledge-based approach. *Academy of Management Review*, 33(1), 163-184. doi:10.5465/AMR.2008.27751276
- Ringle, C. M., Wende, S., & Becker, J.-M. (2015). SmartPLS (Version 3.0). Hamburg: SmartPLS. Retrieved from www.smartpls.com
- Rogers, T. T., & McClelland, J. L. (2014). Parallel Distributed Processing at 25: Further Explorations in the Microstructure of Cognition. *Cognitive Science*, 38(6), 1024-1077. doi:10.1111/cogs.12148
- Rogoff, B. (1991). Social interaction as apprenticeship in thinking: Guided participation in spatial planning. In L. B. Resnick, J. M. Levine, & S. D. Teasley (Eds.), *Perspectives on socially shared cognition* (pp. 349-364). Washington, D.C.: American Psychological Association.
- Rouse, W. B., & Morris, N. M. (1986). On looking into the black box: Prospects and limits in the search for mental models. *Psychological Bulletin*, 100(3), 349-363. doi:10.1037/0033-2909.100.3.349
- Rousseau, V., Aubé, C., & Savoie, A. (2006). Teamwork Behaviors: A Review and an Integration of Frameworks. *Small Group Research*, 37(5), 540-570. doi:10.1177/1046496406293125
- Rumelhart, D. E., & McClelland, J. L. (1986). *Parallel distributed processing: explorations in the microstructure of cognition, Psychological and biological models* (Vol. 2). Cambridge, MA: MIT Press.
- Salas, E., Cooke, N. J., & Gorman, J. C. (2010). The Science of Team Performance: Progress and the Need for More. . . *Human Factors: The Journal of the Human Factors and Ergonomics Society*, 52(2), 344-346. doi:10.1177/0018720810374614
- Salas, E., Cooke, N. J., & Rosen, M. A. (2008). On teams, teamwork, and team performance: Discoveries and developments. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, 50(3), 540-547.
- Salas, E., Rosen, M. A., Burke, C. S., & Goodwin, G. F. (2009). The wisdom of collectives in organizations: an update of the teamwork competencies. In E. Salas, G. F. Goodwin, & C. S. Burke (Eds.), *Team effectiveness in complex organizations: cross-disciplinary perspectives and approaches* (pp. 39-79). New York: Routledge.
- Salas, E., Shuffler, M. L., Thayer, A. L., Bedwell, W. L., & Lazzara, E. H. (2015). Understanding and Improving Teamwork in Organizations: A Scientifically Based Practical Guide. *Human Resource Management*, 54(4), 599-622. doi:10.1002/hrm.21628
- Salas, E., Sims, D. E., & Burke, C. S. (2005). Is there a "Big Five" in Teamwork? *Small Group Research*, 36(5), 555-599. doi:10.1177/1046496405277134
- Sander, P. C., van Doorn, R. R. A., van der Pal, J., & Zijlstra, F. R. H. (2015). Team adaptation to an unforeseen system failure: Limits of the potential aids of shared knowledge and standardized communication. *European Journal of Work and Organizational Psychology*, 24(5), 796-811. doi:10.1080/1359432X.2015.1006199
- Sarason, I. G., Pierce, G. R., & Sarason, B. R. (1996). *Cognitive interference : theories, methods, and findings*. Mahwah, N.J: Lawrence Erlbaum.

