

**Leading for Innovation:
An Empirical Analysis of Ambidextrous
Leadership**

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Friederike Schwantje Gerlach

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Betreuung: Prof. Dr. Kathrin Rosing

Gutachter: Prof. Dr. Kathrin Rosing (Universität Kassel)

Prof. Dr. Sandra Ohly (Universität Kassel)

Prof. Dr. Michael Gielnik (Leuphana Universität Lüneburg)

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Abstract

This dissertation investigates leadership in innovation processes. Based on ambidexterity theory, the focus is on the contradictory aspects of creativity and implementation within the innovation process and how leaders can support employees in addressing them. More specifically, this dissertation takes a within-process perspective looking at the influences of leader behaviors depending on different situations within the innovation process. The ambidextrous leadership model provides concrete leader behaviors defined to address the specifics of the innovation process. Thus, the relevance of these specific leader behaviors for the innovation process, i.e. opening and closing leader behaviors, is examined. Furthermore, the flexible adaptation of ambidextrous leader behaviors and the alignment of leader and follower behaviors with situational requirements of creativity and implementation is investigated. Three dissertation studies are described including a longitudinal field study across six weeks as well as two experimental designs manipulating leadership in the laboratory. The results emphasize the relevance of opening and closing leader behavior for leadership in innovation processes. Furthermore, it has been found that the alignment of leader and follower behaviors with situational requirements of creativity and implementation leads to higher innovation performance. Unfortunately, evidence for the flexible adaptation of ambidextrous leader behaviors was not provided. Nonetheless, this might be due to operationalizations of the flexibility component disregarding the alignment of leader behaviors with situational requirements. This dissertation adds to our understanding of leadership for innovation, because the within-process perspective for innovation is emphasized and provides evidence for the relevance of situational requirements of creativity and implementation. These aspects need to be considered by leaders to reach successful innovations.

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List of Abbreviations

ANOVA	analysis of variance
CI	confidence interval
ICC	intraclass correlation
LMX	leader-member exchange
MANOVA	multivariate analysis of variance
MLQ	multifactor leadership questionnaire
SJT	situational judgement test

1. Introduction

Innovation is essential for organizations to create and retain a competitive advantage on the market (Porter, 1990; Rosenbusch, Brinckmann, & Bausch, 2011; Rubera & Kirca, 2012). Consequently, organizations demand from their employees to be innovative, creating and implementing new products, procedures or processes (Shalley, Gilson, & Blum, 2000; Shin, Yuan, & Zhou, 2017; West & Farr, 1990). In this regard, leadership has been suggested as a central facilitator enabling followers to be innovative (Hunter, Thoroughgood, Myer, & Ligon, 2011; Junni, Sarala, Tarba, Liu, & Cooper, 2015; Mumford, 2000). It has been found that interactions with leaders during the innovation process, leader support for innovation and positive leadership approaches, e.g. transformational leadership and leader-member exchange, are positively associated with innovation performance (Carnevale, Huang, Crede, Harms, & Uhl-Bien, 2017; Hughes, Lee, Tian, Newman, & Legood, 2018; Mainemelis, Kark, & Epitropaki, 2015; Mumford, Scott, Gaddis, & Strange, 2002). However, based on the specifics of the innovation process it has also been argued that leadership for innovation is different from leadership in other work processes (Hunter et al., 2011; Hunter, Cushenbery, & Jayne, 2017; Rosing, Frese, & Bausch, 2011).

Innovation is defined as the “intentional introduction and application within a role, group or organization of ideas processes, products or procedures, new to the relevant unit of adoption” (West & Farr, 1990, p. 9). *Innovation performance* is the outcome of this process including the generation of useful, novel ideas and their implementation (Amabile, 1988; West, 2002a; West & Farr, 1990). This definition already speaks to the complexity of the innovation process because it incorporates both a requirement for creativity and a requirement for implementation (Bledow, Frese, Anderson, Erez, & Farr, 2009; West & Farr, 1990). *Creativity requirements* are present in situation where creativity is necessary to generate new and useful ideas (Amabile, 1988; Amabile & Pratt, 2016; West & Farr, 1990). Contrary, *implementation requirements* are present in situations when an idea needs to be put to practice

focusing on an efficient realization (West, 2002a, 2002b; West & Farr, 1990). Both requirements fluctuate within the process leading to situations in which creativity requirements, and situations in which implementation requirements are more prominent (Bledow, Rosing, & Frese, 2013; Rosing et al., 2018). Nonetheless, innovation processes can only be successful when both situational requirements of creativity and implementation are addressed (Axtell et al., 2000; Junni, Sarala, Taras, & Tarba, 2013; Rosing et al., 2018). This has been coined as being ambidextrous, addressing contradictory requirements in a well-balanced manner (Junni et al., 2013; O'Reilly & Tushman, 2013; Raisch, Birkinshaw, Probst, & Tushman, 2009). The concept applies to the innovation process, as situational requirements of creativity and implementation are very different, sometimes even contradictory (Andriopoulos & Lewis, 2009; Miron-Spektor, Erez, & Naveh, 2011). Thus, it is very challenging, but also highly relevant for success, to address both requirements in a balanced manner within the innovation process (Bledow et al., 2009; Rosing & Zacher, 2017).

Leaders in innovation processes have the overarching task to monitor the whole innovation process, including situational requirements of creativity and implementation as well as their integration to reach high innovation performance (Hunter et al., 2011; Hunter et al., 2017; Mumford et al., 2002). Thus, specific leader behaviors addressing creativity and implementation are necessary and moreover, these behaviors need to be changed flexibly within the process itself to address the varying situational requirements of creativity and implementation (Hunter et al., 2011; Hunter et al., 2017; Rosing et al., 2011). A new approach to leadership for innovation that addresses these specifics is the ambidextrous leadership model describing two leader behaviors (Rosing et al., 2011). *Opening leader behavior* includes, for instance, encouraging to take risks or thinking in different directions and addresses the situational creativity requirement, whereas *closing leader behavior* addresses the situational requirement for implementation with behavior such as monitoring goal attainment and focusing on efficiency (Rosing et al., 2011; Zacher & Rosing, 2015). Both

behaviors need to be applied flexibly and in line with the situational requirements of creativity and implementation to reach high innovation performance (Rosing et al., 2011)

This dissertation aims to investigate the ambidextrous leadership model in detail to add to the literature on leadership in innovation processes in three ways. First, situational requirements of creativity and implementation are defined as key parts of the innovation process. Thus, opening and closing leader behaviors directly addressing these situational requirements are critical for innovation success (Rosing et al., 2011). Previous empirical research is extended (Zacher, Robinson, & Rosing, 2016; Zacher & Rosing, 2015; Zacher & Wilden, 2014) by applying differential methodological approaches in the three dissertation studies, i.e. a longitudinal field study and two laboratory experiments, to underline the positive effects of opening and closing leader behaviors. Second, this dissertation sheds light on the model's flexibility component, i.e. when and how often leaders change their behavior. For this purpose, the flexible application of opening and closing leader behaviors and its impact on innovation performance is analyzed (Rosing et al., 2011). Third, the situational requirements of creativity and implementation are directly examined in terms of their alignment with leader and follower behaviors (Bledow et al., 2009; Rosing et al., 2011; Shalley, Zhou, & Oldham, 2004). Following the ambidextrous leadership model, leader and follower behaviors will only lead to better innovation performance when these behaviors are aligned with situational requirements of creativity and implementation (Rosing et al., 2011; Rosing et al., 2018).

In the following, the theoretical background of the dissertation is presented. First, an overview of research on leadership in innovation processes is provided. This will be followed by a background to ambidexterity and innovation processes zooming in on individual ambidexterity enacted by followers. Then, the ambidextrous leadership model as a leadership approach that takes the specifics of the innovation process into account will be explained.

Finally, the conceptual model of the dissertation and the three separate dissertation studies are introduced.

2. Theoretical Background

2.1 Leading for Innovation: State of the Art

Leadership is one of the central influences in innovation processes, supporting followers to reach innovation success (Hammond, Neff, Farr, Schwall, & Zhao, 2011; Hughes et al., 2018; Junni et al., 2015). In general, it has been found that leader support in innovation processes is positively associated with innovation performance (Madrid, Patterson, Birdi, Leiva, & Kausel, 2014; Yuan & Woodman, 2010). Regarding established as well as contemporary leadership approaches (e. g. empowering, servant and authentic leadership), transformational leadership and leader-member exchange are studied most with respect to innovation (Hughes et al., 2018). However, these leadership approaches have shown inconsistent empirical relationships with innovation performance (Carnevale et al., 2017; Hughes et al., 2018; Mainemelis et al., 2015). For instance, transformational leadership has often been suggested to increase creativity and innovation performance (Jansen, Vera, & Crossan, 2009; Nemanich & Vera, 2009; Waldman & Bass, 1991). In line with this, meta-analytic results show a positive relationship of transformational leadership with creativity and innovation performance (Rosing et al., 2011; Wang, Oh, Courtright, & Colbert, 2011). However, the relationships in the separate, individual studies vary widely showing positive and negative relationships or no associations (Kang, Solomon, & Choi, 2015; Keller & Weibler, 2015; Pieterse, van Knippenberg, Schippers, & Stam, 2010; Rosing et al., 2011). Moreover, another stream of research has found a u-shaped relationship in that low and high levels of transformational leadership are positively related to innovation performance, whereas moderate levels are not positively associated (Eisenbeiß & Boerner, 2010; Eisenbeiß & Boerner, 2013). Similar results can be found with respect to leader-member exchange (Gerstner & Day, 1997; Graen & Uhl-Bien, 1995). Meta-analyses found a positive overall

relationship of leader-member exchange with innovation performance (Carnevale et al., 2017; Rosing et al., 2011). However, for this approach credibility intervals and high variation of effects also indicate inconsistencies (Carnevale et al., 2017; Rosing et al., 2011). Both constructs show that there is a pattern of heterogeneous relationships between these leadership approaches and innovation performance (Hughes et al., 2018; Mainemelis et al., 2015; Rosing et al., 2011). These effects might occur due to the specifics of the innovation process, which are not considered by these leadership approaches (Rosing et al., 2011).

Leadership for innovation is different from leadership in other work processes (Hunter et al., 2011; Hunter et al., 2017; Mumford et al., 2002). Consequently, research has suggested specific components that need to be considered when investigating leadership in innovation processes (Hunter et al., 2011; Mainemelis et al., 2015; Shalley & Gilson, 2004). First, leaders need to address the creativity requirements by providing options and opportunities to thrive (Basadur, 2004; Mainemelis et al., 2015; Shalley & Gilson, 2004). They have to give freedom and independence to the creative followers (Havermans, Den Hartog, Keegan, & Uhl-Bien, 2015; Hunter et al., 2017; Mumford et al., 2002). Moreover, they have to encourage followers to acquire new knowledge to generate ideas that challenge the existing status quo (Amabile & Pratt, 2016; Havermans et al., 2015; Rosing et al., 2011). Second, a directive component is essential to leading for innovation, giving the followers a goal concerning what the innovation process should accomplish (Mainemelis et al., 2015). Leaders need to address the implementation requirements for instance by providing structure and planning of the associated activities (Hunter et al., 2011; Hunter et al., 2017; Mumford, 2000; Mumford et al., 2002). In this case, leaders need to pay attention to existing rules and routines and act within a given framework of timely deadlines and structures (Havermans et al., 2015; Miron-Spektor et al., 2011; Miron-Spektor & Erez, 2017; Rosing et al., 2011). Third, leading for innovation requires an integration of creativity and implementation requirements (Hunter et al., 2017; Lukoschek, Gerlach, Stock, & Xin, 2018; Mumford et al., 2002). Thereby, leaders need to

attend to the dynamics within the innovation process addressing situational requirements of creativity and implementation whenever they are present (Rosing et al., 2011; Rosing et al., 2018). Consequently, leading for innovation is a challenging task and leaders need to develop an expertise for the innovation process, its dynamics and the associated follower behaviors to adequately support them.

2.2 The Innovation Process through an Ambidexterity Lens

For this purpose, the literature on ambidexterity offers insights into how to handle contradictory requirements. Ambidexterity literally means two-handedness and describes the skill that one can use the left and right hand equally well. This concept has been transferred to management literature, for instance, describing the equal application of exploration and exploitation (O'Reilly & Tushman, 2013; Raisch et al., 2009). Exploration applies to the pursuit of new knowledge and creative development of new products, processes or procedures (He & Wong, 2004; Jansen, van Den Bosch, & Volberda, 2006; March, 1991) while exploitation relies on existing knowledge and an implementation of known competencies and products (He & Wong, 2004; Jansen et al., 2006; March, 1991). Following both strategies implies tensions and obstacles as they are very different, sometimes even contradictory (Andriopoulos & Lewis, 2009; Miron-Spektor, Ingram, Keller, Smith, & Lewis, 2018). However, these tensions need to be resolved in order to reach high overall performance (O'Reilly & Tushman, 2013; Raisch & Birkinshaw, 2008)

Ambidexterity provides theoretical grounding to analyze the specifics of the innovation process as this process is also characterized by tensions and paradoxes (Andriopoulos & Lewis, 2009; Bledow et al., 2009; Miron-Spektor et al., 2018). Innovation is characterized by a duality including situational requirements of creativity and implementation within the process itself (Bledow et al., 2009; Rosing et al., 2018). On the one hand, creativity requirements are characterized by novelty; so divergent thinking and ground breaking assumptions are needed (Amabile & Pratt, 2016; Andriopoulos & Lewis, 2009; Miron-

Spektor & Erez, 2017). On the other hand, implementation requirements include efficiency, control and the acceptance of boundaries and constraints (Andriopoulos & Lewis, 2009; Miron-Spektor et al., 2018). Depending on the different tasks within the process, requirements of creativity or implementation need to be addressed in a given situation (Janssen, 2000; Shalley et al., 2000; Shin et al., 2017; Unsworth, Wall, & Carter, 2005). Accordingly, for successful innovation processes, leaders and followers need to be ambidextrous considering and integrating the two contradictory situational requirements of creativity and implementation (Bledow et al., 2009; Rosing et al., 2011; Schnellbacher, Heidenreich, & Wald, 2019).

There has been a considerable debate on how to integrate creativity and implementation in the innovation process (Bledow et al., 2009; Farr, Sin, & Tesluk, 2003; Schroeder, van de Ven, Scudder, & Polley, 1989). On the one hand, it has been suggested that creativity and implementation requirements follow a linear pattern (Cooper, 1990; Farr et al., 2003; Lubart, 2001). For this research stream, it is proposed that creativity requirements need to be addressed first and then subsequently, at one point, a change to implementation occurs (Farr et al., 2003). On the other hand, based on ambidexterity literature, scholars have demonstrated a more complex pattern which is characterized by constant changes between situational requirements of creativity and implementation (Bledow et al., 2009; Cheng & van de Ven, 1996; Schroeder et al., 1989). Following this, an integration of the conflicting requirements of creativity and implementation is most likely when a constant change in focus enables the actors to use the synergies between creativity and implementation (Bledow et al., 2009; Schroeder et al., 1989). In line with this perspective, empirical evidence suggests that changes in follower behavior are necessary to address situational creativity and implementation requirements to reach better innovation performance (Cheng & van de Ven, 1996; Rosing et al., 2018). Consequently, ambidexterity provides a theoretical perspective for

understanding the mechanisms enabling innovation performance (Anderson, Potočnik, & Zhou, 2014; Bledow et al., 2009).

2.3 Being Ambidextrous: Employee Behaviors for Ambidexterity

Ambidexterity has initially been introduced as an organizational-level construct, describing organizations that utilize creativity to explore new opportunities while at the same time exploiting existing competencies and capabilities for implementation (Gibson & Birkinshaw, 2004; O'Reilly & Tushman, 2004; Raisch et al., 2009). Different mechanisms through which organizations can achieve ambidexterity have been defined: Structural ambidexterity describes the simultaneous pursuit of exploration and exploitation in different subunits (O'Reilly & Tushman, 2013). The sequential approach focuses on shifting from exploration to exploitation over time (O'Reilly & Tushman, 2013; Raisch & Birkinshaw, 2008). This dissertation focuses on contextual ambidexterity for which the tensions associated with exploration and exploitation are resolved at the individual level implying that followers within leadership processes are relevant to the resolution (Gibson & Birkinshaw, 2004; O'Reilly & Tushman, 2013; Rosing & Zacher, 2017).

In line with contextual ambidexterity, there has been an increasing interest in individual level ambidexterity (Jasmand, Blazevic, & Ruyter, 2012; Mom, van Den Bosch, & Volberda, 2007; Mom, van Den Bosch, & Volberda, 2009; Tempelaar & Rosenkranz, 2013). It has been suggested that individual employees, i.e. followers, use temporal shifts and switch between exploration and exploitation behaviors to resolve the tension between the two aspects (Rosing & Zacher, 2017; Schnellbacher et al., 2019). Employee *exploration behaviors* increase the behavioral variance of followers (Gupta, Smith, & Shalley, 2006), using activities such as “search, variation, risk taking, experimentation, play, flexibility, [...]” (March, 1991, p. 71). Contrary, employee *exploitation behavior* entails the reduction of behavioral variance (Gupta et al., 2006) in activities such as “refinement, choice, production, efficiency, selection, [...] execution” (March, 1991, p. 71). Research provides support that a combination of

exploration and exploitation behaviors at the individual level is positively related to better performance (Good & Michel, 2013; Schnellbacher et al., 2019; Zhang, Wei, & van Horne, 2019).

Looking at the innovation process, the concept of individual ambidexterity might also be a mechanism to resolve the tensions associated with creativity and implementation (Bledow et al., 2009; Rosing & Zacher, 2017). Employees need to address situational requirements of creativity and implementation by showing certain behaviors, i.e. activities that the employees execute during their work (Montag, Maertz, & Baer, 2012). Thereby, exploration behavior addresses the requirement for creativity, whereas exploitation behavior will be beneficial for implementation requirements. For employees within innovation processes acting ambidextrous, showing both exploration and exploitation behavior, will enable an integration and resolution of the tensions associated with situational requirements of creativity and implementation (Bledow et al., 2009; Rosing & Zacher, 2017). In line with this, empirical evidence shows that individual ambidexterity is positively associated with innovation performance (Axtell et al., 2000; Jasmand et al., 2012; Rosing & Zacher, 2017).

However, research on ambidextrous behaviors is lacking an answer to the question of how employees integrate creativity and implementation within the innovation process (Schnellbacher et al., 2019; Shalley et al., 2004; Swart, Turner, van Rossenberg, & Kinnie, 2017). In line with research on temporal patterns within the innovation process, it has been suggested that employees need to switch behaviors regularly to integrate creativity and implementation requirements (Schnellbacher et al., 2019). However, research has not investigated how and when these changes occur within the process. This points to two important shortcomings. First, research on innovation needs to take a more micro-level perspective looking at the process components of situational requirements of creativity and implementation in more detail (Shalley et al., 2004; West, 2002a, 2002b). As situational creativity and implementation requirements change within the innovation process (Bledow et

al., 2009; Rosing et al., 2018; Schroeder et al., 1989), they need to be addressed in a given situation. Therefore, it is important for research to consider the situational requirements within the innovation process in order to draw conclusion on how to integrate and address both requirements (Bledow et al., 2009). This will lead to more insights into the specifics of creativity and implementation requirements and their interplay within the innovation process (Shalley et al., 2004). Second, the fluctuating requirements within the process demand actors to adapt flexibly (O'Reilly & Tushman, 2013; Rosing et al., 2011; Rosing & Zacher, 2017). Nonetheless, there is a significant knowledge gap regarding how flexibility is achieved and whether this actually leads to increased innovation performance. Existing research usually investigates interactions of employee behaviors, such as exploration and exploitation behavior, which only represents the combination of general tendencies and their relationship to performance (Schnellbacher et al., 2019; Zacher & Rosing, 2015; Zacher & Wilden, 2014; Zhang et al., 2019). Consequently, it is important to look at flexibility in innovation in more detail to analyze how this is enacted within the process. Investigating creativity, implementation and flexibility within the innovation process, will provide research with insights into how innovation success can be achieved.

2.4 Leadership for Innovation: The Ambidextrous Leadership Model

Ambidextrous leadership provides a model that addresses these shortcomings and takes situational requirements of creativity and implementation as well as the flexibility component into account (Rosing et al., 2011). The model describes two specific leader behaviors. On the one hand, opening leader behavior includes activities such as allowing different strategies to accomplish a goal, encouraging risk taking and allowing errors, giving room for independent thinking, new ideas and experimenting (Rosing et al., 2011; Zacher & Rosing, 2015). This leader behavior addresses situational creativity requirements and will lead to follower exploration behavior (Rosing et al., 2011; Zacher et al., 2016; Zacher & Rosing, 2015). On the other hand, closing leader behavior includes establishing deadlines,

monitoring goal attainment, controlling the adherence to rules and avoiding mistakes (Rosing et al., 2011; Zacher & Rosing, 2015). This leader behavior addresses implementation requirements and exploitation behavior will be increased (Rosing et al., 2011). As creativity and implementation requirements fluctuate throughout the innovation process (Bledow et al., 2009; Rosing et al., 2018; Schroeder et al., 1989), the leader needs to act flexibly adjusting the leader behavior depending on the situational requirements (Rosing et al., 2011). More specifically, leaders need to adapt towards opening leader behavior when creativity is required (Rosing et al., 2011). Contrary, leaders need to show closing leader behavior when implementation requirements are present (Rosing et al., 2011). Through switching between opening and closing leader behavior in an appropriate manner, the leader supports followers' individual ambidexterity in terms of appropriate changes in follower exploration and exploitation behaviors (Rosing et al., 2011; Zacher et al., 2016). Finally, follower individual ambidexterity will result in a successful integration of creativity and implementation leading to high innovation performance (Bledow et al., 2009; Rosing et al., 2011; Rosing & Zacher, 2017).

Previous studies on the ambidextrous leadership model provide promising results in terms of the postulated relationships. A positive relationship of the interaction of opening and closing leader behaviors with innovation performance has been found (Zacher & Rosing, 2015; Zacher & Wilden, 2014). Moreover, Zacher et al. (2016) found the predicted relationship between opening leader behavior and follower exploration behavior and closing leader behavior and follower exploitation behavior in a cross-sectional sample. Taken together, these studies show some of the postulated relationships of the ambidextrous leadership model (Zacher et al., 2016; Zacher & Rosing, 2015; Zacher & Wilden, 2014).

However, the existing research also provides some shortcomings. First, it needs to be emphasized that both creativity and implementation and thus, opening and closing leader behaviors are important for innovation processes (Rosing et al., 2011). For instance, within-

person effects of leader behavior have emerged as central to leadership research (Breevaart & Bakker, 2018; Breevaart, Bakker, Demerouti, & Derks, 2016; Lanaj, Johnson, & Lee, 2016). More specifically, leader behaviors as well as innovation-related constructs vary on a weekly basis (Breevaart & Zacher, 2019; Madrid et al., 2014). Consequently, this time perspective is a necessary addition for the empirical investigation of opening and closing leader behaviors in innovation processes. Second, research on leadership in general and leadership for innovation is lacking sufficient experimental studies in order to draw causal conclusions (Antonakis, 2017; Antonakis, Bendahan, Jacquart, & Lalive, 2010; Hughes et al., 2018). This shortcoming also applies to ambidextrous leadership since all existing studies on the model are based on correlational evidence (Zacher et al., 2016; Zacher & Rosing, 2015; Zacher & Wilden, 2014). Consequently, causal conclusions in terms of the direction of the relationship between leader behavior, follower behavior and innovation performance cannot be drawn (Antonakis et al., 2010; Antonakis, 2017; Antonakis, Bendahan, Jacquart, & Lalive, 2014; Highhouse, 2009). However, this is essential because, as leadership researchers, we should be interested in the effects that leader behaviors have on follower behaviors and performance (Fischer, Dietz, & Antonakis, 2017; Hughes et al., 2018). Therefore, leadership for innovation research is in need of experimental methods manipulating leader behavior (Antonakis, 2017; Highhouse, 2009; Hughes et al., 2018). Third, the research on leadership in innovation processes has mostly relied on self-reported innovation performance ratings (Zacher et al., 2016; Zacher & Wilden, 2014) which have been criticized (Reiter-Palmon, Forthmann, & Barbot, 2019; Reiter-Palmon, Robinson-Morrall, Kaufman, & Santo, 2012; Robinson-Morrall, Reiter-Palmon, & Kaufman, 2013). As there is a strong relationship between creative self-efficacy and self-perception of creative performance, these measures need to be interpreted with caution (Reiter-Palmon et al., 2012). Thus, a more objective way to measure creativity and innovation performance is necessary to draw more precise conclusion also with respect to

leadership influences (Anderson et al., 2014; Barbot, Hass, & Reiter-Palmon, 2019; Reiter-Palmon et al., 2019).

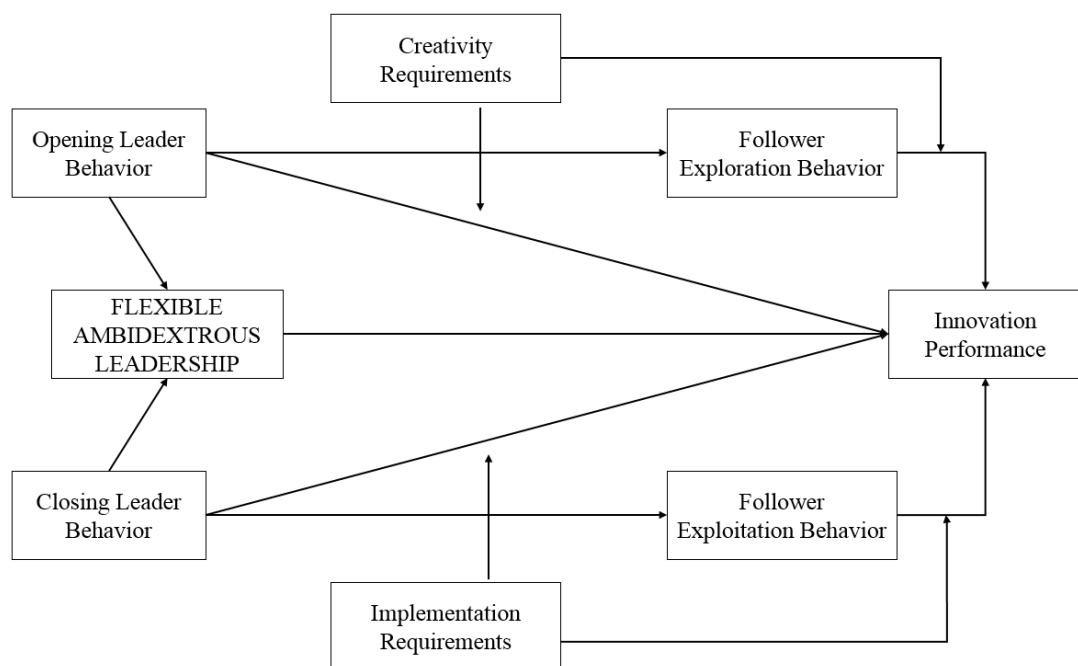
In addition, existing literature on ambidextrous leadership for innovation is limited in that central assumptions have not been investigated empirically yet (Rosing et al., 2011). First, innovation has been proposed to be characterized by a dynamic interplay of situational requirements of creativity and implementation (Bledow et al., 2013; Rosing et al., 2018). Consequently, the model for ambidextrous leadership includes a flexible application of opening and closing leader behaviors (Rosing et al., 2011). This flexible leadership approach will help the followers to act ambidextrous and resolve associated tensions by integrating both creativity and implementation to reach high innovation performance (Hunter et al., 2011; Hunter et al., 2017; Rosing et al., 2011). Nonetheless, existing empirical research has only shown the positive relationship of the interaction of general tendencies of opening and closing leader behaviors (Zacher & Rosing, 2015; Zacher & Wilden, 2014). Thus, conclusions concerning the actual flexible changing of leader behaviors cannot be drawn from this research. Second, the role of situational requirements of creativity and implementation has not been addressed sufficiently in existing research on innovation and leadership for innovation (Bledow et al., 2009; Rosing et al., 2011; Rosing et al., 2018). It has been proposed that leaders and followers will only be effective when they align behaviors with the situational requirements of creativity and implementation (Rosing et al., 2011). However, the situational appropriateness of ambidextrous leader behaviors as well as follower exploration and exploitation behaviors has not been examined thus far. This is important as only situationally appropriate behaviors will show a positive association with innovation performance (Bledow et al., 2009; Rosing et al., 2011).

2.5 Model of the Dissertation

In this dissertation, the methodological limitations and the conceptual research gaps associated with leadership and innovation are addressed in three separate studies. First, the

influence of opening and closing leader behavior on innovation performance is investigated. Second, the flexibility component within the innovation process is examined by analyzing the interplay of opening and closing leader behavior and its effect on innovation performance. Third, the alignment of leader and follower behaviors with situational requirements of creativity and implementation within the innovation process is examined. Finally, the mediating role of follower exploration and exploitation behavior within the ambidextrous leadership model will also be considered. For the full conceptual model, please refer to Figure 1.

Figure 1: Conceptual Model of the Dissertation



2.6 Summary of Studies

Study 1: Ambidextrous Leadership and Innovation Performance: A Longitudinal Study

In Study 1, the effects of opening and closing leader behaviors as well as their interaction are investigated in a longitudinal field study. $N = 54$ employees provided data on leader behaviors and innovation performance over the course of six weeks resulting in a total of $N = 254$ weekly reports. Furthermore, the employees rated traditional leadership styles (i.e. transformational, transactional and instrumental leadership, leader-member exchange) on a

general level to simultaneously analyze different leadership approaches with respect to innovation performance. Instrumental leadership was positively associated with innovation performance (level 2). Furthermore, positive relationships between opening and closing leader behaviors and innovation performance were found (level 1). However, the positive relationship of the interplay of opening and closing leader behaviors with innovation performance could not be shown in this sample (level 1).

Study 2: Flexible Adaptation of Leader Behavior: An Experimental Analysis of the Beneficial Effect of Flexibility in Innovation Processes

To investigate the flexibility component of ambidextrous leadership with a different method, an experiment was conducted in Study 2 which enables causal conclusions. $N = 93$ participants either received no leadership (control group), a sequential or a flexible application of ambidextrous leadership. The results did not reveal any significant differences between the three experimental groups for innovation performance. Therefore, this study also did not provide empirical evidence for the positive effect of a flexible adaptation of opening and closing leader behaviors on innovation performance. However, descriptive tendencies indicate that appropriate changes provide an explanation in this regard. According to these descriptive results, a flexible application of ambidextrous leadership could lead to better innovation performance when many appropriate changes are administered. This is in line with the model of ambidextrous leadership as changes in leader behavior should only be effective when the leader behavior is appropriate, i.e. aligned with creativity and implementation requirements (Rosing et al., 2011).

Study 3: Aligning Leader and Follower Behaviors with Innovation Requirements Improves Performance: An Experimental Study

The role of the appropriateness of leader behavior was further analyzed in Study 3. The alignment of opening and closing leader behavior with creativity and implementation requirements was investigated in a laboratory experiment. Two different tasks manipulating

creativity and implementation requirements and four different video messages from the leader manipulating opening and closing leader behavior were used. This resulted in a 2x2x2 between-subjects design. A total of $N = 245$ students participated in this experiment. The results support the assumption that opening leader behavior is more effective when aligned with creativity requirements. Moreover, closing leader behavior is more effective when aligned with implementation requirements. The same pattern could be found with respect to follower behaviors of exploration and exploitation. Exploration behavior showed a more positive association with performance when aligned with creativity requirements, whereas exploitation behaviors were more positively associated with performance, when implementation was required. However, unfortunately, the postulated moderated mediation effects for leader behaviors on innovation performance mediated by follower exploration and exploitation behavior was not found. Nonetheless, Study 3 provides support for the importance of creativity and implementation requirements as they determine the effectiveness of leader and follower behaviors in innovation processes.

3. Study 1: Ambidextrous Leadership and Innovation Performance: A Longitudinal Study

Innovation is of great importance to organizations as they attempt to maintain a competitive advantage (Porter, 1990; Rosenbusch et al., 2011; Rubera & Kirca, 2012). The innovation process requires employees to be creative and to implement new ideas to achieve high innovation performance (Good & Michel, 2013; Rosing & Zacher, 2017; West & Farr, 1990). These two requirements fluctuate within the innovation process and demand very different employee behaviors, which can be challenging (Bledow et al., 2009; Miron-Spektor & Erez, 2017; Rosing et al., 2018). Leadership has been suggested as one of the prime influences that can help employees attain high innovation performance (Hammond et al., 2011; Hughes et al., 2018; Junni et al., 2013). Due to the characteristics of this process and existing empirical research, scholars have argued that a specific approach to leadership for innovation is necessary (Hunter et al., 2011; Mumford, 2000; Rosing et al., 2011). This study aims to investigate such a model for leadership in innovation processes, that is, ambidextrous leadership (Rosing et al., 2011).

The ambidextrous leadership model offers two specific leader behaviors (Rosing et al., 2011). Opening leader behavior describes aspects such as encouraging employees to acquire new knowledge or questioning the status quo and applies to creativity requirements (Rosing et al., 2011; Zacher & Rosing, 2015). In contrast, closing leader behavior involves, for instance, setting goals or attending to deadlines and addresses implementation requirements (Rosing et al., 2011; Zacher & Rosing, 2015). The ambidextrous leadership model further suggests that both leader behaviors need to be applied flexibly in line with the situational requirements of creativity and implementation requirements (Rosing et al., 2011). Existing research shows promising results concerning the relationship of ambidextrous leader behaviors and innovation performance (Zacher et al., 2016; Zacher & Rosing, 2015; Zacher & Wilden, 2014). Nonetheless, the effectiveness has not yet been analyzed rigorously and simultaneously

with other, traditional leadership styles to empirically demonstrate the importance of ambidextrous leader behaviors for the innovation process (Hughes et al., 2018).

Accordingly, this study aims to examine the relationship of opening and closing leader behaviors with innovation performance while simultaneously analyzing traditional leadership styles, including transformational (Bass, 1985), transactional (Bass, 1985), and instrumental leadership (Antonakis & House, 2014), as well as leader-member exchange (Gerstner & Day, 1997; Graen & Uhl-Bien, 1995). Based on the model of ambidextrous leadership, we hypothesize that opening and closing leader behaviors, as well as the interplay of these two behaviors will be positively related to innovation performance (Rosing et al., 2011). To account for the dynamics within innovation processes, we investigated these relationships on a weekly level.

This study contributes to existing literature in three ways. First, we underline the importance of ambidextrous leadership for leadership in innovation processes (Rosing et al., 2011). The model reflects the specifics of the innovation process by incorporating different leader behaviors addressing creativity and implementation requirements (Bledow et al., 2009; Rosing et al., 2011). Second, we demonstrate positive effects of opening and closing leader behaviors while simultaneously analyzing traditional leadership styles. Although a simultaneous analysis of different leadership approaches is necessary to draw conclusions on their relative predictive validity, only few studies have measured multiple forms of leadership at once with regard to innovation performance (Hughes et al., 2018). Third, considering the dynamics of the innovation process, we analyze the influence of ambidextrous leadership using a multilevel design across six weeks. Taking the fluctuating requirements into account it can be expected that the relevant processes for leadership in innovation processes occur on a weekly level (Breevaart & Zacher, 2019; Madrid et al., 2014). Accordingly, this time frame adds an important perspective to the literature on ambidextrous leadership.

Theoretical Background

Leadership for innovation is different from leadership in other organizational contexts because the innovation process shows some unique characteristics (Hunter et al., 2011; Mumford, 2000; Rosing et al., 2011). Innovation is defined as the “intentional introduction and application within a role, group or organization of ideas, processes, products or procedures, new to the relevant unit of adoption” (West & Farr, 1990, p. 9). Accordingly, we adopt a definition of innovation performance as the observable successful implementation of a creative idea (West & Farr, 1990). This definition speaks to the complexity of the innovation process as it includes both a creativity and an implementation requirement (Bledow et al., 2009; West & Farr, 1990). On the one hand, creativity requires employees to indulge in divergent thinking, breaking rules and assumptions, and acquiring new knowledge (Amabile & Pratt, 2016; Andriopoulos & Lewis, 2009; Miron-Spektor & Erez, 2017). Implementation, on the other hand, requires a focus on usefulness and finishing a product in a timely and efficient manner (Miron-Spektor et al., 2011; Miron-Spektor & Erez, 2017). Employees are more successful in terms of innovation performance when acting on both requirements (Bledow et al., 2009; Jasmand et al., 2012; Rosing & Zacher, 2017).