- Sarason, I. G., Pierce, G. R., & Sarason, B. R. (2014). *Cognitive interference: Theories, methods, and findings*: Routledge.
- Sarstedt, M., Ringle, C. M., Smith, D., Reams, R., & Hair Jr, J. F. (2014). Partial least squares structural equation modeling (PLS-SEM): A useful tool for family business researchers. *Journal of Family Business Strategy*, 5(1), 105-115. doi:<http://dx.doi.org/10.1016/j.jfbs.2014.01.002>
- Schiebener, J., Wegmann, E., Pawlikowski, M., & Brand, M. (2014). Effects of goals on decisions under risk conditions: Goals can help to make better choices, but relatively high goals increase risk-taking. *Journal of Cognitive Psychology*, 26(4), 473-485. doi:10.1080/20445911.2014.903254
- Schultz, U., & Vandenbosch, B. (1998). Information Overload in a Groupware Environment: Now You See It, Now You Don't. *Journal of Organizational Computing and Electronic Commerce*, 8(2), 127-148. doi:10.1207/s15327744joce0802_3
- Scott, B. A., & Judge, T. A. (2006). Insomnia, Emotions, and Job Satisfaction: A Multilevel Study. *Journal of Management*, 32(5), 622-645. doi:10.1177/0149206306289762
- Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Boston: Houghton Mifflin.
- Shrout, P. E., & Fleiss, J. L. (1979). Intraclass correlations: Uses in assessing rater reliability. *Psychological Bulletin*, 86(2), 420-428. doi:10.1037/0033-2909.86.2.420
- Smith-Jentsch, K. A., Campbell, G. E., Milanovich, D. M., & Reynolds, A. M. (2001). Measuring Teamwork Mental Models to Support Training Needs Assessment, Development, and Evaluation: Two Empirical Studies. *Journal of Organizational Behavior*, 22(2), 179-194. Retrieved from <http://www.jstor.org/stable/3649590>
- Smith-Jentsch, K. A., Cannon-Bowers, J. A., Tannenbaum, S. I., & Salas, E. (2008). Guided Team Self-Correction: Impacts on Team Mental Models, Processes, and Effectiveness. *Small Group Research*, 39(3), 303-327. doi:10.1177/1046496408317794
- Smith-Jentsch, K. A., Kraiger, K., Cannon-Bowers, J. A., & Salas, E. (2009). Do Familiar Teammates Request and Accept More Backup? Transactive Memory in Air Traffic Control. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, 51(2), 181-192. doi:10.1177/0018720809335367
- Smith-Jentsch, K. A., Mathieu, J. E., & Kraiger, K. (2005). Investigating Linear and Interactive Effects of Shared Mental Models on Safety and Efficiency in a Field Setting. *Journal of Applied Psychology*, 90(3), 523-535. doi:10.1037/0021-9010.90.3.523
- Snijders, T. A. B., & Bosker, R. J. (1994). Modeled Variance in Two-Level Models. *Sociological Methods & Research*, 22(3), 342-363. doi:10.1177/0049124194022003004
- Snijders, T. A. B., & Bosker, R. J. (1999). *Multilevel analysis: an introduction to basic and advanced multilevel modeling*. London: Sage.
- Sparrow, J. (1998). *Knowledge in organizations: access to thinking at work*. London: Sage.
- Stasser, G., & Titus, W. (1985). Pooling of unshared information in group decision making: Biased information sampling during discussion. *Journal of Personality and Social Psychology*, 48(6), 1467-1478. doi:10.1037/0022-3514.48.6.1467
- Stout, R. J., Cannon-Bowers, J. A., Salas, E., & Milanovich, D. M. (1999). Planning, Shared Mental Models, and Coordinated Performance: An Empirical Link Is Established. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, 41(1), 61-71. doi:10.1518/001872099779577273
- Sullivan, L. M. (2008). Repeated Measures. *Circulation*, 117(9), 1238-1243. doi:10.1161/circulationaha.107.654350
- Sundstrom, E., de Meuse, K. P., & Futrell, D. (1990). Work teams: Applications and effectiveness. *American Psychologist*, 45(2), 120-133. doi:10.1037/0003-066X.45.2.120