Dealing with creativity and implementation requirements is challenging especially considering the dynamics of the requirements (Bledow et al., 2009; Rosing et al., 2018; Schroeder et al., 1989). The two requirements do not follow a linear path, but rather they fluctuate unpredictably within the innovation process (Cheng & van de Ven, 1996; Schroeder et al., 1989). Therefore, employees need to adapt and balance their behavior according to the fluctuating requirements of creativity and implementation to achieve high innovation performance (He & Wong, 2004; Jasmand et al., 2012; Rosing & Zacher, 2017). Consequently, to study the innovation process and its specifics, it is essential to analyze within-person dynamics to reach conclusions concerning the fluctuating requirements and associated challenges (Madrid et al., 2014; Rosing et al., 2018).

The Case for Ambidextrous Leadership

Rosing and colleagues (2011) introduced the ambidextrous leadership model, which specifically describes two leader behaviors – opening and closing – to consider both creativity and implementation requirements. The model postulates that both leader behaviors as well as their interplay are relevant in terms of overall innovation performance (Rosing et al., 2011). Ambidextrous leadership is a more recent leadership approach that adds significantly to the leadership literature (Bormann & Rowold, 2018; Rosing et al., 2011; Yukl, Gordon, & Taber, 2016). First, opening and closing leader behaviors have been specifically defined as concrete advice concerning the task performance associated with creativity and implementation requirements (Rosing et al., 2011; van Knippenberg & Sitkin, 2013; Yukl, 1999). Second, as a central tenet, ambidextrous leadership incorporates situational requirements of the innovation process (Rosing et al., 2011). In this regard, ambidextrous leadership specifies situational conditions under which a leader behavior will be effective (Rosing et al., 2011). Finally, ambidextrous leadership describes a combination of leader behaviors (Breevaart & Zacher, 2019; Rosing et al., 2011). More specifically, the interplay of opening and closing leader behaviors enables the integration of creativity and implementation within the innovation process (Rosing et al., 2011; Rosing et al., 2018; Rosing & Zacher, 2017).

Hypothesis Development: Ambidextrous Leadership and Innovation Performance

These three aspects show that ambidextrous leadership has been specifically defined for the innovation process and, as such, has advantages over traditional leadership approaches with regard to innovation performance (Rosing et al., 2011). In line with this, we postulate that opening leader behavior should have a positive association with innovation performance as it addresses creativity requirements (Rosing et al., 2011; Zacher et al., 2016). Encouraging followers to do their work differently and experimenting with various solutions increases divergent thinking, which helps employees to deal with creativity requirements within the innovation process (Gilhooly, Fioratou, Anthony, & Wynn, 2007; Miron-Spektor & Erez,

2017). Furthermore, combining existing knowledge and reorganizing it will enhance idea generation and is also encouraged by opening leader behavior (Mumford, 2000; Rosing et al., 2011). To act on creativity requirements, followers need autonomy (Hammond et al., 2011; Mumford et al., 2002), which is provided by opening leader behavior as it gives the opportunity for independent ideas and actions (Rosing et al., 2011). Opening leader behavior further encourages followers to take risks and supports them in questioning existing approaches (Rosing et al., 2011). This provides a psychologically safe environment in which followers have the opportunity to address creativity requirements without fearing negative consequences (Baer & Frese, 2003; Hunter, Bedell, & Mumford, 2007).

Hypothesis 1: Opening leader behavior is positively related to innovation performance.

In addition, closing leader behavior should be positively related to innovation performance since it addresses the implementation requirements of the innovation process (Rosing et al., 2011; Zacher et al., 2016). Regarding implementation requirements, employees need to attain certain quality standards and a flawless product should result (Miron, Erez, & Naveh, 2004). Closing leader behavior provides specific guidelines and standards for the tasks within the innovation process (Rosing et al., 2011). This formalizes the work and enables individuals to pay attention to the quality of the outcome (Jansen et al., 2006; Miron et al., 2004). Moreover, closing leader behavior includes a focus on efficiency which goes hand in hand with avoiding mistakes and, thus, also directs the attention toward implementation requirements (Rosing et al., 2011). This is additionally supported by closing leader behavior as the leader takes corrective actions and controls the adherence to rules (Miron et al., 2004; Rosing et al., 2011). For implementation requirements, deadlines and associated time constraints are crucial and, thus, closing leader behavior entails setting deadlines and monitoring goal achievement (Rosing et al., 2011). With these time constraints, followers focus on the essential tasks (Amabile et al., 2002; West, 2002b).

Hypothesis 2: Closing leader behavior is positively related to innovation performance.

Finally, we hypothesize that the interplay of opening and closing leader behavior is positively related to innovation performance. Creativity and implementation are both essential requirements of the innovation process (Bledow et al., 2009; Rosing et al., 2018; Schroeder et al., 1989). These requirements fluctuate in a non-linear and inconsistent manner within the innovation process (Cheng & van de Ven, 1996; Rosing et al., 2018; Schroeder et al., 1989). Depending on the situational requirements, employees need to show very different, sometimes contradictory behaviors (Andriopoulos & Lewis, 2009; Miron-Spektor et al., 2018; Smith & Lewis, 2011). Leaders can support these behavioral changes by showing opening and closing leader behaviors (Hunter et al., 2011; Rosing et al., 2011). As they switch between opening and closing leader behavior depending on the situational requirements, leaders improve employee performance contingent on the requirements and enable an integration of creativity and implementation (Rosing et al., 2011). Contrary, applying only opening leader behavior would lead to creative ideas that will not be implemented successfully, whereas only showing closing leader behavior will not encourage original and creative ideas (Gibson & Birkinshaw, 2004; He & Wong, 2004; Rosing et al., 2011). Therefore, the application of both opening and closing leader behavior is necessary (Rosing et al., 2011). Previous research has shown a positive influence of the interplay between opening and closing leader behaviors on innovation performance (Zacher et al., 2016; Zacher & Wilden, 2014).

Hypothesis 3: The interaction of opening and closing leader behavior is positively related to innovation performance.

Method

Sample

Data was collected from $N = 54$ employees from different German companies who provided $N = 254$ weekly reports. Due to missing data, some analyses including the main regression analysis were only conducted with 49 employees. We recruited the employees

through postal mail and personal contacts at exhibitions in Germany. A requirement for participation was that employees were working on at least one innovation project that included the generation and implementation of new and potentially useful ideas (West & Farr, 1990). The employees in our sample mostly worked in companies with more than 50 employees (88.6%) in different industries, for instance electrical and mechanical engineering or aeronautics. Employees were on average 36.79 ($SD = 9.07$) years old. 45 (83.3%) were male, 7 (13%) were female, and 2 (3.7%) did not provide information on their gender.

Procedure

This data set is part of a larger data collection project and only those variables that are relevant for the presented research question are reported. Employees working on innovation projects filled out weekly online questionnaires across a period of six weeks.

Before the weekly data collection, participants received baseline questionnaires (duration: approximately 40 minutes). They chose an innovative project for which they would answer the questions in the following weekly questionnaires. In this respect, weekly work as well as interaction with the leader concerning the project in the following six weeks was necessary. Employees then answered questions concerning this project, general opening and closing leader behavior, as well as control variables. After this baseline questionnaire, employees received weekly questionnaires on Fridays for the following six weeks. They first described the weekly activities in the chosen project. Subsequently, they assessed opening and closing leader behaviors and their own innovation performance. At the end of the last week, the questionnaire included additional control variables.

Measures

Innovation Performance. Weekly innovation performance of the employee was assessed with a 5-item scale (Scott & Bruce, 1994) adapted to the weekly level (Ohly, Sonnentag, Niessen, & Zapf, 2010). For example, employees rated the extent to which they “searched out new technologies, processes, techniques, and/or product ideas” during the past

week. All items were rated on a 5-point scale ranging from 1 = “not true at all” to 5 = “very true”. On average reliability was very good with $\alpha = .85$, ranging from $\alpha = .79$ to $\alpha = .90$.

Opening and Closing Leader Behaviors. Opening and closing leader behaviors were assessed at the general level as well as the weekly level using the German version of scales used by Zacher and Rosing (2015). We adapted the scales to the weekly level (Ohly et al., 2010). Opening leader behavior was measured using 7 items. An example item was “This week my leader tolerated mistakes.” Cronbach’s alpha was on average $\alpha = .82$, ranging from $\alpha = .75$ to $\alpha = .89$. Closing leader behavior was also measured using 7 items, for example “This week my leader established routines.” Items were rated on a scale ranging from 1 = “not at all” to 5 = “very strongly.” On average Cronbach’s alpha was $\alpha = .81$, ranging from $\alpha = .71$ to $\alpha = .87$.

Control Variables

Many traditional leadership styles have been examined with respect to innovation performance (Hughes et al., 2018; Rosing et al., 2011). However, to examine the effectiveness of leadership for the innovation process, it is important to simultaneously analyze different approaches to draw conclusions (Hughes et al., 2018). To this end, based on well-established taxonomies of leadership approaches (Borgmann, Rowold, & Bormann, 2016; De Rue, Nahrgang, Wellmann, & Humphrey, 2011; Yukl et al., 2016), we controlled for four traditional approaches that span the whole spectrum of active and positive leadership styles.

Transformational Leadership. Transformational leadership entails a leader motivating the follower to go beyond their self-interests (Bass, 1985, 1999). We assessed transformational leadership using the German version of the Multifactor Leadership Questionnaire (MLQ Form 5x Short) in the baseline questionnaire (Avolio, Bass, & Jung, 1999; Felfe, 2006). The scale consists of 20 items including for instance “My leader talks about his most important values and beliefs.” All items were assessed on a 5-point scale

ranging from 1 = “never” to 5 = “regularly, almost always”. The reliability for the scale was $\alpha = .93$.

Transactional Leadership. Transactional leadership describes an exchange-relationship of actions and rewards (Bass, 1999; Bass, Avolio, Jung, & Berson, 2003). We also used the German version of the MLQ to assess transactional leadership in the baseline questionnaire (Avolio et al., 1999; Felfe, 2006). These items were also rated on a scale ranging from 1 = “never” to 5 = “regularly, almost always.” The scale consists of 8 items such as “My leader provides me with assistance in exchange for my efforts.” The reliability for the scale was $\alpha = .68$.

Instrumental Leadership. Instrumental leadership describes a strategic perspective as leaders should be able to adapt to the external environment and acquire and manage resources efficiently (Antonakis & House, 2014). We assessed instrumental leadership using a scale provided by Antonakis and House (2014) in the last weekly questionnaire. The scale contained 16 items and employees rated the frequency of behavior on a scale from 1 = “not at all” to 5 = “very strongly.” An example item is “My supervisor understands the constraints of our organization.” The reliability for the scale was $\alpha = .92$.

Leader-Member Exchange. Leader-member exchange (LMX) focuses on the dyadic nature of leadership and zooms in on the relationship between a leader and a follower (Gerstner & Day, 1997; Graen & Uhl-Bien, 1995). Leader-member exchange was measured with a German version of the LMX-7 in the baseline questionnaire (Schyns, 2002). The scale includes 7 items, for example “I have enough confidence in my supervisor that I defend his decisions.” Different 5-point rating scales were used depending on the item. The scale showed a good reliability, $\alpha = .74$.

Statistical Analysis

The data of this study has a nested structure, as the weekly reports are nested within employees. Therefore, multilevel random intercept regression analysis was conducted using the R-packages lme4 (Bates, Mächler, Bolker, & Walker, 2015) and lmerTest (Kuznetsova, Brockhoff, & Christensen, 2017). Before the analyses, we centered the predictors. All level-2 predictors were grand-mean centered, whereas the level-1 predictors were centered within the person (Enders & Tofighi, 2007). Moreover, we computed intraclass correlation coefficients (ICC) based on an unconditional random coefficient model (Bliese, 2000, see Table 1). The *ICC(1)* for the dependent variable innovation performance was .47, indicating that the within-person variance was substantial with 53%. Thus, the multilevel data structure needs to be considered in the analyses (Bliese, 2000; Scherbaum & Ferreter, 2008).

Results

Table 1 shows the descriptive statistics and intercorrelations of the study variables that were conducted based on a sample of $N = 49$ or $N = 54$ employees depending on the exclusion of missing data. The results show that all leadership constructs are significantly interrelated, which has been found previously (Bormann & Rowold, 2018; Yukl, 2012). This underlines the importance of simultaneously analyzing the effects of these leadership approaches with respect to innovation performance (Hughes et al., 2018).

Table 1: Intercorrelations of Study Variables in Study 1

	\bar{x}	<i>SD</i>	<i>ICC(1)</i>	1	2	3	4	5	6	7	8	9
Level 2: Person-Level												
1. Opening Leader Behavior	4.03	0.62			.14	.82**	.51**	.41**	.48**	.62**	.12	.50**
2. Closing Leader Behavior	3.28	0.73				.34*	.58**	.18	.12	.14	.50**	.02
3. Transformational Leadership	3.76	0.59					.67**	.49**	.73**	.53**	.30*	.49**
4. Transactional Leadership	3.30	0.54						.42**	.49**	.32*	.40**	.24
5. Instrumental Leadership	3.66	0.67							.35*	.36*	.44**	.42**
6. LMX	3.93	0.60								.40**	.32*	.31*
Level 1: Week-Level												
7. Opening Leader Behavior	3.40	0.75	.67								.22	.70**
8. Closing Leader Behavior	2.26	0.75	.65							.33**		.20
9. Innovation Performance	2.83	0.93	.47							.39**	.23**	

Note: $N = 49-54$ (level 2), $N = 219-254$ (level 1). For those variables assessed on level 1, below the diagonal correlations at the within-person level are displayed, above the diagonal correlations at the between-person level are displayed. *ICC(1)* = Intraclass Coefficient 1 (Bliese, 2000). * $p < .05$, ** $p < .01$.

To examine the role of leadership styles and behaviors for innovation performance, a multilevel regression analysis with a random intercept model was conducted (see Table 2). Due to missing data this analysis was only conducted with $N = 49$ employees providing $N = 219$ weekly reports. At level 2, transformational, transactional, and instrumental leadership, as well as leader-member exchange, opening and closing leader behaviors were entered as control variables. At level 1, opening and closing leader behavior as well as their interaction were added to the regression.

The results for the traditional leadership styles only indicate a relationship between instrumental leadership and innovation performance. Instrumental leadership showed a significant positive association with innovation performance ($B = .30, SE = 0.14, p = .042$). Transformational ($B = 0.53, SE = 0.37, p = .158$) and transactional ($B = -0.14, SE = 0.26, p = .598$) leadership did not show a significant relationship. Leader-member exchange also did not show a significant association ($B = -0.10, SE = 0.22, p = .649$).

Hypotheses 1 and 2 state that opening and closing leader behavior have positive relationships with innovation performance. Both opening leader behavior ($B = 0.60, SE = 0.11, p < .001$) and closing leader behavior ($B = 0.24, SE = 0.12, p = .048$) were positively associated with innovation performance. Thus, Hypotheses 1 and 2 were supported. Moreover, the interaction of the two ambidextrous leader behaviors is expected to be positively associated with innovation performance (H3). However, no significant relationship was found in this regard ($B = -0.31, SE = 0.28, p = .266$) and, thus, Hypothesis 3 was rejected.

Table 2: Multilevel Regression Analysis Predicting Innovation Performance

Outcome: Innovation Performance	Fixed			Random	
	Est.	<i>SE</i>	<i>t</i>	<i>df</i>	<i>SD</i>
Intercept	2.88	0.08	34.77**	41.45	0.49
Level 2: Person-Level					
Opening Leader Behavior	0.08	0.25	0.31	42.25	
Closing Leader Behavior	-0.15	0.16	-0.97	43.26	
Transformational Leadership	0.53	0.37	1.4	39.91	
Transactional Leadership	-0.14	0.26	-0.53	39.69	
Instrumental Leadership	0.30	0.14	2.09*	43.00	
LMX	-0.10	0.22	-0.46	42.90	
Level 1: Week-Level					
Opening Leader Behavior	0.60	0.11	5.25**	170.45	
Closing Leader Behavior	0.24	0.12	1.99*	170.82	
Opening x Closing Leader Behavior	-0.31	0.28	-1.12	176.08	

Note. $N = 49$ (level 2), $N = 219$ (level 1). Est. = Estimate. *df* and *p*-values were determined with the R-package lmerTest (Kuznetsova et al., 2017). Opening leader behavior and closing leader behavior (level 1) was centered within the cluster (person-mean centered). All level 2 variables were grand-mean centered. * $p < .05$, ** $p < .01$.

Discussion

In this study, we support the proposition that opening and closing leader behaviors have positive relationships with innovation performance. This points to the importance of specific leader behaviors of opening and closing for the innovation process and underlines the relevance of ambidextrous leader behaviors for research in this area (Rosing et al., 2011; Zacher et al., 2016; Zacher & Rosing, 2015). We did not find the postulated relationship of the interplay of opening and closing leader behaviors with innovation performance. This is surprising since both theoretical arguments (Rosing et al., 2011) and empirical data have supported this association (Zacher & Rosing, 2015; Zacher & Wilden, 2014). A possible interpretation lies in the (mis)alignment of leader behaviors with situational requirements. The ambidextrous leadership model suggests that only if opening and closing leader behavior are applied according to situational demands of creativity and implementation, the interplay will have a positive effect (Rosing et al., 2011). This is especially important when regarding within-person fluctuations, because one leader showing different leader behaviors within a week could be seen as sending mixed signals if the behavior is not aligned with the situational requirements.

Another interesting result is the positive relationship of instrumental leadership with innovation performance even after controlling for other traditional leadership styles. Until now, research has not found consistent effects of instrumental leadership with respect to creativity or innovation performance (Lin & McDonough, 2011; Tung & Yu, 2016). An interpretation could be provided by the complex activities required within the innovation process (Bledow et al., 2009; Janssen, 2000; Mumford, 2000). It has been suggested that innovation processes do not only require creativity and implementation, but also idea promotion (Janssen, 2000; Mumford, 2000; Mumford et al., 2002). Idea promotion includes the championing of ideas within the organization (Howell & Boies, 2004; Janssen, 2000). Leaders need to gain support to secure resources and financial aids for promising ideas

(Janssen, 2000; Mumford, 2000). For this purpose, leaders need to form strategic alliances and networks within the organization (Mumford, 2000; Mumford et al., 2002). Idea promotion thus requires leaders to act strategically. This goes hand in hand with instrumental leadership, because instrumental leaders identify opportunities and give support and resources to reach a certain goal (Antonakis & House, 2014). Consequently, instrumental leadership might aid idea promotion within the innovation process (Antonakis & House, 2014; Mumford, 2000; Mumford et al., 2002).

Taken together, instrumental leadership as well as opening and closing leader behavior directly address creativity, implementation, and idea promotion relevant to innovation processes (Antonakis & House, 2014; Mumford et al., 2002; Rosing et al., 2011). All three approaches are defined as specific leader behaviors which shows an advantage when addressing the diverse requirements within the innovation process (Hunter et al., 2011; Mumford et al., 2002; Rosing et al., 2011). This need cannot be met by other leadership styles (Bass, 1985, 1999; Gerstner & Day, 1997; Graen & Uhl-Bien, 1995) or the recent developments toward an integration of these (Borgmann et al., 2016; Yukl, 2012; Yukl et al., 2016). These broader approaches do not take the distinct requirements of the innovation process into account (Bledow et al., 2009; Rosing et al., 2011). Consequently, ambidextrous and instrumental leadership provide important leader behaviors to support the specifics of the innovation process.

Theoretical Contribution

This study contributes to existing literature in three ways. First, the paper underlines the importance of ambidextrous leadership as a model for leadership in innovation processes. Ambidextrous leadership describes concrete leader behaviors that specifically cater to creativity and implementation requirements (Rosing et al., 2011). This is an advantage over traditional leadership approaches with respect to the innovation process. For instance, both the facet of intellectual stimulation in transformational leadership and opening leader behavior

aim at fostering creativity (Bass, 1985; Rosing et al., 2011). However, transformational leadership applies to employees general motivation to work beyond the expected (Bass, 1985, 1999; Bass et al., 2003), whereas opening leader behavior gives concrete advice concerning the task performance associated with creativity requirements (Rosing et al., 2011).

Furthermore, compared to traditional leadership approaches, the ambidextrous leadership model takes the situational requirements of creativity and implementation into account and describes concrete contingencies under which a leader behavior will be effective (Rosing et al., 2011). By contrast, traditional leadership approaches do not regard the situational characteristics for effectiveness. Thus, these approaches do not offer solutions concerning the necessary integration of creativity and implementation requirements in the innovation process (Bledow et al., 2009; Rosing et al., 2011). These unique characteristics of the ambidextrous leadership model provide theoretical grounding for a differentiation to traditional leadership styles and emphasize the importance of the model for leadership in innovation processes.

Second, we provide support for these arguments by showing that opening and closing leader behaviors are positively related to innovation performance. These results are in line with existing literature, especially regarding the positive effects of opening leader behavior (Zacher et al., 2016; Zacher & Rosing, 2015; Zacher & Wilden, 2014). Nonetheless, the results extend the literature on ambidextrous leadership by replicating the positive relationship of opening and closing leader behavior for a German sample as earlier study had been conducted with samples from the USA (Zacher et al., 2016) and Australia (Zacher & Rosing, 2015; Zacher & Wilden, 2014).

Third, data for this study was collected in a longitudinal study investigating the processes on a within-person level. This perspective is relevant as the integration of creativity and implementation requirements occurs over time within the innovation process (Rosing et al., 2011; Schnellbacher et al., 2019). Furthermore, it has been suggested that the integration of creativity and implementation will be more successful when kept in the same system – in

this case one leader-follower dyad (Bledow et al., 2009; Miron-Spektor et al., 2018; Smith & Lewis, 2011). As the knowledge about the idea and the implementation stays with the actors of the process, the integration is easier (Gibson & Birkinshaw, 2004; He & Wong, 2004). Earlier studies on ambidextrous leadership examined the processes in a daily diary (Zacher & Wilden, 2014) or cross-sectional data sets (Zacher et al., 2016; Zacher & Rosing, 2015). The week-level analysis provides an important time frame as the interactions between leaders and employees in innovation processes might occur in a weekly rather than daily manner (Breevaart & Zacher, 2019; Madrid et al., 2014).

Limitations and Future Research

Notwithstanding the contributions of this study, there are also limitations that need to be considered. First, the results are based on self-report data and, thus, could be subject to different biases such as the common method bias (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003; Reiter-Palmon et al., 2012). However, since we administered measurement across six weeks at different points in time, this reduces the risk of common method bias (Breevaart & Bakker, 2018; Podsakoff et al., 2003). Nonetheless, causal conclusions cannot be drawn based on this research (Antonakis et al., 2010, 2014). Thus, experimental designs on these relationships should be applied in future research (Antonakis et al., 2010, 2014; Hughes et al., 2018).

Second, although we provide a first comparison of different leadership approaches in innovation processes (Hughes et al., 2018), this comparison is incomplete in that not all leadership constructs were measured at the within-person level. Thus, we can only compare leadership effects at the between-person level. Recent research has shown that traditional leadership styles also fluctuate on the within-person level (Breevaart & Bakker, 2018; Breevaart & Zacher, 2019). Consistent with earlier leadership research we measured the traditional leadership styles on the between-person level (Antonakis & House, 2014; Bass, 1985; Gerstner & Day, 1997; Graen & Uhl-Bien, 1995). However, comparing within-person

effects of different leadership approaches in the innovation process is an interesting avenue for future research.

Third and finally, the flexible change between opening and closing leader behavior which is a central tenet of ambidextrous leadership (Rosing et al., 2011) has not been investigated extensively in this study. The flexibility aspect of ambidextrous leadership cannot be operationalized properly by an interaction term as this term does not include the appropriateness of leader behavior for a specific situation. To find better operationalizations of the leader flexibility in ambidextrous leadership, we need to gather a more detailed understanding of creativity and implementation requirements and the relevant dynamics within the innovation process (Bledow et al., 2009; Halbesleben, Novicevic, Harvey, & Buckley, 2003; Rosing et al., 2018). With this knowledge, we might be able to find better operationalization including situational appropriateness to detect whether the flexible adjustment of ambidextrous leader behaviors helps employees to reach successful innovations (Rosing et al., 2011).

Practical Implications

The present study also holds some practical implications, as it emphasizes the importance of concrete and specific leader behaviors for the innovation process. The results underline that opening and closing leader behaviors are positively associated with innovation performance. Thus, organizational leaders in innovation processes should apply opening and closing leader behaviors to address creativity and implementation requirements within the process (Rosing et al., 2011). Furthermore, instrumental leadership revealed a positive relationship with innovation performance. We postulate that this leadership style is relevant to innovation processes, as idea promotion to acquire financial means and top management support is eminent (Antonakis & House, 2014; Janssen, 2000; Mumford et al., 2002). Taking these three aspects into account, leaders will be able to support employees to achieve high innovation performance.

4. Study 2: Flexible Adaptation of Leader Behaviors: An Experimental Analysis of the Beneficial Effect of Flexibility in Innovation Processes

Today's business world is characterized by a dynamic and ever-changing environment (Halbesleben et al., 2003). Accordingly, flexibility and dynamic adaptation has been coined as an important prerequisite for successful leadership (Halbesleben et al., 2003; Vroom & Jago, 2007; Yukl & Mahsud, 2010). This is especially true for innovation processes as they are characterized by fluctuating situational requirements, including creativity and idea implementation (Bledow et al., 2009; Rosing et al., 2011; van de Ven, 2016). Consequently, leaders who aim to promote innovation must act flexibly and adjust their leader behavior according to these situational requirements (Havermans et al., 2015; Hunter et al., 2011; Rosing et al., 2011). Flexibility has been recognized in theoretical models on leadership, but research is lacking a thorough empirical investigation of this component of leadership (Fiedler, 1971; Halbesleben et al., 2003; Peters, Hartke, & Pohlmann, 1985; Yukl & Mahsud, 2010). Therefore, the goal of this study is to examine the effectiveness of a flexible leadership approach for innovation processes.

Regarding the innovation process, the flexible adaptation of leader behavior could be key to an effective leadership approach (Halbesleben et al., 2003; Havermans et al., 2015; Rosing et al., 2011). Leaders have been proposed as a central influence for successful innovation processes (Hughes et al., 2018; Junni et al., 2015; Mainemelis et al., 2015). However, the empirical relationships of traditional leadership approaches with innovation performance are inconsistent and vary widely (Carnevale et al., 2017; Rosing et al., 2011). This could be due to the dynamics of innovation processes associated with the fluctuating requirements of creativity and implementation and a neglect of matching these requirements with appropriate leader behaviors (Rosing et al., 2011; Rosing et al., 2018). A flexible adaptation of leader behavior to address both requirements could provide a solution, insofar

that flexible leaders change towards the appropriate behavior in a given situation of the innovation process (Halbesleben et al., 2003; Hunter et al., 2017; Rosing et al., 2011).

Consequently, research on leadership in innovation processes benefits from an empirical analysis of a flexible approach including different leader behaviors for creativity and implementation requirements. The model of ambidextrous leadership describes such a flexible adaptation of two types of leader behaviors (Rosing et al., 2011). On the one hand, opening leader behavior, such as encouraging to take risks, questioning existing structures and routines, addresses creativity requirements (Rosing et al., 2011; Zacher et al., 2016; Zacher & Rosing, 2015). On the other hand, setting goals including deadlines and focusing on efficiency are example of closing leader behavior, which should apply to the implementation requirements (Rosing et al., 2011; Zacher et al., 2016; Zacher & Rosing, 2015). Most importantly, for successful innovation processes, both ambidextrous leader behaviors need to be applied flexibly in order to address both creativity and implementation requirements in a given situation (Hunter et al., 2011; Rosing et al., 2011). Although flexibility is at the core of ambidextrous leadership, actual changes between opening and closing leader behaviors have not been investigated empirically yet (Zacher et al., 2016; Zacher & Rosing, 2015; Zacher & Wilden, 2014). This is problematic because, based on our knowledge of the innovation process, adequate changes should catalyze the effectiveness of ambidextrous leadership for innovation success (Bledow et al., 2009; Rosing et al., 2011; Rosing et al., 2018).

In addition, existing literature on leadership for innovation has relied mostly on correlational designs (Hughes et al., 2018). Thus, conclusions in terms of causal influences cannot be drawn, for instance due to possible reverse causality issues (Antonakis et al., 2010; Antonakis, 2017; Highhouse, 2009). Consequently, there have been calls for more experimental work in leadership research in general (Antonakis, 2017; Hughes et al., 2018; Podsakoff & Podsakoff, 2019) and in leadership for innovation more specifically (Hughes et al., 2018; Zacher et al., 2016; Zacher & Rosing, 2015).

This paper considers these limitations and investigates the flexible adaptation of ambidextrous leader behaviors in a controlled setting. We aim to contribute to the existing leadership literature in two ways. First, our research aims to provide empirical support for the flexible adaptation of leader behaviors within the innovation process (Rosing et al., 2011). Second, we intend to give insights on how flexible leadership can be standardized in a laboratory setting to draw causal conclusions. In line with this, we highlight the difficulties and challenges associated with such a laboratory experiment (Antonakis, 2017; Highhouse, 2009; Podsakoff & Podsakoff, 2019).

Theoretical Background and Hypothesis Development

Flexibility in Innovation Processes

Innovation is defined as the “intentional introduction and application within a role, group or organization of ideas, processes, products or procedures, new to the relevant unit of adoption“ (West & Farr, 1990, p. 9). Accordingly, innovation incorporates both creativity and idea implementation (Bledow et al., 2009; Rosing et al., 2018; West & Farr, 1990). These two requirements of creativity and implementation are central within the innovation process, however, they include different and sometimes even contradictory demands (Bledow et al., 2009; Miron-Spektor et al., 2018; Miron-Spektor & Erez, 2017). On the one hand, creativity requires the generation of ideas associated with novelty, taking risks, and new opportunities (Amabile, 1988; Amabile & Pratt, 2016; Andriopoulos & Lewis, 2009). Implementation requirements, on the other hand, entail the efficient and error-free realization of a product, process, or procedure (Andriopoulos & Lewis, 2009; Miron-Spektor et al., 2011; Miron-Spektor et al., 2018). Despite the differences between these requirements, employees are most successful in innovative endeavors when they address both situational requirements of creativity and implementation (Axtell et al., 2000; He & Wong, 2004; Unsworth et al., 2005). Situational requirement of both creativity and implementation are present throughout the whole innovation process (Bledow et al., 2009; Rosing et al., 2018; Rosing & Zacher, 2017).

They fluctuate within the innovation process resulting in situations where creativity requirements as well as situations in which implementation requirements are more prominent (Bledow et al., 2009; Rosing et al., 2018). Actors within the innovation process need to adjust their behavior in line with these requirements to address both aspects and integrate them to reach high innovation performance (Bledow et al., 2009; Rosing et al., 2011; Rosing et al., 2018; Zacher & Rosing, 2015). As creativity and implementation involve different, sometimes even contradictory activities, this flexible adaptation poses a challenge for employees (Andriopoulos & Lewis, 2009; Miron-Spektor et al., 2018). To better understand how employees face this challenge, research on innovation processes needs to regard mechanisms that can support employees with respect to this flexible adaptation.

Leadership for Innovation

Leadership has been suggested as one of the central influences that can support followers in mastering the challenge of innovation (Hunter et al., 2011; Junni et al., 2015; Mumford et al., 2002). In general it has been proposed that leader support for creativity and innovation will be helpful (Mainemelis et al., 2015; Shalley & Gilson, 2004; Shalley & Lemoine, 2019). Nonetheless, research on traditional leadership approaches shows inconsistent relationships with innovation performance (Hughes et al., 2018; Mainemelis et al., 2015; Rosing et al., 2011). This could be routed in the dynamics of the innovation process associated with creativity and implementation because traditional leadership models do not offer solutions for the integration of these contradictory requirements (Rosing et al., 2011). However, leaders need to deal with situational requirements of both creativity and implementation to provide guidance for their followers (Mumford et al., 2002; Rosing et al., 2011). They need to support followers to manage the multiple tensions and direct followers' behaviors so they can address both creativity and implementation requirements (Hunter et al., 2011; Miron-Spektor et al., 2018; Rosing et al., 2011). In line with this, early research has

suggested that a combination of different leader behaviors should be advantageous (Waldman & Bass, 1991).

A more recent model adopts this perspective (Hunter et al., 2011; Mumford, 2000; Rosing et al., 2011). The model of ambidextrous leadership considers the situational requirements of creativity and implementation as it incorporates two leader behaviors (Rosing et al., 2011). Opening leader behavior describes aspects such as experimenting with different ideas, tolerating mistakes as a chance to learn, and taking risks, whereas closing leader behavior incorporates controlling goal attainment, sanctioning errors, and emphasizing efficiency (Rosing et al., 2011; Zacher & Rosing, 2015). According to the model, opening leader behavior should address creativity requirements, whereas closing leader behavior will be helpful when implementation is required (Rosing et al., 2011). As creativity and idea implementation are addressed, a leader applying both opening and closing leader behavior should support followers with respect to the activities necessary for innovation success (Axtell et al., 2000; Bledow et al., 2009; Rosing et al., 2011). Contrary, a leader who is not showing ambidextrous leader behaviors does not address the innovation requirements of creativity and implementation and thus, does not provide guidance on the specific tasks inherent to the innovation process (Rosing et al., 2011). Correlational evidence shows that the combination of opening and closing leader behaviors is associated with better innovation performance (Zacher et al., 2016; Zacher & Rosing, 2015; Zacher & Wilden, 2014). Accordingly, a leader showing both opening and closing leader behaviors supports the followers with respect to both creativity and implementation requirements and, thus, superior innovation performance will result.

Hypothesis 1: The presence of ambidextrous leader behaviors leads to better innovation performance compared to the absence of these leader behaviors.

Flexible Adaptation of Leadership in Innovation Processes

In addition to addressing creativity and implementation requirements, leaders also need to be aware of the dynamic nature of the innovation process (Bledow et al., 2009; Rosing et al., 2011; Rosing et al., 2018). We propose that a flexible pattern of leader behaviors is most suitable for the innovation process (Rosing et al., 2011). However, some researchers assume a linear pattern for the innovation process, such that a creativity phase is followed by an implementation phase in a strictly sequential manner (Cooper, 1990; Farr et al., 2003; Lubart, 2001). For instance, Farr and colleagues (2003) propose two creativity phases (problem identification and generation of creative ideas) that are followed by two implementation phases (idea evaluation and application). Such a model would argue that since creativity is addressed in the first part of the innovation process, leaders should apply opening leader behavior in the beginning (Farr et al., 2003; Rosing et al., 2011). After sufficient time, the leaders would change their behavior once to show closing leader behavior in the second phase when implementation is addressed (Farr et al., 2003; Rosing et al., 2011). However, these models do not consider the ever-changing situational requirements of creativity and implementation throughout the innovation process (Bledow et al., 2009; Rosing et al., 2018). A leader disregarding the fluctuating situational dynamics of the innovation process, gives inadequate and not fitting advice (Rosing et al., 2011; Zhou, 2003). Thus, the followers are demotivated because they are pressured to follow mismatched instructions and their autonomy to deal with the situational requirements is restricted (Liu, Chen, & Yao, 2011; Shalley & Perry-Smith, 2001; Zhou, 2003).