- Sundstrom, E., McIntyre, M., Halfhill, T., & Richards, H. (2000). Work groups: From the Hawthorne studies to work teams of the 1990s and beyond. *Group Dynamics: Theory, Research, and Practice*, 4(1), 44-67. doi:10.1037/1089-2699.4.1.44
- Sundstrom, E. D. (1999). The challenges of supporting work team effectiveness. In E. D. Sundstrom (Ed.), *Supporting work team effectiveness : best management practices for fostering high performance* (pp. 3-23). San Francisco, Calif: Jossey-Bass
- Tajfel, H. (1982). Social Psychology of Intergroup Relations. *Annual Review of Psychology*, 33(1), 1-39. doi:doi:10.1146/annurev.ps.33.020182.000245
- Tannenbaum, S. I., Mathieu, J. E., Salas, E., & Cohen, D. (2012). Teams Are Changing: Are Research and Practice Evolving Fast Enough? *Industrial & Organizational Psychology*, 5(1), 2-24. doi:10.1111/j.1754-9434.2011.01396.x
- Thaler, R. (1985). Mental Accounting and Consumer Choice. *Marketing Science*, 4(3), 199-214. doi:doi:10.1287/mksc.4.3.199
- Thomas-Hunt, M. C., Ogden, T. Y., & Neale, M. A. (2003). Who's Really Sharing? Effects of Social and Expert Status on Knowledge Exchange Within Groups. *Management Science*, 49(4), 464-477. doi:doi:10.1287/mnsc.49.4.464.14425
- Thompson, L., & Fine, G. A. (1999). Socially Shared Cognition, Affect, and Behavior: A Review and Integration. *Personality & Social Psychology Review (Lawrence Erlbaum Associates)*, 3(4), 278. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=3181390&site=ehost-live>
- Thompson, L. L., Levine, J. M., & Messick, D. M. (1999). *Shared cognition in organizations: the management of knowledge*. Mahwah, N.J.: Lawrence Erlbaum Associates.
- Uitdewilligen, S., Waller, M. J., & Pitariu, A. H. (2013). Mental Model Updating and Team Adaptation. *Small Group Research*, 44(2), 127-158. doi:10.1177/1046496413478205
- Uitdewilligen, S., Waller, M. J., & Zijlstra, F. R. H. (2010). Team Cognition and Adaptability in Dynamic Settings: A Review of Pertinent Work *International Review of Industrial and Organizational Psychology 2010* (pp. 293-353): Wiley-Blackwell.
- van Knippenberg, D., De Dreu, C. K. W., & Homan, A. C. (2004). Work Group Diversity and Group Performance: An Integrative Model and Research Agenda. *Journal of Applied Psychology*, 89(6), 1008-1022. doi:10.1037/0021-9010.89.6.1008
- van Knippenberg, D., & Schippers, M. C. (2007). Work Group Diversity. *Annual Review of Psychology*, 58, 515-541. doi:10.1146/annurev.psych.58.110405.085546
- Van Vugt, M., De Cremer, D., & Janssen, D. P. (2007). Gender Differences in Cooperation and Competition: The Male-Warrior Hypothesis. *Psychological Science (Wiley-Blackwell)*, 18(1), 19-23. doi:10.1111/j.1467-9280.2007.01842.x
- Vashdi, D. R., Bamberger, P. A., & Erez, M. (2013). Can Surgical Teams Ever Learn? The Role of Coordination, Complexity, and Transitivity in Action Team Learning. *Academy of Management Journal*, 56(4), 945-971. doi:10.5465/amj.2010.0501
- Vogus, T. J., Rothman, N. B., Sutcliffe, K. M., & Weick, K. E. (2014). The affective foundations of high-reliability organizing. *Journal of Organizational Behavior*, 35(4), 592-596. doi:10.1002/job.1922
- Webster, J., & Wong, W. K. P. (2008). Comparing traditional and virtual group forms: identity, communication and trust in naturally occurring project teams. *The International Journal of Human Resource Management*, 19(1), 41-62. doi:10.1080/09585190701763883
- Weick, K. E., & Roberts, K. H. (1993). Collective Mind in Organizations: Heedful Interrelating on Flight Decks. *Administrative Science Quarterly*, 38(3), 357-381. doi:10.2307/2393372