In order to integrate both situational requirements of creativity and implementation, a flexible approach to leadership is more promising because followers are enabled to change their behaviors and address the situational requirement within the process (Fiedler, 1971; Peters et al., 1985; Rosing et al., 2011). The situational requirements of creativity and implementation fluctuate in an unpredictable manner, as creativity and implementation follow

an iterative pattern and thus, chaotic changes are the rule (Bledow et al., 2009; Cheng & van de Ven, 1996; Rosing et al., 2018; Schroeder et al., 1989). In line with this, ambidextrous leaders need to identify creativity and implementation requirements within the innovation process and identify what followers need to address the specific requirement in any given situation (Rosing et al., 2011). They should adjust their leader behavior toward opening leader behavior when creativity is required whereas they need to adapt to closing leader behavior when implementation requirements are more prominent (Rosing et al., 2011). With the appropriate leader behavior for a given situation, the leader provides information on how to address a certain situational requirement of either creativity or implementation (Rosing et al., 2011; Zhou, 2003). This reasonable and adequate leader behavior will motivate followers to attend to the task at hand (Shalley, 1991, 1995; Shalley & Perry-Smith, 2001). As the leader behavior changes, the leaders' advice remains reasonable, informative and adequate to situational requirements and thus, the motivation to innovate stays high (Shalley & Perry-Smith, 2001; Zhou & Oldham, 2001). Therefore, the flexible adaptation of leader behaviors should improve followers' ability to flexibly address creativity and implementation requirements (Bledow et al., 2009; Rosing et al., 2011). Followers' flexibility will then be helpful in finding a constructive way to deal with the contradictions within the innovation process (Bledow et al., 2009; Rosing & Zacher, 2017). Accordingly, flexibility supports the integration of creativity and implementation to reach higher innovation performance (Axtell et al., 2000; Miron-Spektor & Erez, 2017; Rosing et al., 2018).

Hypothesis 2: The flexible application of opening and closing leader behaviors leads to better innovation performance than the sequential application of opening and closing leader behaviors.

Method

Data for the experiment were collected using a between-subjects design manipulating leadership as an independent variable with three conditions: no leadership (control group),

sequential, and flexible ambidextrous leadership. For each experimental session, a dyadic approach including one confederate as a leader and one participant as a follower was used.

Sample

For the experiment, we recruited $N = 107$ students from a German university via social networks or lectures. $n = 8$ participants were dropped because the confederates did not follow the scripts for instance by providing suggestive tips. $n = 3$ participants were dropped due to technical issues. One participant was excluded each for severe language difficulties, because the confederate and the participant knew each other, or because the participant did not pay attention to the confederate. In total, $n = 14$ participants were dropped. This led to a final sample size of $N = 93$. Participants were randomly assigned to one of the three experimental groups leading to 27 to 33 participants for each. They were on average 22.91 years old ($SD = 4.94$). 73 participants (78.5 %) were female, 20 (21.5%) were male. They majored in different subjects, most of them studied psychology (40.9%).

Procedure

After they were welcomed at the laboratory, participants gave their consent to participation and video recordings of the experiment. The experimenter informed them that they would take part in an innovation competition by completing an innovation task (for experimenter instructions refer to supplemental materials, Appendix A). Participants were told that somebody would support them while working on the task. To introduce the confederate as a leader, the experimenter described the person, who was waiting in the other room, as fulfilling tasks inherent to leadership (Yukl, 2012; Yukl et al., 2016). The participants were informed that the person would provide the task information and the goal for the competition. Furthermore, the person would control the adherence to the task instructions and support the participant during task completion. Lastly, participants were told that the person would evaluate the task outcome for the competition. Subsequently, the

experimenter accompanied the participant to the laboratory, where the confederate was waiting. The task instructions and completion were videotaped. The confederate gave the instruction for the innovation task and explained that the three best results out of all participants were rewarded with a 50€ voucher. During task completion confederates showed leader behavior depending on the experimental condition. When the execution time was expired, a questionnaire including manipulation checks and demographics was administered. Afterwards, the experimenter tested the result of the innovation task. Finally, participants were debriefed.

Experimental Task

The innovation task was to build a construction from craft material that would secure an egg when dropped from two meters. For this task, participants were provided with five colored sheets, three balloons, three strings, ten pieces of sticky tape, 20 straws, as well as a scissors and glue. The goal of the task was to create a construction that was most secure and original with as little material as possible (cf. supplemental materials). Each participant was provided with five eggs to build the construction. Therefore, participants could use multiple eggs during the preparation phase. This specific task was chosen as it appropriately represents innovation: First, the task is sufficient because it is open-ended and the generation of new and useful ideas (being creative) is necessary (Amabile, 1988; Amabile & Pillemer, 2012; Miron-Spektor & Beenen, 2015). Second, participants had to implement their ideas to reach an practical and innovative result, the construction (West, 2002a, 2002b; West & Farr, 1990). Participants had 30 minutes for the task completion. This timeframe was pretested so that participants had enough time to finish the task. However, the timeframe was also chosen to provide a medium level of time pressure. This is important for external validity as innovation projects in organizations usually have deadlines.

Experimental Manipulations

We manipulated three different leadership conditions through confederates that acted as leaders. The confederates were six female research assistants (two per condition) on average 23.5 years old ($SD = 2.88$). We used different confederates per condition to avoid an expectancy effect resulting from confederates knowing the content of the other conditions and making assumptions about the hypotheses (e.g. Rosenthal, 1994). Accordingly, all confederates were led to believe that their leadership style was expected to be most effective for innovation and were blind to the contents of the other conditions.

To standardize leader behavior within conditions, sentences for the no leadership condition as well as for opening and closing leader behaviors were pre-defined based on existing literature (Rosing et al., 2011; Zacher & Rosing, 2015). For some example sentences please refer to Table 3, for the full-length scripts to the supplemental materials. Prior to data collection, the confederates were trained in accordance with the experimental conditions. The initial training session took two to five hours with a follow-up session of one hour. During the training session confederates of all leadership conditions learned about the experiment and the experimental task. Moreover, they all received information about the current research on innovation processes and associated follower behaviors. All confederates were trained to greet the participants and provide the task instructions in the same manner. Furthermore, we instructed confederates not to interact with the participants aside from task-related conversations that they could conduct with the standardized sentences.

Table 3: Standardized Sentences for the Leadership Manipulations Provided by Confederates

Leadership Manipulation	Examples for Standardized Sentences
Opening Leader Behavior	<ul style="list-style-type: none"> - You can take all the different materials and consider whether they would help to secure the egg. - Consider different directions for your ideas. - You don't need to be afraid of mistakes – you can learn from them. - If this idea doesn't work, you are still one step closer to a solution.
Closing Leader Behavior	<ul style="list-style-type: none"> - For a good solution, it is helpful to plan how you are going to implement it. - Beware of the time. At the end you need to have a finalized construction to take part in the competition. - Think about the goal of the task, the egg needs to be secured for you to win the competition. - For a good solution make sure that you work thoroughly and avoid mistakes.
No Leadership	<ul style="list-style-type: none"> - Decide for yourself how you solve the task. - I don't know about that. - I don't have any ideas and I also need to keep working on my own task. - Unfortunately, I don't have any time to engage in your task.

Confederates in the no leadership condition were taught that individuals should work self-organized within innovation processes (Hinkin & Schriesheim, 2008; Yang, 2015) and, thus, they were instructed not to intervene with the work of participants. As learning this leader behavior was quite simple, training for this condition only took two hours.

Confederates were trained not to intervene with the innovation process without producing negative affect. To realize this situation in a socially appropriate manner and similar to a field setting, confederates in this condition worked on a different task using a computer in the same room during the experiment. They first gave instructions for the innovation task to participants and then explained that they were given a different task that they needed to work on now. If participants in this condition asked questions concerning their innovation task or the procedure, confederates had standardized sentences to answer such as, “Unfortunately, I don’t have any time to engage in your task” or “Decide for yourself how you solve the task”.

In the training for the sequential condition, confederates learned about opening and closing leader behaviors (Rosing et al., 2011) and the sequential model for the innovation process (Farr et al., 2003). Subsequently, they were trained on how to apply the standardized sentences of opening and closing leader behavior in the predefined sequential manner. Training of the sequential leadership condition took about 4 hours. In the experimental sessions, the confederates then applied opening leader behavior within the first eight minutes and then switched to closing leader behavior for the remaining 22 minutes of task completion. These timeframes resulted from pretests with the experimental task that revealed that giving participants equal amounts of time for creativity and implementation reduced performance, as many participants were not able to finish the implementation of their constructions. In order to provide a fair test of the experimental conditions, we aimed to design the best possible sequential condition and thus, decided on time frames of eight minutes for opening and 22 minutes for closing leader behavior.

In the flexible condition, confederates were trained to switch between the two types of leader behaviors depending on situational cues. These confederates learned about the dynamic nature of the innovation process and that leaders should adjust their behavior depending on the situational requirements (Bledow et al., 2009; Rosing et al., 2011; Schroeder et al., 1989). Confederates were trained on how to show opening and closing leader behaviors and furthermore, on how to change their behavior adequately and in line with situational cues. Thus, this leadership condition was most difficult to learn, and the training took about 5 hours. For the training of confederates in this condition, pretests were necessary to understand the changes in behavior for the specific innovation task used in this experiment. $N = 17$ students participated in the pretest in the laboratory, where they worked on the innovation task of building a construction to secure the egg. Since creativity and implementation related behaviors are not always overtly observable (e.g., problem-solving cognitions such as divergent thinking to reach novel solutions), we utilized a verbal protocol technique requiring individuals to verbalize their thoughts during the task completion (Ericsson & Simon, 1999; Grégoire, Barr, & Shepherd, 2010; Ryan & Haslegrave, 2007). After task completion, research assistants coded the video recordings concerning creativity- and implementation-related behaviors either shown or verbalized by participants. Subsequently, the coders identified changes in behavior. In the following, we developed a category system for situational cues that signal a change from creativity to implementation and vice versa. After conducting these pretests, we used the resulting categories to design training situations for the confederates of the flexible ambidextrous leadership condition. For instance, the participants voiced insecurity and concern regarding the stability of the construction (e.g., “I am not sure whether this construction is stable enough to secure the egg”) and this functioned as a signal for the confederate to change to opening leader behavior to address the creativity requirement.

Measures

Manipulation Check. To analyze whether the manipulation of the different leadership conditions was successful, we needed to determine the level of opening and closing leader behavior in all conditions as well as the changes in leader behavior in the two experimental conditions. For this information, participants rated opening and closing leader behavior on a rating scale (Zacher & Rosing, 2015). This scale contained 7 items each for opening and closing leader behavior that were rated on a 5-point Likert scale ranging from 1 = “not at all” to 5 = “very strongly”. An example for opening leader behavior was “The other person, who was in the room with me, gave room for my own ideas.” and the scale showed good reliability, $\alpha = .72$. An example for closing leader behavior was “The other person, who was in the room with me, controlled adherence to rules.” The reliability was satisfactory, $\alpha = .66$.

Moreover, we coded the confederates’ sentences recorded in the videos. The coding resulted in four variables relevant for the analyses: opening and closing leader behaviors, changes in leader behavior, as well as a count for appropriate changes in leader behavior. First, each sentence was coded as opening, closing, or no leader behavior according to the predefined standardized sentences. Two independent coders coded a video from each experimental group showing very good interrater reliability based on Cohen’s Kappa (Cohen, 1960) for the experimental conditions of no leadership ($\kappa = .96$), sequential ambidextrous leadership ($\kappa = .90$) and flexible ambidextrous leadership ($\kappa = .99$). Accordingly, coder one coded the standardized sentences in the remaining videos leading to a count of codings for opening leader behavior and a count of codings for closing leader behavior for each participant. Subsequently, coder two counted the changes between opening and closing leader behaviors resulting in a third variable. Furthermore, coder two also evaluated whether these changes in behavior were appropriate concerning the situational requirements. For this coding, appropriate changes were defined as those changes that supported the participant in task completion by for instance reducing uncertainty or supporting a decision. Contrary,

inappropriate changes were defined as those changes that interrupted the process and disturbed the participants in task completion. This coding resulted in a fourth variable for counts of appropriate changes.

To analyze whether the manipulation was successful, we tested the difference between the leadership conditions concerning the participants' ratings of opening and closing leader behaviors using multivariate analysis of variance (MANOVA). According to the manipulation, we expected both the sequential as well as the flexible leadership condition to show significantly more opening and closing leader behaviors compared to the no leadership condition. First, we analyzed the participants' ratings of opening and closing leader behavior. Using Wilks' Lambda, a significant difference between the conditions was identified, $\Lambda = 0.63$, $F(4,178) = 11.58$, $p < .001$. Subsequent univariate analysis of variance (ANOVA) revealed a significant effect on opening, $F(2,90) = 19.9$, $p < .001$, and closing leader behavior, $F(2,90) = 6.49$, $p = .002$. Post-hoc comparison further clarified that more opening behavior was shown in the sequential ambidextrous leadership condition ($p = .001$) and the flexible ambidextrous leadership condition ($p < .001$), each compared to the no leadership condition. For the ratings of closing leader behavior, more leader behavior was shown in the sequential ($p = .006$) and flexible ($p = .01$) ambidextrous leadership condition, each compared to the no leadership condition. Similar results were obtained using the more objective codings of opening and closing leader behavior. Therefore, the manipulation of leader behavior was successful in that both sequential and flexible leadership conditions showed more opening and closing leader behavior than the no leadership condition.

We further tested the differences between the conditions concerning the changes in leader behavior with a t-test. For this analysis, we expected to see a significant difference between the sequential and flexible condition of ambidextrous leadership, indicating more changes in the flexible ambidextrous leadership condition. As we did not expect participants to be able to provide valid information about the number of changes in leader behavior, this

analysis was based on the video codings. The analysis supported our assumption as it showed a significant difference between the sequential and the flexible condition, $t(58) = -6.38$, $p < .001$. Subsequent comparison of the means showed more changes in the flexible ($\bar{x} = 6.76$, $SD = 3.66$) compared to the sequential ambidextrous leadership condition ($\bar{x} = 2.04$, $SD = 1.29$). Therefore, the leadership manipulation was also successful comparing the flexible and the sequential condition as confederates in the flexible condition switched their behavior more often. Taken together, these results point to a successful leadership manipulation.

Performance. Innovation task performance was operationalized in two dependent variables: effectiveness and originality. First, *effectiveness* describes the degree to which the construction fulfilled the task goal. For this purpose, the construction was dropped from different heights up to 2 meters (1.6 feet). To begin with, the construction was dropped from 0.25 meters (0.8 feet). If the egg was still intact, the construction was dropped from the next level (0.5 meters, 1.6 feet) and so on until the 2-meter drop (6.5 feet), using the same egg. Performance was scored depending on the height at which the egg broke. Second, *originality* was rated independently by the confederates as experts based on a rating scale (Barbot et al., 2019; Bledow et al., 2013; De Dreu, Baas, & Nijstad, 2008; Reiter-Palmon et al., 2019). A video from the completed construction was evaluated on a scale from 1 = “not original” to 5 = “very original” (Bledow et al., 2013; De Dreu et al., 2008; Miron-Spektor & Beenen, 2015). The confederates are experts for the construction as they attended to different solutions during task completion. Furthermore, the confederates were trained on the evaluation criteria (Barbot et al., 2019; Reiter-Palmon et al., 2019). However, to avoid confounding, each confederate evaluated only those constructions that they did not attend to during task execution. A construction was defined as very original when it was radical, new, and unique compared to the other constructions (Amabile, 1988; Herman & Reiter-Palmon, 2011; Miron-Spektor & Beenen, 2015). The interrater reliability for the originality score based on all

constructions was very good with $ICC = .80$ (Shrout & Fleiss, 1979). Accordingly, the ratings of the different coders were averaged resulting in one originality score for each construction.

Statistical Analysis

To test our hypotheses, we conducted a MANOVA. We examined the differences between the three experimental groups with respect to innovation performance in terms of effectiveness and originality.

Results

Correlations of all study variables as well as means and standard deviations can be seen in Table 4. The table shows some significant correlations among the variables for coding of leader behavior. Especially the correlation between “changes in leader behavior” and “appropriate changes” is high ($r = .93, p < .001$), indicating that changes in leader behavior were mostly appropriate. However, no significant correlations were found for the dependent variables: effectiveness and originality.

Table 4: Intercorrelation of Study Variables in Study 2

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8
1. Ratings Opening Leader Behavior	3.26	0.76								
2. Ratings Closing Leader Behavior	2.95	0.68	.20							
3. Codings Opening Leader Behavior	8.90	8.43	.57**	.35**						
4. Codings Closing Leader Behavior	15.38	13.46	.41**	.41**	.85**					
5. Codings Changes in Leader Behavior	4.63	3.69	.39**	.11	.51**	.01				
6. Coding Appropriate Changes	3.40	3.70	.44**	.02	.37**	-.16	.93**			
7. Performance: Effectiveness (DV) ^a	1.23	1.25	-.05	.03	.02	-.01	-.05	-.05		
8. Performance: Originality (DV) ^b	2.75	0.98	.02	.02	-.01	.01	.08	.11	.09	

Note: $N = 93$. ^a 1 = 0.25m 2 = 0.5 3 = 0.75m, 4 = 1.0m 5 = 1.25 6 = 1.5m 7 = 1.75m 8 = 2.0m. ^b 1 = not original 5 = very original. * $p < .05$, ** $p < .01$. DV = Dependent Variable.

Hypothesis Testing

We hypothesize that participants receiving flexible and sequential ambidextrous leader behaviors show better innovation performance compared to the no leadership condition (Hypothesis 1). To test this assumption, we compared the no leadership group to the other two experimental groups. Moreover, Hypothesis 2 states that flexible ambidextrous leadership leads to better innovation performance than the sequential application of opening and closing leader behaviors. This was tested comparing the flexible and the sequential ambidextrous leadership condition. To test these hypotheses, we conducted a MANOVA regarding the effects of leadership condition on both dependent variables: effectiveness and originality. Using Wilk's Lambda, results revealed no significant effects, $\Lambda = 0.99$, $F(4, 178) = 0.21$, $p = .93$. Thus, Hypotheses 1 and 2 could not be supported.

Exploratory Analyses

Since the model of ambidextrous leadership focuses on those changes that are appropriate in terms of situational requirements (Rosing et al., 2011), we conducted additional analyses to examine the effects of appropriateness. To begin with, correlational analysis shows that most changes were appropriate because the relationship between changes and appropriate changes is very high ($r = .93$, $p < .001$). This is in line with our training as the changes in the flexible condition should be appropriate whereas changes in the sequential condition could be inappropriate. However, it can be assumed that more appropriate changes in the flexible ambidextrous leadership condition, that is a stronger manipulation, would lead to better innovation performance (Rosing et al., 2011). In case of many appropriate changes, the participants could show more appropriate behavior in line with situational requirements. Thus, in this case they would be more likely to integrate creativity and implementation requirements (Rosing et al., 2011).