- Weingart, L. R., & Cronin, M. A. (2012). Teams research in the 21st century: A case for theory consolidation. In E. Salas, G. F. Goodwin, & C. S. Burke (Eds.), *Team effectiveness in complex organizations : cross-disciplinary perspectives and approaches* (pp. 509-524). New York: Routledge.
- Wildman, J. L., Thayer, A. L., Pavlas, D., Salas, E., Stewart, J. E., & Howse, W. R. (2012). Team Knowledge Research: Emerging Trends and Critical Needs. *Human Factors*, 54(1), 84-111. doi:10.1177/0018720811425365
- Williams, K. J., Donovan, J. J., & Dodge, T. L. (2000). Self-Regulation of Performance: Goal Establishment and Goal Revision Processes in Athletes. *Human Performance*, 13(2), 159-180. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=3334615&site=ehost-live>
- Wilson, K. A., Salas, E., Priest, H. A., & Andrews, D. (2007). Errors in the Heat of Battle: Taking a Closer Look at Shared Cognition Breakdowns Through Teamwork. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, 49(2), 243-256. doi:10.1518/001872007x312478
- Wuchty, S., Jones, B. F., & Uzzi, B. (2007). The Increasing Dominance of Teams in Production of Knowledge. *Science*, 316(5827), 1036-1039. doi:10.1126/science.1136099
- Zaccaro, S. J., Rittman, A. L., & Marks, M. A. (2001). Team leadership. *The Leadership Quarterly*, 12(4), 451-483. doi:[http://dx.doi.org/10.1016/S1048-9843\(01\)00093-5](http://dx.doi.org/10.1016/S1048-9843(01)00093-5)

Series of Dissertations

The dissertations may be ordered in printed copies from BI's website:
www.bi.no/en/Research/Research-Publications/

2016

- 11/2016 *Prosper Ameh Kwei-Narh*
A mid-range theory of monitoring behaviors, shared task mental models, and team performance within dynamic settings
- 10/2016 *Anton Diachenko*
Ownership type, performance, and context: Study of institutional and industrial owners
- 9/2016 *Ranvir S. Rai*
Innovation in Practice: A Practice-Theoretical Exploration of Discontinuous Service Innovations
- 8/2016 *Gordana Abramovic*
Effective Diversity Management on the Line - Who and How? On the role of line managers in organisations with a diverse workforce
- 7/2016 *Mohammad Ejaz*
Why do some service innovations succeed while others fail? A comparative case study of managing innovation processes of two internet-based aggregation financial services at Finn.no (Penger.no)
- 6/2016 *Asmund Rygh*
Corporate governance and international business: Essays on multinational enterprises, ownership, finance and institutions
- 5/2016 *Chen Qu*
Three Essays on Game Theory and Patent-Pool Formation
- 4/2016 *Arash Aloosh*
Three Essays in International Finance
- 3/2016 *John-Erik Mathisen*
Elaborating and Implemental Mindsets in Business-related Behavior: An Investigation of the Interface between Cognition and Action. How goals and plans emerge and relate to cognition and action in business.
- 2/2015 *Øyvind Nilsen Aas*
Essays in industrial organization and search theory
- 1/2016 *Dominique Kost*
Understanding Transactive Memory Systems in Virtual Teams: The role of integration and differentiation, task dependencies and routines

2015

- 8/2015 *Andreea Mitrache*
Macroeconomic Factors and Asset Prices – An Empirical Investigation
- 7/2015 *Lene Pettersen*
Working in Tandem: A Longitudinal Study of the Interplay of Working Practices and Social Enterprise Platforms in the Multinational Workplace