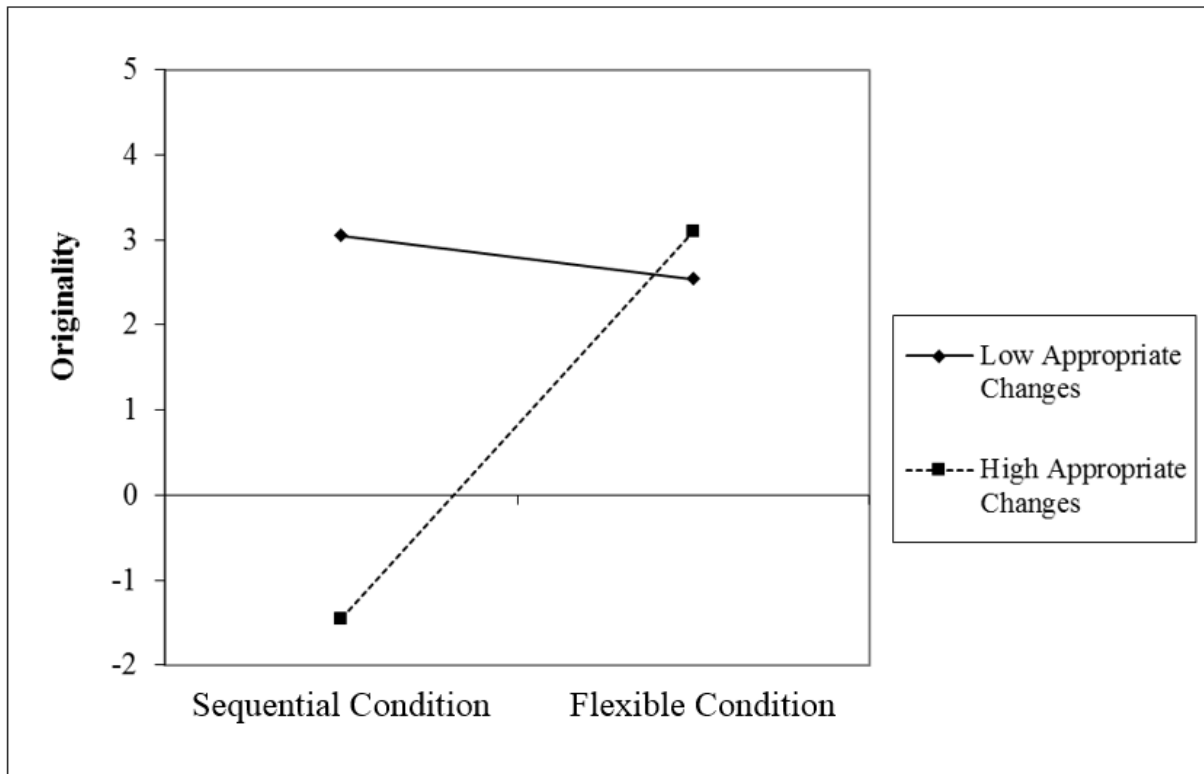
To explore this assumption, we looked at the difference between the sequential and flexible ambidextrous leadership condition for innovation performance depending on the number of appropriate changes in leader behavior as a moderator. The analysis was conducted using hierarchical regression modeling and the PROCESS tool for simple slope analyses (Hayes, 2013). First, we investigated the influence of leadership condition as the independent variable and appropriate changes as the moderator on effectiveness. The results are displayed in Table 5. We did not find a significant interaction of leadership condition and appropriate changes on effectiveness ($B = 0.23$, $SE = 0.54$, $p = .67$). Second, we investigated the influence of leadership condition (independent variable) and appropriate changes (moderator) on originality. The results are also displayed in Table 5. In this case, the interaction of leadership condition and appropriate changes on originality also did not meet conventional levels of statistical significance ($B = 0.69$, $SE = 0.38$, $p = .07$). However, due to the descriptive trend, we explored the descriptive results with a simple slope analysis. This revealed no significant difference between the two conditions in case of no appropriate changes ($B = -0.31$, $SE = 0.40$, $p = .44$), average ($B = 2.02$, $SE = 1.17$, $p = .09$) and high levels ($B = 4.56$, $SE = 2.53$, $p = .08$) of appropriate changes. The descriptive results of this interaction are displayed in Figure 2.

Table 5: Moderated Regression Analysis of Leadership Condition and Appropriate Changes on Originality and Effectiveness

	Dependent Variable = Effectiveness	Dependent Variable = Originality
STEP 1		
Leadership Condition ^a	0.53(0.52)	-0.12(0.37)
Appropriate Changes	-0.05(0.07)	0.03(0.05)
STEP 2		
Leadership Condition	0.43(0.57)	-0.31(0.40)
Appropriate Changes	-0.73(1.61)	-2.02(1.12)
Leadership Condition x Appropriate Changes	0.23(0.54)	0.69(0.38)
R ²	.02	.07
F	0.41	1.36

Note: $N = 60$. ^a 1 = Sequential Ambidextrous Leadership 2 = Flexible Ambidextrous Leadership. * $p < .05$, ** $p < .01$

Figure 2: Interaction Effect of Leadership Condition and Appropriate Changes on Originality



Discussion

Our experiment represents a first attempt to manipulate ambidextrous leadership in a laboratory setting to provide evidence for the effectiveness of a flexible adaptation of leader behaviors in the innovation process (Rosing et al., 2011). Unexpectedly, we did not find significant effects of the manipulated leadership conditions on innovation performance. The application of ambidextrous leader behaviors irrespective of a flexible or sequential manner did not influence the innovation performance in this experimental task and did not lead to higher innovation performance compared to the absence of leader behaviors.

The exploratory analyses regarding the interaction of appropriate changes and leadership condition on originality point to a potentially methodological shortcoming. The descriptive results indicate that the appropriateness of changes may constitute a boundary condition for the expected effects. Even though the effects did not meet conventional levels of statistical significance, the descriptive results are in line with the model of ambidextrous

leadership, as the flexible changes can only be supportive if they are appropriate to the situational requirements (Rosing et al., 2011). One could conclude that the training of confederates in the flexible ambidextrous leadership condition was not strong enough. We trained confederates thoroughly on when to change their leader behavior based on situational cues. This was successful, as regarding the correlational data, confederates changed appropriately most of the time. However, the manipulation of flexible leadership might not have been strong enough in that not enough appropriate changes could be shown, as the difference between sequential and flexible ambidextrous leadership in terms of innovation performance was not significant.

Furthermore, confederates talked a lot during task completion, which could have impeded the feeling of autonomy. As the timeframe for the innovation process was significantly shortened compared to field innovation projects, the level of interaction was higher than one would expect in the field. Consequently, participants could have felt controlled and restricted in their autonomy in both conditions that included active leader behaviors (Liu et al., 2011; Unsworth & Clegg, 2010; Zhou, 2003) and thus, the participants' motivation and innovation performance could have been reduced (Liu et al., 2011; Shalley & Perry-Smith, 2001; Zhou, 2003).

Theoretical and Methodological Contributions

Our study contributes to research on ambidextrous leadership by investigating the causal influences of the flexible changes between opening and closing leader behaviors on innovation performance (Rosing et al., 2011; Zacher et al., 2016; Zacher & Rosing, 2015). Research on ambidextrous leadership shows that the interaction of opening and closing leader behaviors is positively related to innovation performance (Zacher & Rosing, 2015; Zacher & Wilden, 2014). However, these studies did not consider the flexible adaptation in line with situational requirements and this is addressed in the presented experiment. We did not find any significant effects and therefore, the flexible adaptation of opening and closing leader

behaviors did not lead to superior performance when compared to a sequential application or no leadership conditions. However, exploratory analyses regarding appropriate changes as a moderator suggest that it may be possible to find the proposed effects when adjusting the experimental set-up (Rosing et al., 2011). The descriptive results indicate that when confederates showed many appropriate changes, flexibility was associated with better innovation performance. This is only a descriptive result that did not reach inferential significance and conclusions need to be drawn with caution. Nonetheless, this result points to the importance of appropriateness for the flexible adjustment of opening and closing leader behaviors.

Additionally, this study adds to the leadership literature as we provide a possibility concerning the manipulation of a flexible leadership approach in a controlled setting. Using confederates in this regard seems promising, as they can act dynamically depending on situational requirements. Leadership research aims to analyze the influence leaders have on follower behaviors and performance outcomes (Fischer et al., 2017). However, research methods based on correlational data are commonly used but are insufficient to analyze causal influences (Antonakis, 2017; Hughes et al., 2018). Therefore, controlled settings such as a randomized experiments are called for (Antonakis et al., 2014; Antonakis, 2017; Hughes et al., 2018). As interactions between leaders and followers are central to many leadership theories (Avolio et al., 1999; Graen & Uhl-Bien, 1995; Rosing et al., 2011), we also need to examine the causal effects of these interactions. This is especially relevant for leadership models that incorporate leader behaviors as a flexible reaction to situational requirements, such as the ambidextrous leadership model (Rosing et al., 2011).

Limitations and Future Research

Our experiment shows the challenges related to examining flexible leadership and further provides ideas on future research. As this was a first approach to the standardization of flexible leadership, some shortcomings with respect to the internal validity need to be

considered. The results concerning the interaction with appropriate changes suggest that a stronger manipulation could have been successful. A descriptive difference between sequential and flexible ambidextrous leadership was found depending on the number of appropriate changes. This points to the importance of a more extensive training for confederates to ensure that the manipulation is strong enough. Thus, more thorough trainings on the model of ambidextrous leadership need to be developed and evaluated (Highhouse, 2009). This will increase the power of the experimental manipulation and could also be used to implement ambidextrous leadership with leaders in the field.

Compared to innovation projects in the field, the experimental task chosen was different. The task was to a large degree concerned with the implementation – the actual crafting of the construction. Creativity was necessary to find a successful solution. However, the implementation was very time-consuming. Therefore, changes in leader behavior might not have been necessary and appropriate as much as in innovation processes in an organizational context. Thus, an experimental design that is more closely related to innovation projects in field settings could be an idea for future research on this issue. One suggestion is to design an experimental task that participants can work on for longer periods of time. For example, participants could work outside the laboratory and come in for meetings in which leader behavior could be manipulated. These meetings could lead to a more prominent manipulation as the leader behaviors can be shown more often and more opportunities to show appropriate changes are created. We believe that this set-up offers the opportunity to strengthen the manipulation without intervening with task completion too much. Furthermore, this would strengthen the external validity (Highhouse, 2009; Podsakoff & Podsakoff, 2019).

Another restriction of external validity common to experimental set-ups lies in the confederates (Antonakis, 2017; Highhouse, 2009). In the presented experiment, the confederates were introduced as persons that would fulfill all the tasks that leaders in an organizational context perform (Yukl, 2012; Yukl et al., 2016). Nonetheless, it can be

assumed that the sources of influence and power in the organizational context are more complex and different influences need to be considered (e. g. Subašić, Reynolds, Turner, Veenstra, & Haslam, 2011). Thus, future studies should also regard the flexible interplay of opening and closing leader behavior in field studies to receive realistic insights. However, this was not the aim of the presented study as the goal was to provide causal evidence on the flexible interplay of ambidextrous leader behaviors and this can only be achieved through experiments where the generalizability is limited (Antonakis, 2017; Highhouse, 2009; Podsakoff & Podsakoff, 2019).

In addition, future research on flexible and dynamic leadership should investigate mediating mechanisms. Follower flexibility in terms of innovation relevant behavior could be a mediating mechanism specifically for ambidextrous leadership (Jasmand et al., 2012; Rosing et al., 2011; Rosing & Zacher, 2017). It has been proposed that opening leader behavior is positively related to follower exploration behavior addressing creativity requirements, whereas closing leader behavior is positively related to follower exploitation behaviors addressing implementation requirements (March, 1991; Rosing et al., 2011; Zacher et al., 2016). Moreover, follower ambidexterity, the combination of follower exploration and exploitation behaviors, has been associated with higher performance (Jasmand et al., 2012; Rosing & Zacher, 2017; Schnellbacher et al., 2019; Zhang et al., 2019). These relationships point to a possible mediating mechanism of the combination of follower exploration and exploitation behaviors. However, the full mediation with respect to flexible adaptation of leaders and followers has not been investigated empirically. Accordingly, this will be an interesting avenue for future research.

Conclusion

The goal of this article was to investigate the flexible adaptation of ambidextrous leader behaviors within a standardized setting. Our study provides a first attempt showing descriptive support for the flexible adaptation of opening and closing leader behavior with

respect to appropriate changes (Rosing et al., 2011). However, these descriptive effects need to be interpreted with caution. Therefore, more research on the model of ambidextrous leadership with respect to the flexible adaptation of behaviors is necessary.

Although we could not find the proposed effects, the implementation of flexible leadership based on interactions within a laboratory setting is necessary. Innovation and a flexible working matter are highly relevant in today's business world (Halbesleben et al., 2003; Rosing et al., 2011; Rubera & Kirca, 2012). Thus, it is a central challenge for future leadership research to further consider how we can empirically investigate flexible and adaptive leadership. Examining the influence of flexible leader behavior in controlled settings is a very important next step to draw causal conclusions (Antonakis et al., 2010, 2014; Antonakis, 2017). Therefore, it is necessary to consider different formats to investigate flexible adaptation of leader behaviors in a controlled setting.

5. Study 3: Aligning Leader and Follower Behaviors with Innovation

Requirements Improves Performance: An Experimental Study

Innovation is of central importance to organizations as they strive to gain or maintain a competitive advantage in the market (Porter, 1990; Rosenbusch et al., 2011; Rubera & Kirca, 2012). *Innovation* is defined as the “intentional introduction and application within a role, group or organization of ideas, processes, products or procedures, new to the relevant unit of adoption” (West & Farr, 1990, p. 9). This definition speaks to the complexity of the innovation process in that it incorporates both a requirement to be creative and a requirement to implement (Potočnik & Anderson, 2016; West & Farr, 1990). Creativity requirements are present when employees need to generate new and creative ideas (Amabile, 1988; Amabile & Pratt, 2016; West & Farr, 1990). Implementation is required when the realization of an outcome is needed (West, 2002a, 2002b; West & Farr, 1990). Innovation scholars have emphasized the difficulty of integrating creativity and implementation within the process and thus, both requirements have implicitly been recognized (Bledow et al., 2009; Miron-Spektor & Erez, 2017; Rosing et al., 2018). As creativity and implementation are very different, sometimes even contradictory, they need to be addressed by different behaviors within the innovation process (Bledow et al., 2009; Miron-Spektor et al., 2018; Rosing et al., 2011). Thus, conceptualizing creativity and implementation requirements as key parts of the innovation process will enable us to uncover the effectiveness of leader and follower behaviors in specific situations within the innovation process (Rosing et al., 2011; Shalley et al., 2004).

Leadership has been proposed as one of the central influences within the innovation process, and different models such as transformational leadership and leader-member exchange have been found to be relevant in this regard (Hammond et al., 2011; Hughes et al., 2018; Junni et al., 2015). However, research on leadership for innovation will benefit from an integration of a micro-level perspective on examining the requirements of creativity and

implementation within the innovation process. The model of ambidextrous leadership addresses this integration by proposing two leader behaviors that address the situational requirements of creativity and implementation (Rosing et al., 2011). *Opening leader behavior* entails leaders encouraging their followers to take risks and giving opportunities for independent thinking and experimenting with diverse ideas and should be especially helpful in situations when creativity is required (Rosing et al., 2011). In contrast, *closing leader behavior* involves leader actions such as ensuring rules are followed, establishing routines, and monitoring target attainments and should increase follower performance when implementation is required (Rosing et al., 2011). The model of ambidextrous leadership further proposes a dyadic approach where leader behavior should promote follower behaviors of exploration and exploitation (Rosing et al., 2011; Zacher et al., 2016). Follower exploration and exploitation behaviors also speak to the requirements of creativity and implementation. *Follower exploration behavior* describes behaviors such as experimentation, flexibility, and taking risks, whereas *follower exploitation behavior* entails behaviors such as refinement, effectiveness, and selection (March, 1991). Thus, follower exploration behavior is an approach to tasks with a variety of behaviors that should be helpful for creativity (Gupta et al., 2006; Rosing et al., 2011). Contrarily, follower exploitation behavior includes a focus on known behaviors that should promote implementation (Gupta et al., 2006; Rosing et al., 2011). Both leader and follower behaviors can thus be aligned with creativity and implementation requirements within the innovation process. The importance of the role of requirements within the process becomes more apparent when considering the possible effects of a misalignment. For example, a leader who focuses on meeting deadlines (*closing leader behavior*) when the task requires the development of new ideas (creativity requirement) or encourages thinking in new directions (*opening leader behavior*) when the task requires the final realization of a product (implementation requirement) is unlikely to be successful. Yet,

the alignment of leader and follower behaviors with situational requirements of the innovation process has not been investigated empirically.

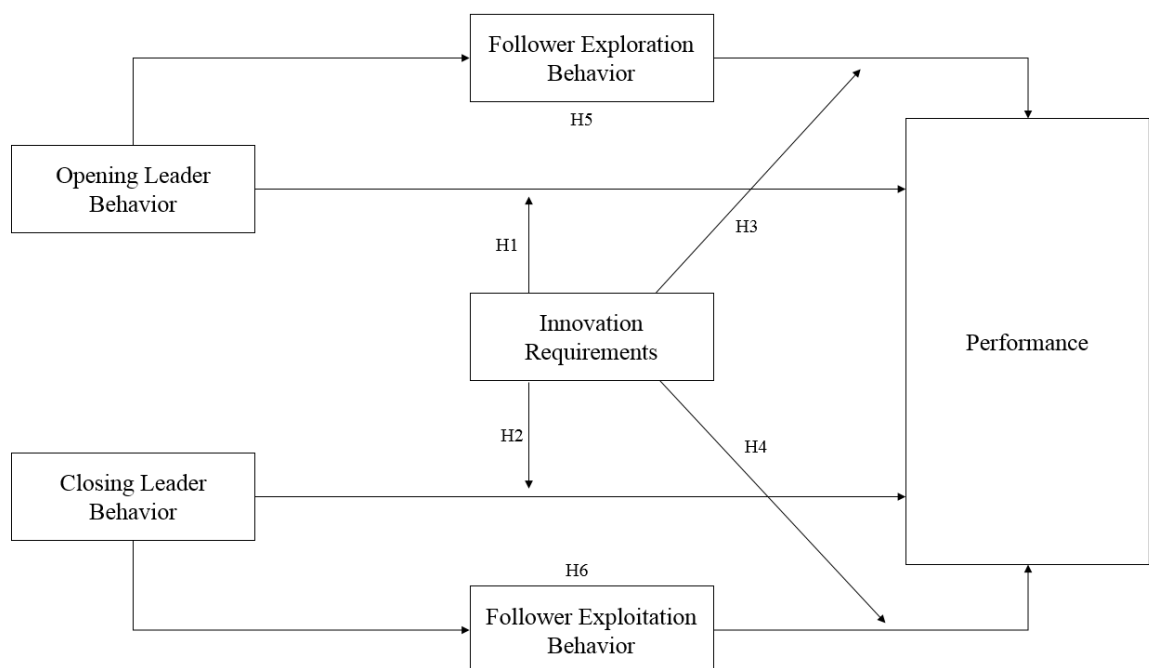
Moreover, most research on leadership for innovation relied on correlational data (Hughes et al., 2018). Unfortunately, we cannot draw causal conclusions concerning the influence of leadership in innovation processes based on these studies (Antonakis, 2017; Hughes et al., 2018). Therefore, this research contributes by analyzing the causal effects of leader behaviors on innovation performance. This is important as a reverse effect could also exist (Antonakis et al., 2010, 2014; Hughes et al., 2018). Furthermore, there has been considerable debate on the influence of perception on self-report measures of leadership and innovation performance (Antonakis, 2017; Hughes et al., 2018; Reiter-Palmon et al., 2012). For example, research shows that knowledge about leaders' performance influences the evaluation of leader behaviors (Lord, Binning, Rush, & Thomas, 1978; Wang, van Iddekinge, Zhang, & Bishoff, 2019).