- 6/2015 *Di Cui*
Three Essays on Investor Recognition and Mergers & Acquisitions
- 5/2015 *Katja Maria Hydle*
Cross border practices: Transnational Practices in Professional Service Firms
- 4/2014 *Ieva Martinkenaite-Pujanaskiene*
Evolutionary and power perspectives on headquarters-subsidiary knowledge transfer: The role of disseminative and absorptive capacities
- 3/2015 *Tarje Gaustad*
The Perils of Self-Brand Connections: Consumer Response to Changes in Brand Image
- 2/2015 *Jakob Utgård*
Organizational form, local market structure and corporate social performance in retail
- 1/2015 *Drago Bergholt*
Shocks and Transmission Channels in Multi-Sector Small Open Economies
- 2014**
- 13/2014 *Nam Huong Dau*
Asset Pricing with Heterogeneous Beliefs and Portfolio Constraints
- 12/2014 *Vegard Kolbjørnsrud*
On governance in collaborative communities
- 11/2014 *Ignacio García de Olalla López*
Essays in Corporate Finance
- 10/2014 *Sebastiano Lombardo*
Client-consultant interaction practices: Sources of ingenuity, value creation and strategizing
- 9/2014 *Leif Anders Thorsrud*
International business cycles and oil market dynamics
- 8/2014 *Ide Katrine Birkeland*
Fire Walk with Me: Exploring the Role of Harmonious and Obsessive Passion in Well-being and Performance at Work
- 7/2014 *Sinem Acar-Burkay*
Essays on relational outcomes in mixed-motive situations
- 6/2014 *Susanne H.G. Poulsson*
On Experiences as Economic Offerings
- 5/2014 *Eric Lawrence Wiik*
Functional Method as a Heuristic and Research Perspective: A Study in Systems Theory
- 4/2014 *Christian Enger Gimsø*
Narcissus and Leadership Potential - The measurement and implications of narcissism in leadership selection processes
- 3/2014 *Mehrad Moeini-Jazani*
When Power Has Its Pants Down: Social Power Increases Sensitivity to Internal Desires
- 2/2014 *Yuriy Zhovtobryukh*
The role of technology, ownership and origin in M&A performance

1/2014 *Siv Staubo*
Regulation and Corporate Board Composition

2013

9/2013 *Bjørn Tallak Bakken*
Intuition and analysis in decision making: On the relationships between cognitive style, cognitive processing, decision behaviour, and task performance in a simulated crisis management context

8/2013 *Karl Joachim Breunig*
Realizing Reticulation: A Comparative Study of Capability Dynamics in two International Professional Service Firms over 10 years

7/2013 *Junhua Zhong*
Three Essays on Empirical Asset Pricing

6/2013 *Ren Lu*
Cluster Networks and Cluster Innovations: An Empirical Study of Norwegian Centres of Expertise

5/2013 *Therese Dille*
Inter-institutional projects in time: a conceptual framework and empirical investigation

4/2013 *Thai Binh Phan*
Network Service Innovations: Users' Benefits from Improving Network Structure

3/2013 *Terje Gaustad*
Creating the Image: A Transaction Cost Analysis of Joint Value Creation in the Motion Picture Industry

2/2013 *Anna Swärd*
Trust processes in fixed-duration alliances: A multi-level, multi-dimensional, and temporal view on trust

1/2013 *Sut I Wong Humborstad*
Congruence in empowerment expectations: On subordinates' responses to disconfirmed experiences and to leaders' unawareness of their empowerment expectations

2012

9/2012 *Robert Buch*
Interdependent Social Exchange Relationships: Exploring the socially embedded nature of social exchange relationships in organizations

8/2012 *Ali Faraji-Rad*
When the message feels right: Investigating how source similarity enhances message persuasiveness

7/2012 *Marit Anti*
Commercial friendship from a customer perspective: Exploring social norm of altruism in consumer relationships and self-interest-seeking behavior

6/2012 *Birgit Helene Jevnaker*
Vestiges of Design-Creation: An inquiry into the advent of designer and enterprise relations

5/2012 *Erik Aadland*
Status decoupling and signaling boundaries: Rival market category emergence in the Norwegian advertising field, 2000-2010

- 4/2012 *Ulaş Burkay*
The Rise of Mediating Firms: The Adoption of Digital Mediating Technologies and the Consequent Re-organization of Industries
- 3/2012 *Tale Skjølstvik*
Beyond the 'trusted advisor': The impact of client-professional relationships on the client's selection of professional service firms
- 2/2012 *Karoline Hofslett Kopperud*
Well-Being at Work: On concepts, measurement, and leadership influence
- 1/2012 *Christina G. L. Nerstad*
In Pursuit of Success at Work: An Empirical Examination of the Perceived Motivational Climate, Its Outcomes and Antecedents
- 2011**
- 12/2011 *Kjell Jørgensen*
Three Articles on Market Microstructure at the Oslo Stock Exchange (OSE)
- 11/2011 *Siri Valseth*
Essays on the information content in bond market order flow
- 10/2011 *Elisabet Sørfjorddal Hauge*
How do metal musicians become entrepreneurial? A phenomenological investigation on opportunity recognition
- 9/2011 *Sturla Lyngnes Fjesme*
Initial Public Offering Allocations
- 8/2011 *Gard Paulsen*
Betwixt and between: Software in telecommunications and the programming language Chill, 1974-1999
- 7/2011 *Morten G. Josefsen*
Three essays on corporate control
- 6/2011 *Christopher Wales*
Demands, designs and decisions about evaluation: On the evaluation of postgraduate programmes for school leadership development in Norway and England
- 5/2011 *Limei Che*
Investors' performance and trading behavior on the Norwegian stock market
- 4/2011 *Caroline D Ditlev-Simonsen*
Five Perspectives on Corporate Social Responsibility (CSR): Aan empirical analysis
- 3/2011 *Atle Raa*
Fra instrumentell rasjonalitet til tvetydighet: En analyse av utviklingen av Statskonsults tilnærming til standarden Mål- og resultatstyring (MRS) 1987-2004
- 2/2011 *Anne Louise Koefoed*
Hydrogen in the making - how an energy company organises under uncertainty
- 1/2011 *Lars Erling Olsen*
Broad vs. Narrow Brand Strategies: The Effects of Association Accessibility on Brand Performance

2010

- 8/2010 *Anne Berit Swanberg*
Learning with Style: The relationships among approaches to learning, personality, group climate and academic performance
- 7/2010 *Asle Fagerstrøm*
Implications of motivating operations for understanding the point-of-online-purchase: Using functional analysis to predict and control consumer purchasing behavior
- 6/2010 *Carl J. Hatteland*
Ports as Actors in Industrial Networks
- 5/2010 *Radu-Mihai Dimitriu*
Extending where? How consumers' perception of the extension category affects brand extension evaluation
- 4/2010 *Svanhild E. Haugnes*
Consumers in Industrial Networks: a study of the Norwegian-Portuguese bacalhau network
- 3/2010 *Stine Ludvigsen*
State Ownership and Corporate Governance: Empirical Evidence from Norway and Sweden
- 2/2010 *Anders Dysvik*
An inside story – is self-determination the key? Intrinsic motivation as mediator and moderator between work and individual motivational sources and employee outcomes. Four essays
- 1/2010 *Etty Ragnhild Nilsen*
Opportunities for learning and knowledge creation in practice