Taking these shortcomings into consideration, a central advantage of the present study is the explicit experimental manipulation of both opening and closing leader behaviors and innovation requirements which allows us to draw causal conclusions. Using this more rigorous method, we aim to investigate whether the alignment of leader and follower behaviors with creativity and implementation requirements leads to increased performance. We further analyze whether followers' exploration and exploitation behaviors represent mediating mechanisms for the effects of leader behaviors on performance as proposed by Rosing et al (2011). For an illustration of our conceptual model see Figure 1.

Our study contributes to the literature in two ways. First, conceptualizing specific creativity and implementation requirements will change our understanding from general job requirements to be creative or innovative towards a micro-level perspective on situation-specific requirements of creativity and implementation within the innovation process (Rosing et al., 2011; Shin et al., 2017; Unsworth et al., 2005). This new within-process perspective

may suggest different situational approaches in terms of leader and follower behaviors to address creativity or implementation requirements (Rosing et al., 2011; Shalley et al., 2004). Second, we offer a methodological contribution to the literature on leadership and innovation by drawing causal conclusions regarding the influence of opening and closing leader behaviors on performance.

Figure 3: Conceptual Model of Study 3



Theoretical Background and Hypothesis Development

The Innovation Process

Innovation is a complex process that includes at least two sub-processes of creativity and implementation (Amabile & Pratt, 2016; Potočnik & Anderson, 2016; West, 2002b). Despite differences between specific innovation models, all models agree that employees need to generate new and useful ideas (Amabile, 1988; Amabile & Pratt, 2016). In addition, having many ideas will not be sufficient, as creative ideas also need to be implemented so that organizations benefit from them (Axtell et al., 2000; Baer, 2012; West, 2002a). Accordingly,

we focus on these two sub-processes and postulate that within the innovation process employees face the requirement to be creative and the requirement to implement (Janssen, 2000; Rosing et al., 2018; Shin et al., 2017; Unsworth et al., 2005). Importantly, these requirements are inherent to the tasks that individuals attend to within the innovation process. Thus, these requirements need to be differentiated from performance in innovation processes, which is defined as the evaluation of the process outcome (Shalley et al., 2000; Shin et al., 2017).

Although research has explored the role of requirements as the level of creativity or innovation a job requires in general (Janssen, 2000; Shalley et al., 2000; Shin et al., 2017; Unsworth et al., 2005), only very little research has focused on the specific requirements regarding creativity and implementation that are inherent to the tasks within the innovation process (Shalley et al., 2004). When creativity is required, novelty (Amabile & Pratt, 2016), divergent insights, and unexpected considerations are needed (Miron-Spektor & Erez, 2017). A creativity requirement is associated with ground-breaking opportunities and risks are often inherent (Andriopoulos & Lewis, 2009). By contrast, implementation relies on efficiency, where discipline, control, and structure are important prerequisites for dealing with the requirement (Andriopoulos & Lewis, 2009; Miron-Spektor et al., 2018). Implementation requires the outcome to be practical and, therefore, the acceptance of boundaries and constraints within the organizational environment is necessary (Miron-Spektor et al., 2011; Miron-Spektor & Erez, 2017). Creativity and idea implementation are related, but are distinct aspects of the innovation process that show very different characteristics (Bledow et al., 2009; Smith & Lewis, 2011; Smith & Tushman, 2005). However, both aspects are highly relevant for successful innovation processes, because the integration of creativity and idea implementation is associated with better innovation performance (Axtell et al., 2000; He & Wong, 2004; Rosing et al., 2018; Rosing & Zacher, 2017). Accordingly, creativity and

implementation requirements need to be addressed, and they should be addressed by very different leader and follower behaviors (Bledow et al., 2009; Rosing et al., 2011).

Leadership and Innovation Performance

We propose that leader behaviors can help individuals to deal with creativity and implementation requirements (Anderson et al., 2014; Junni et al., 2015; Rosing et al., 2011). Leadership is a central influence within the innovation process, for instance, providing support for creativity is beneficial (Amabile, Schatzel, Moneta, & Kramer, 2004; Hughes et al., 2018; Junni et al., 2015; Mainemelis et al., 2015). Nonetheless, results concerning the role of traditional leadership models in the innovation process, such as transformational and transactional leadership, are not as straightforward (Hughes et al., 2018; Rosing et al., 2011). This is not surprising, because these models do not explicitly consider different innovation requirements (Hunter et al., 2011; Hunter et al., 2017; Rosing et al., 2011). Regarding the entire innovation process including idea implementation (West, 2002a, 2002b), one needs to take both creativity and implementation into account (Hunter et al., 2011; Mumford et al., 2002; Rosing et al., 2011). Two leader behaviors that directly correspond to these requirements have been defined in the model of ambidextrous leadership: opening and closing leader behavior (Rosing et al., 2011). A study by Zacher and colleagues (2016) found that opening leader behavior is positively related to exploration, whereas closing leader behavior is positively related to exploitation behavior. Moreover, the interaction of opening and closing leader behaviors has been shown to predict innovation performance including creativity and implementation aspects, such that performance is highest when both opening and closing behaviors are high (Zacher & Rosing, 2015; Zacher & Wilden, 2014).

Alignment of Leader Behaviors and Requirements

Based on propositions of the model of ambidextrous leadership, we examine the differential effects of opening and closing leader behaviors on performance when the moderating influence of innovation requirements is considered. We first suggest that high

levels of opening leader behavior will increase performance when creativity requirements are present. Opening leader behavior emphasizes the goal to be creative which will support individuals to address a creativity requirement (Mainemelis et al., 2015; Shalley, 1991; Shalley & Gilson, 2004). Looking at this in more detail, opening leader behavior provides individuals with room for independent thinking and acting (Rosing et al., 2011). For innovation success, autonomy to decide is important for individuals to find creative solutions (Hammond et al., 2011; Mumford et al., 2002; Shalley & Gilson, 2004) and this is provided by opening leader behavior. Furthermore, to be creative, individuals need to question existing structures and routines (Hunter et al., 2007; Miron-Spektor & Erez, 2017; Shalley & Gilson, 2004). This is encouraged by opening leader behavior (Rosing et al., 2011). Moreover, opening leader behavior provides an environment in which individuals search for new information and knowledge (Kremer, Villamor, & Aguinis, 2019; Rosing et al., 2011). This enables creativity, because diversity of knowledge and perspectives will help individuals to access different information and consequently find novel and unusual solutions (Mumford et al., 2002; Shalley & Gilson, 2004; Taylor & Greve, 2006). Moreover, individuals who strive to learn have been shown to perform better in terms of creativity (Gong, Huang, & Farh, 2009; Hirst, van Knippenberg, & Zhou, 2009). Such a learning goal orientation is encouraged by opening leader behavior, i.e. seeing mistakes as a chance to learn (Rosing et al., 2011). Lastly, a climate for psychological safety is important for employees to unfold their creative potential (Baer & Frese, 2003). This is supported by opening leader behavior, since it provides individuals with safety to voice ideas and take risks (Hunter et al., 2011; Rosing et al., 2011).

In contrast, a high level of opening leader behavior will not be helpful in case of implementation requirements. When implementation is required, employees need to focus on efficiency and quality (Miron et al., 2004; Miron-Spektor et al., 2011). They have to address the implementation in a given environment with constraints and boundaries (Andriopoulos

& Lewis, 2009; Miron-Spektor et al., 2011). Opening leader behavior does not focus on these constraints and boundaries, but rather encourages the questioning of existing structures (Rosing et al., 2011). Furthermore, when opening leader behavior is applied, mistakes are seen as a chance to learn (Rosing et al., 2011). This contradicts the notion of implementing a high-quality product in an efficient manner (Miron et al., 2004; Miron-Spektor et al., 2011). Therefore, a high level of opening leader behavior will not support employees when facing these challenges associated with implementation.

Hypothesis 1: Innovation requirements moderate the effect of opening leader behavior on performance, such that opening leader behavior has a positive effect on performance in situations that require creativity, but not in situations that require implementation.

We further propose that a high level of closing leader behavior promotes innovation performance, when implementation rather than creativity is required. In general, closing leader behavior emphasizes productivity goals and thus, enables individuals to address implementation requirements (Rosing et al., 2011; Shalley, 1991). More specifically, closing leader behavior is characterized by planning and setting specific goals (Rosing et al., 2011) and therefore, shapes an environment in which employees are not distracted by unnecessary activities (Miron-Spektor et al., 2011; Mumford, 2000). In case of implementation requirements, individuals need to focus on the essential goals and be effective (Miron-Spektor et al., 2011; Mumford, 2000). Closing leader behavior includes the monitoring of goal attainment within given deadlines and puts constraints on time as a resource (Rosing et al., 2011). Time constraints are associated with narrow processing and thus, a focus on essential task, which is also important for implementation requirements (Amabile et al., 2002; Mumford, 2000; West, 2002b). Moreover, employees are expected to produce high-quality outcomes (Miron et al., 2004). Closing leader behavior encourages individuals to attend to details and avoid mistakes (Rosing et al., 2011). Furthermore, closing leader behavior focuses

on existing knowledge and routines, which help individuals to attend to the quality of outcomes, rather than the process (Jansen et al., 2006; Miron et al., 2004; Rosing et al., 2011).

In contrast, the environment created by a high level of closing leader behavior will not be particularly useful in case of creativity requirements. Creativity requirements necessitate engaging in divergent thinking, questioning existing structures, and taking risks to search for different and novel solutions (Amabile, 1988; Andriopoulos & Lewis, 2009; Miron-Spektor & Erez, 2017). As closing leader behavior provides a tight structure by setting deadlines, planning, and monitoring activities (Rosing et al., 2011), this will restrict individuals to focus on specific tasks and activities. This restriction will not be supportive when addressing a creativity requirement.

Hypothesis 2: Innovation requirements moderate the effect of closing leader behavior on performance, such that closing leader behavior has a positive effect on performance in situations that require implementation, but not in situations that require creativity.

Alignment of Follower Behaviors and Requirements

Furthermore, we propose that follower behaviors should also be aligned with creativity and implementation requirements to result in better innovation performance. Two concepts that are relevant in this context are exploration and exploitation (e. g. He & Wong, 2004; Raisch & Birkinshaw, 2008). Recently, these concepts were conceptualized at the individual level as concrete individual behaviors (Good & Michel, 2013; Jasmand et al., 2012; Rosing & Zacher, 2017). On the one hand, individuals who engage in exploration behavior attempt to acquire new knowledge and try to do things in unconventional ways (Good & Michel, 2013; March, 1991; Mom et al., 2007). On the other hand, individuals show exploitation behavior by focusing their attention on prior knowledge, rules, routines, and proven patterns (Good & Michel, 2013; March, 1991; Mom et al., 2007). Importantly, exploration and exploitation behaviors are not identical to innovation performance, which is defined as the outcome of

these behaviors (Montag et al., 2012). Although, for instance, exploration behavior may lead to higher creativity performance, the behavior itself and the evaluated outcome of the behavior need to be differentiated (Montag et al., 2012).

We hypothesize that the effects of exploration and exploitation behaviors on innovation performance are dependent on creativity and implementation requirements. First, we expect exploration behavior to have a positive relationship with performance when creativity requirements are high. When creativity is required, novelty, divergent insights, and diverse considerations are necessary (Amabile, 1988; Amabile & Pratt, 2016; Miron-Spektor & Erez, 2017). These requirements are best addressed when individuals search for new knowledge, experiment, and flexibly apply new behaviors (Andriopoulos & Lewis, 2009; March, 1991; Mom et al., 2007). Therefore, exploration behavior should help followers attain higher performance in situations when creativity is required. In contrast, exploration behavior should not be particularly useful when implementation requirements are high. Followers who are experimenting with different solutions, and flexibly switching between alternatives, will not be able to finish a high-quality product in the most efficient manner (Andriopoulos & Lewis, 2009; Miron et al., 2004).

Hypothesis 3: Innovation requirements moderate the relationship between exploration behavior and performance, such that exploration behavior is positively related to performance in situations that require creativity, but not in situations that require implementation.

Second, we propose that exploitation behavior is positively related to innovation performance when implementation is required. With implementation requirements present, efficiency, discipline, control, and structure are characteristics of the situation (Andriopoulos & Lewis, 2009; Miron et al., 2004; Miron-Spektor et al., 2018). These requirements are best addressed when individuals focus on deepening existing knowledge and essential tasks (March, 1991; Mom et al., 2007). Therefore, relying on existing structures and routines

should be most effective when putting an idea to use (Gupta et al., 2006; Huang, Gibson, Kirkman, & Shapiro, 2017; March, 1991). In contrast, exploitation behavior will not be useful in case of creativity requirements. When creativity is necessary, new considerations and ways to address tasks are important (Amabile & Pratt, 2016; Miron-Spektor & Erez, 2017).

Therefore, sticking to rules, guidelines, and routines is unlikely to be helpful (March, 1991).

Hypothesis 4: Innovation requirements moderate the relationship between exploitation behavior and performance, such that exploitation behavior is positively related to performance in situations that require implementation, but not in situations that require creativity.

Requirements, Leadership, and Follower Behaviors: An Integrated Model

In combination, we expect indirect effects of leader behaviors on innovation performance through follower behaviors (Rosing et al., 2011). Specifically, we propose an indirect effect of opening leader behavior through follower exploration behavior in case of creativity requirements. We expect opening leader behavior to have a positive effect on follower exploration behavior. This effect should be independent of task requirements as opening leader behavior directly aims at fostering follower exploration behavior. For instance, opening leader behavior encourages the search for new information and knowledge acquisition (Rosing et al., 2011). This goes hand in hand with exploration behavior of search (March, 1991; Mom et al., 2007). Furthermore, opening leader behavior increases the quest for alternatives (Rosing et al., 2011), thereby also increasing experimentation and flexibility as follower behaviors (March, 1991; Mom et al., 2007). The positive relationship between opening leader behavior and follower exploration behavior has been shown in a field study on ambidextrous leadership (Zacher et al., 2016). Taken together, opening leader behavior will increase follower exploration behavior (Rosing et al., 2011). Then, follower exploration behavior will help the employees to address creativity requirements (as compared to implementation requirements) and improve innovation performance. Therefore, we postulate

a mediation via follower exploration behavior moderated by innovation requirements at the second stage of the mediation:

Hypothesis 5: The positive indirect effect of opening leader behavior on performance through follower exploration behavior will be stronger in case of creativity requirements as compared to implementation requirements.

We further suggest that follower exploitation behavior mediates the link between closing leader behavior and innovation performance under implementation requirements. Closing leader behavior encourages individuals to apply existing knowledge and to lean on routines (Rosing et al., 2011). Furthermore, closing leader behavior formalizes individuals' work by setting a strong framework of rules and goals, which has been shown to increase exploitation behavior (Jansen et al., 2006; Lavie, Stettner, & Tushman, 2010). The resulting time pressure due to deadlines and clear expectations should additionally increase conservative thinking and the reliance on routines (Amabile et al., 2002; Rosing et al., 2011). Therefore, leaders applying closing leader behavior should increase follower exploitation behavior (Gupta et al., 2006; Rosing et al., 2011), independent of the requirements represented within a task. This relationship has also been shown in a field study on ambidextrous leadership (Zacher et al., 2016). Subsequently, follower exploitation behavior will help individuals address implementation requirements (as compared to creativity requirements) to reach high performance outcomes. Therefore, we propose a mediation via follower exploitation behavior that is moderated by innovation requirements at the second stage of the mediation:

Hypothesis 6: The positive indirect effect of closing leader behavior on performance through follower exploitation behavior will be stronger in case of implementation requirements as compared to creativity requirements.

Method

We tested our hypotheses with a 2x2x2 between-subjects experimental design. In the experiment, we independently manipulated innovation requirements (creativity vs. implementation) of a task and leader behaviors in terms of opening behavior (no opening vs. opening) and closing behavior (no closing vs. closing).

Sample

Participants were recruited at a German university using a system for psychology students to receive credits for participation in experimental studies. Students from other disciplines were recruited in lectures and through social media and received ten euros as compensation. The initial sample size was $N = 250$. Five participants had to be excluded due to computer problems or because they had previously taken part in one of the pre-tests. This led to a final sample size of $N = 245$ with 29 to 32 participants in each of the eight experimental conditions. Participants were on average 23.35 years old ($SD = 4.48$). There were 66.5% female, 32.7% male participants and 0.8% did not provide information. Students from a variety of disciplines participated, mostly psychology (49.0%), followed by business studies (12.2%) and engineering (11.0%).