2009

- 8/2009 *Erna Senkina Engebretsen*
Transportation Mode Selection in Supply Chain Planning
- 7/2009 *Stein Bjørnstad*
Shipshaped: Kongsberg industry and innovations in deepwater technology, 1975-2007
- 6/2009 *Thomas Hoholm*
The Contrary Forces of Innovation: An Ethnography of Innovation Processes *in the Food Industry*.
- 5/2009 *Christian Heyerdahl-Larsen*
Asset Pricing with Multiple Assets and Goods
- 4/2009 *Leif-Magnus Jensen*
The Role of Intermediaries in Evolving Distribution Contexts: A Study of Car Distribution
- 3/2009 *Andreas Brekke*
A Bumper? An Empirical Investigation of the Relationship between the Economy and the Environment
- 2/2009 *Monica Skjöld Johansen*
Mellom profesjon og reform: Om fremveksten og implementeringen av enhetlig ledelse i norsk sykehusvesen

1/2009 *Mona Kristin Solvoll*
Televised sport: Exploring the structuration of producing change and stability in a public service institution

2008

7/2008 *Helene Loe Colman*
Organizational Identity and Value Creation in Post-Acquisition Integration: The Spiralling Interaction of the Target's Contributive and the Acquirer's Absorptive Capacities

6/2008 *Fahad Awaleh*
Interacting Strategically within Dyadic Business Relationships: A case study from the Norwegian Electronics Industry

5/2008 *Dijana Tiplić*
Managing Organizational Change during Institutional Upheaval: Bosnia-Herzegovina's Higher Education in Transition

4/2008 *Jan Merok Paulsen*
Managing Adaptive Learning from the Middle

3/2008 *Pingying Zhang Wenstøp*
Effective Board Task Performance. Searching for Understanding into Board Failure and Success

2/2008 *Gunhild J. Ecklund*
Creating a new role for an old central bank: The Bank of Norway 1945-1954

1/2008 *Øystein Strøm*
Three essays on corporate boards

2007

6/2007 *Martha Kold Bakkevig*
The Capability to Commercialize Network Products in Telecommunication

5/2007 *Siw Marita Fosstenløy*
Enhancing Intangible Resources in Professional Service Firms. A Comparative Study of How Competence Development Takes Place in Four Firms

4/2007 *Gro Alteren*
Does Cultural Sensitivity Matter to the Maintaining of Business Relationships in the Export Markets? An empirical investigation in the Norwegian seafood industry

3/2007 *Lars C. Monkerud*
Organizing Local Democracy: The Norwegian Experience

2/2007 *Siv Marina Flø Karlsen*
The Born Global – Redefined. On the Determinants of SMEs Pace of Internationalization

1/2007 *Per Engelseth*
The Role of the Package as an Information Resource in the Supply Chain. A case study of distributing fresh foods to retailers in Norway

2006

10/2006 *Anne Live Vaagaasar*
From Tool to Actor - How a project came to orchestrate its own life and that of others

9/2006 *Kjell Brynjulf Hjertø*
The Relationship Between Intragroup Conflict, Group Size and Work Effectiveness

- 8/2006 *Taran Thune*
Formation of research collaborations between universities and firms: Towards an integrated framework of tie formation motives, processes and experiences
- 7/2006 *Lena E. Bygballe*
Learning Across Firm Boundaries. The Role of Organisational Routines
- 6/2006 *Hans Solli-Sæther*
Transplants' role stress and work performance in IT outsourcing relationships
- 5/2006 *Bjørn Hansen*
Facility based competition in telecommunications – Three essays on two-way access and one essay on three-way access
- 4/2006 *Knut Boge*
Votes Count but the Number of Seats Decides: A comparative historical case study of 20th century Danish, Swedish and Norwegian road policy
- 3/2006 *Birgitte Grøgaard*
Strategy, structure and the environment. Essays on international strategies and subsidiary roles
- 2/2006 *Sverre A. Christensen*
Switching Relations - The rise and fall of the Norwegian telecom industry
- 1/2006 *Nina Veflen Olsen*
Incremental Product Development. Four essays on activities, resources, and actors
- 2005**
- 6/2005 *Jon Erland Bonde Lervik*
Managing Matters: Transferring Organizational Practices within Multinational Companies
- 5/2005 *Tore Mysen*
Balancing Controls When Governing Agents in Established Relationships: The Influence of Performance Ambiguity
- 4/2005 *Anne Flagstad*
How Reforms Influence Organisational Practices: The Cases of Public Roads and Electricity Supply Organisations in Norway
- 3/2005 *Erlend Kvaal*
Topics in accounting for impairment of fixed asset
- 2/2005 *Amir Sasson*
On Mediation and Affiliation. A Study of Information Mediated Network Effects in The Banking Industry
- 1/2005 *Elin Kubberød*
Not just a Matter of Taste – Disgust in the Food Domain
- 2004**
- 10/2004 *Sverre Tomassen*
The Effects of Transaction Costs on the Performance of Foreign Direct Investments - An empirical investigation
- 9/2004 *Catherine Børve Monsen:*
Regulation, Ownership and Company Strategies. The Case of European Incumbent Telecommunications Operators

- 8/2004 *Johannes A. Skjeltorp*
Trading in Equity Markets: A study of Individual, Institutional and Corporate Trading Decision.
- 7/2004 *Frank Elter*
Strategizing in Complex Contexts
- 6/2004 *Qinglei Dai*
Essays on International Banking and Tax-Motivated Trading
- 5/2004 *Arne Morten Ulvnes*
Communication Strategies and the Costs of Adapting to Opportunism in an Interfirm Marketing System
- 4/2004 *Gisle Henden*
Intuition and its Role in Strategic Thinking
- 3/2004 *Haakon O. Aa. Solheim*
Essays on volatility in the foreign exchange market
- 2/2004 *Xiaoling Yao*
From Village Election to National Democratisation. An Economic-Political Microcosm Approach to Chinese Transformation
- 1/2004 *Ragnhild Silkoset*
Collective Market Orientation in Co-producing Networks
- 2003**
- 2/2003 *Egil Marstein*
The influence of stakeholder groups on organizational decision-making in public hospitals
- 1/2003 *Joyce Hartog McHenry*
Management of Knowledge in Practice. Learning to visualise competence
- 2002**
- 6/2002 *Gay Bjercke*
Business Landscapes and Mindscapes in People's Republic of China. A Study of a Sino-Scandinavian Joint Venture
- 5/2002 *Thorvald Hærem*
Task Complexity and Expertise as Determinants of Task Perceptions and Performance: Why Technology-Structure Research has been unreliable and inconclusive
- 4/2002 *Norman T. Sheehan*
Reputation as a Driver in Knowledge-Intensive Service Firms:
An exploratory study of the relationship between reputation and value creation in petroleum exploration units
- 3/2002 *Line Lervik Olsen*
Modeling Equity, Satisfaction and Loyalty in Business-to-Consumer Markets
- 2/2002 *Fred H. Strønen*
Strategy Formation from a Loosely Coupled System Perspective. The Case of Fjordland
- 1/2002 *Terje I. Våland*
Emergence of conflicts in complex projects. The role of informal versus formal governance mechanisms in understanding interorganizational conflicts in the oil industry

2001

- 6/2001 *Kenneth H. Wathne*
Relationship Governance in a Vertical Network Context
- 5/2001 *Ming Li*
Value-Focused Data Envelopment Analysis
- 4/2001 *Lin Jiang*
An Integrated Methodology for Environmental Policy Analysis
- 3/2001 *Geir Høidal Bjønnes*
Four Essays on the Market Microstructure of Financial Markets
- 2/2001 *Dagfinn Rime*
Trading in Foreign Exchange Markets. Four Essays on the Microstructure of Foreign Exchange
- 1/2001 *Ragnhild Kvålshaugen*
The Antecedents of Management Competence. The Role of Educational Background and Type of Work Experience

2000

- 1/2000 *Per Ingvar Olsen*
Transforming Economies. The Case of the Norwegian Electricity Market Reform