Procedure

Upon arrival at the laboratory participants were given instructions via an online survey tool (Unipark, Questback GmbH) to assume they were a new employee in the university's marketing team. They were informed that the team's goal was to recruit as many high school students as possible for the university and that they would receive their first independent task today. Next, a video message from the team leader was presented. The same male leader in all videos gave information on how the work in the department was done. He explained the way employees dealt with the tasks and emphasized what was important to him. Furthermore, he gave advice on how the tasks could be addressed best. Depending on the leadership condition, the video message contained the manipulation of opening and closing leader behaviors.

Afterwards, participants received the instruction for a task that required either creativity or implementation. Then, they were presented with a short reminder from the leader. This reminder contained the central points of the leadership manipulation and was also pinned as a paper note to their computer screen. Participants in the experimental group in which neither opening nor closing leader behavior was shown did not receive a reminder, because the video message did not include any specific instructions.

Subsequently, participants received additional information for their respective task (i.e., creativity or implementation). For both tasks, participants were given a written guide that contained information on the standards for the task. Additionally, as the implementation task was done using Microsoft Word, participants in these groups received a set of Microsoft Word tips to even out the differences in skill level. Pre-tests indicated that creativity and implementation tasks required different execution times. Thus, participants had 15 minutes for the creativity task and 25 minutes to perform the implementation task. After the predefined time frame, participants were asked to stop working on the task and the leader's reminders were removed from the computer screen. Subsequently, participants rated opening and closing leader behaviors of the leader shown in the video as a manipulation check. They were also asked to rate their own exploration and exploitation behaviors during task completion. Finally, participants answered questions concerning control variables: transformational and transactional leadership as well as demographics.

Independent Variables

Leader behaviors were manipulated in the video messages participants received before task execution. This approach is similar to other experiments manipulating leadership influence in the laboratory (e. g. Jacquart & Antonakis, 2015; Stam, van Knippenberg, & Wisse, 2010; Stam, van Knippenberg, Wisse, & Nederveen Pieterse, 2016). Aspects of *opening leader behavior*, such as questioning existing rules and routines, were either part of the video message (opening) or not (no opening). Likewise, *closing leader behavior*, such as

the instruction that it is necessary to follow existing routines and guidelines were either shown in the video (closing) or not (no closing). This resulted in a total of four different videos: neither opening nor closing leader behavior (no leadership control group), solely opening, solely closing, as well as both opening and closing leader behaviors. The control group video contained information on the team and the tasks they generally do and thus, no specific instructions concerning the task at hand were given. A detailed list of opening and closing leader behaviors is shown in Table 6. For the full-length scripts of the leadership manipulation refer to the supplemental materials (Appendix B).

Table 6: Manipulations of Opening and Closing Leader Behaviors Provided by Video

Messages

Opening Leader Behavior	Closing Leader Behavior
- Unconventional ideas and creativity	- Productivity and efficient implementation
- Try out different and new things	- Work per predefined plans, tasks, and rules
- Be original	- Be attentive to details
- Deal with different positions and opinions	- Be accurate
- Different ways to reach goal	- Systematic and goal-oriented work
- Mistakes as a chance to learn	- Resort to proven routines
- Take risks	- Avoid all mistakes
- New ideas detached from old knowledge and standards	- Be efficient (fast and free of mistakes)

Innovation requirements were manipulated by presenting participants with either a creativity or an implementation task. For the purpose of this research, to allow a comparison between the two requirements, creativity and implementation requirements were manipulated separately as a dichotomous variable for innovation requirements. All materials concerning the tasks are provided in the supplemental materials. First, the *creativity task* asked participants to come up with ideas for the marketing of the university (see supplemental

materials). This task is similar to other creativity tasks (e. g. Bledow et al., 2013; De Dreu et al., 2008; Reiter-Palmon et al., 2019). The written guide for this task contained categories and examples for ideas as well as a flyer for a marketing instrument already implemented at the university. Second, the *implementation task* asked participants to finalize a recruiting brochure about the university (see supplemental materials). We included mistakes in terms of grammar, punctuation, and formatting, which participants were supposed to correct. We also provided additional material such as pictures to ensure that participants could redesign the brochure. The written guide for the implementation task informed participants about the corporate design and standards concerning formatting and phrasing. The guide also included a flyer as an example for a marketing instrument. The tasks showed a clear requirement of either creativity or implementation as task instructions pointed out that the outcome would be judged according to the requirement. Nonetheless, for a more realistic approach creativity and implementation tasks gave participants options to show both exploration and exploitation behaviors. For instance, in the creativity task, participants could draw on existing knowledge and identify ideas closely related to the guide (exploitation behavior) or discover new aspects and come up with original ideas that were not associated with those in the guide (exploration behavior). For the implementation task, participants could rely on the guide and correct the mistakes in the brochure (exploitation behavior) or they had the opportunity to redesign the brochure in terms of new pictures or paragraphs (exploration behavior).

Dependent Variable

The dependent variable *performance* was measured separately for the two different tasks. The task instructions for both tasks provided a clear goal for the task in line with the requirement and accordingly, the performance for each can only be evaluated in line with the respective instruction (Nusbaum, Silvia, & Beaty, 2014; Reiter-Palmon et al., 2019). Thus, in the creativity task, we evaluated creativity as an outcome and in the implementation task, we assessed implementation. However, to reach conclusions concerning the relative effectiveness

of behaviors aligned with the requirement, we needed to compare the creativity and implementation condition. Therefore, we subsequently combined both measures into one dependent variable of performance.

According to the definition of creativity as novel ideas (Amabile, 1988; Amabile & Pratt, 2016), *creativity performance* was measured as a percentage of the number of new ideas compared to the number of total ideas generated by each participant (Hagtvedt, Dossinger, & Harrison, 2016). In line with existing research on brainstorming tasks, we used a rater-based assessment for this purpose (Barbot et al., 2019; Reiter-Palmon et al., 2019). First, a trained research assistant (coder one) counted all the ideas developed during the creativity task for each participant. Initial interrater reliability calculated based on the intraclass correlation coefficient (ICC, Shrout & Fleiss, 1979) with codings from coder one and the first author was based on $n = 10$ answers and showed a very good agreement, $ICC = 0.99$. Subsequently, coder one counted the ideas for all answers. As the task was intended to yield new ideas compared to ideas already in the guide provided to participants (Hagtvedt et al., 2016), another trained research assistant (coder two) identified those ideas, from all the ideas counted, that were new. Initial interrater reliability with codings from coder two and the first author was calculated based on $n = 20$ answers and showed satisfactory agreement, $ICC = 0.99$. Afterwards, coder two coded the other answers in terms of new ideas. Finally, we calculated the proportion of new ideas on all ideas the participant had generated and used this percentage as the dependent variable measuring creativity performance.

Implementation has been defined as the reliable and efficient handling of a task resulting in a high-quality product (Miron et al., 2004; Miron-Spektor et al., 2011). Therefore, *implementation performance* was assessed as the number of mistakes in the brochure that were corrected by participants within the given time frame. Participants who focused on an efficient way to improve the brochure would first attend to the most necessary aspects such as the correction of obvious mistakes instead of redesigning the brochure. Initial interrater

reliability based on Cohen's Kappa (Cohen, 1960) was established with the ratings of coder one and the first author. Fifty-seven mistakes were coded in terms of corrected vs. not corrected and, on average, the agreement based on $n = 20$ brochures was very good, $\kappa = 0.90$. Subsequently, coder one coded all remaining brochures in terms of corrected mistakes. Since it would not be considered high implementation performance to simply "correct" existing mistakes by removing text and adding new text with more mistakes, we further counted the additional mistakes such as spelling, punctuation, or introduction of new colors different from the corporate design. Initial interrater reliability based on ICC (Shrout & Fleiss, 1979) was established with the ratings of coder one and the first author based on $n = 20$ brochures, $ICC = 0.88$. Afterwards, coder one counted all additional mistakes in the remaining brochures. Finally, the number of additional mistakes was subtracted from the number of corrected mistakes. We then calculated this number of mistakes per minute, a measure of efficiency, as the dependent variable representing implementation performance.

Because the goal was to compare differential effects of creativity or implementation requirements, one variable for performance was necessary. Both performance measures were therefore z-standardized to be comparable. Each participant thus, received one z-standardized value for performance resulting from the score of the task he or she had completed.

Measures

Manipulation Check. Opening and closing leader behavior were assessed by participants using the scale developed by Zacher and Rosing (2015). A German version consisting of 7 items for each opening and closing leader behavior was provided by the authors. Items were rated on a 5-point scale ranging from 1 = "not at all" to 5 = "very strongly". An example for opening leader behavior was "My leader gives me the possibility to think and act independently" and the scale showed an excellent reliability, $\alpha = .92$. An example for closing leader behavior was "My leader sanctions mistakes." The reliability was also very good, $\alpha = .85$.

Exploration and Exploitation Behaviors. Participants rated their behavior during task completion on a 5-point scale ranging from 1 = “strongly disagree” to 5 = “strongly agree”. Items were based on Mom et al. (2007) as well as Miller, Bierly, & Daly (2007). Exploration behavior was measured using 12 items, while the exploitation behavior scale contained 10 items (see supplemental materials). For the exploration behavior scale, we excluded one item (“I approached problems in an unbiased manner”) due to a low discriminatory power, leading to a final 11-item scale. An example item for exploration behavior was “During task completion, I searched for new opportunities”. The reliability for exploration behavior, $\alpha = .90$, was very good. “During task completion, I followed existing standards from the department” was an example of exploitation behavior and this scale also showed a very good reliability, $\alpha = .83$. To identify the factor structure of this adapted scale, we computed a confirmatory factor analysis. A two-factor model showed a better fit ($\chi^2[188] = 456.62, p < .001; CFI = .86, RMSEA = .08, SRMR = .10$) than the one-factor solution ($\chi^2[189] = 958.47, p < .001; CFI = .59, RMSEA = .13, SRMR = .16$). The difference between the two models was significant, $F(188,189) = 501.85, p < .001$.

Control Variables. We controlled for transformational and transactional leadership, because these leadership styles have frequently been investigated in the context of innovation (Hughes et al., 2018; Rosing et al., 2011). For instance, the relationships of transformational and transactional leadership and creativity (e. g. Henker, Sonnentag, & Unger, 2015; Wang et al., 2011), innovation (e. g. Jansen, George, van Den Bosch, & Volberda, 2008; Waldman & Bass, 1991) or exploration and exploitation behaviors (e. g. Jansen et al., 2009; Nemanich & Vera, 2009) have been analyzed. To measure transformational and transactional leadership, we used the Multifactor Leadership Questionnaire (MLQ Form 5x Short) provided in a German translation (Avolio et al., 1999; Felfe, 2006). All items were rated on a 5-point scale, ranging from 1 = “never” to 5 = “regularly, almost always”. Transformational leadership was measured with 19 items, as one item was excluded in the German version (Felfe, 2006). An

example item was “My leader talks optimistically about the future” and reliability was excellent, $\alpha = .93$. Transactional leadership was measured using 7 items, as one item was excluded in the German version (Felfe, 2006). “My leader is mainly concerned with mistakes and complaints” was an example for this scale and the reliability was satisfactory, $\alpha = .68$.

Results

Intercorrelations of all study variables and the experimental conditions as well as means and standard deviations are displayed in Table 7. As expected, there were no significant correlations between performance and the independent variables. We found weak positive correlations between the manipulation of opening leader behavior and exploration behavior ($r = .15, p = .02$) and closing leader behavior and exploitation behavior ($r = .14, p = .03$). The manipulation of requirements (coded as 0 = creativity requirement and 1 = implementation requirement) showed a negative relationship with exploration behavior ($r = -.46, p < .001$) and a positive relationship with exploitation behavior ($r = .24, p < .001$). Transformational leadership showed a positive correlation with opening leader behavior ($r = .41, p < .001$) and transactional leadership with closing leader behavior ($r = .34, p < .001$). This is not surprising, as Rosing et al. (2011) pointed out that these leadership constructs are distinct but related. Nonetheless, we controlled for transformational and transactional leadership ratings.

Table 7: Intercorrelations of Experimental Conditions and Variables in Study 3

	\bar{x}	<i>SD</i>	1	2	3	4	5	6	7	8
1. Opening Leader Behavior (IV) ^a										
2. Closing Leader Behavior (IV) ^b			-.00							
3. Innovation Requirements (IV) ^c			-.01	-.02						
4. Performance (DV)			.06	.09	.01					
5. Exploration Behavior	2.95	0.77	.15*	-.19**	-.46**	-.04				
6. Exploitation Behavior	3.52	0.64	-.04	.14*	.24**	.16*	.01			
7. Transformational Leadership	3.28	0.71	.41**	-.20**	.02	-.10	.17**	.09		
8. Transactional Leadership	3.27	0.62	-.31**	.34**	.05	-.11	-.15*	.24**	.07	

Note: $N = 245$. ^a 0 = No Opening Leader Behavior 1 = Opening Leader Behavior. ^b 0 = No Closing Leader Behavior 1 = Closing Leader Behavior. ^c 0 = Creativity Requirement 1 = Implementation Requirement. * $p < .05$, ** $p < .01$. IV = Independent Variable, DV = Dependent Variable.

Manipulation Check

We conducted two regression analyses to investigate whether leadership manipulations were successful. These analyses controlled for transformational and transactional leadership. First, the manipulation of opening leader behavior in the video message had a significant positive effect on ratings of opening leadership ($B = 1.01$, $SE = 0.08$, $p < .001$), whereas the manipulation of closing leader behavior had a significant negative effect on ratings of opening leadership ($B = -0.42$, $SE = 0.08$, $p < .001$). When opening leader behavior was included in the video, participants rated opening leadership higher ($\bar{x} = 4.21$, $SD = 0.66$) compared to when opening leader behavior was not included ($\bar{x} = 2.74$, $SD = 0.83$). Second, opening leader behavior had a significant negative effect on the ratings of closing leadership ($B = -0.58$, $SE = 0.09$, $p < .001$), whereas closing leader behavior had a positive effect on ratings of closing leadership ($B = 0.46$, $SE = 0.08$, $p < .001$). When closing leader behavior was included in the video message, participants rated closing leadership higher ($\bar{x} = 3.45$, $SD = 0.74$) compared to when closing leader behavior was not included ($\bar{x} = 2.71$, $SD = 0.78$). Therefore, we can conclude that the manipulations of opening and closing leader behavior in the video messages were successful.

Hypothesis Tests: Leader Behaviors and Requirements

Hypothesis 1 states that opening leader behavior fosters performance when creativity requirements are present. Hypothesis 2 postulates that closing leader behavior leads to better performance in case of implementation requirements. Hierarchical regression was used to analyze the effects of two-way interactions between leader behaviors and requirements on performance (Aguinis, Beaty, Boik, & Pierce, 2005; Aguinis, Edwards, & Bradley, 2017). Results are reported in Table 8. First, the control variables transformational and transactional leadership were included into the regression equation at Step 1 but did not have significant effects. In Step 2, the independent variables opening and closing leader behavior as well as the requirements were added to the equation. No significant influences of the main effects

were found. In the third step, all two-way interactions between opening leader behavior, closing leader behavior, and requirements were included; a significant increase in R^2 was observed. The interaction of opening leader behavior and requirements was significant ($B = -0.67$, $SE = 0.25$, $p = .007$). This interaction effect is displayed in Figure 4. As expected, simple slope analysis revealed that the effect of opening leader behavior on performance was significant and positive if the task required creativity ($B = 0.54$, $SE = 0.19$, $p = .005$). The effect was not significant in case of implementation requirements ($B = -0.13$, $SE = 0.19$, $p = .50$). These results support Hypothesis 1.

Moreover, the interaction of closing leader behavior and requirements showed a positive effect on performance ($B = 0.82$, $SE = 0.25$, $p = .001$). The interaction is displayed in Figure 5. Simple slope analysis revealed a positive effect of closing leader behavior on performance in case of implementation requirements ($B = 0.69$, $SE = 0.19$, $p < .001$). The effect was not significant when the task required creativity ($B = -0.15$, $SE = 0.18$, $p = .40$). These findings provide support for Hypothesis 2.

Figure 4: Interaction Effect of Opening Leader Behavior and Requirements on Performance

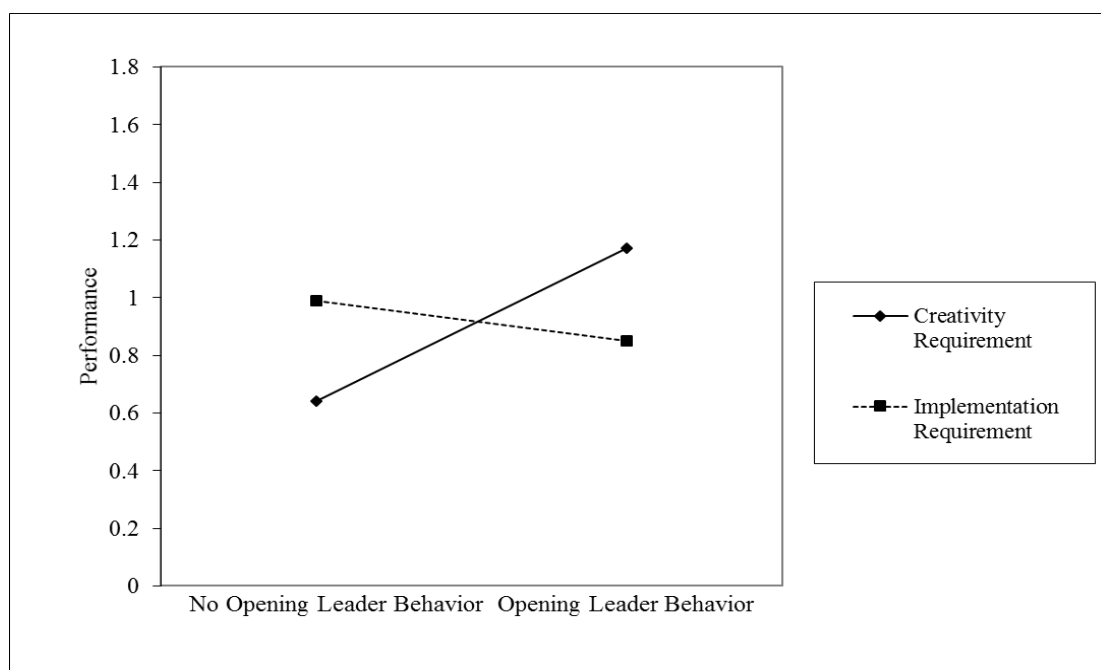
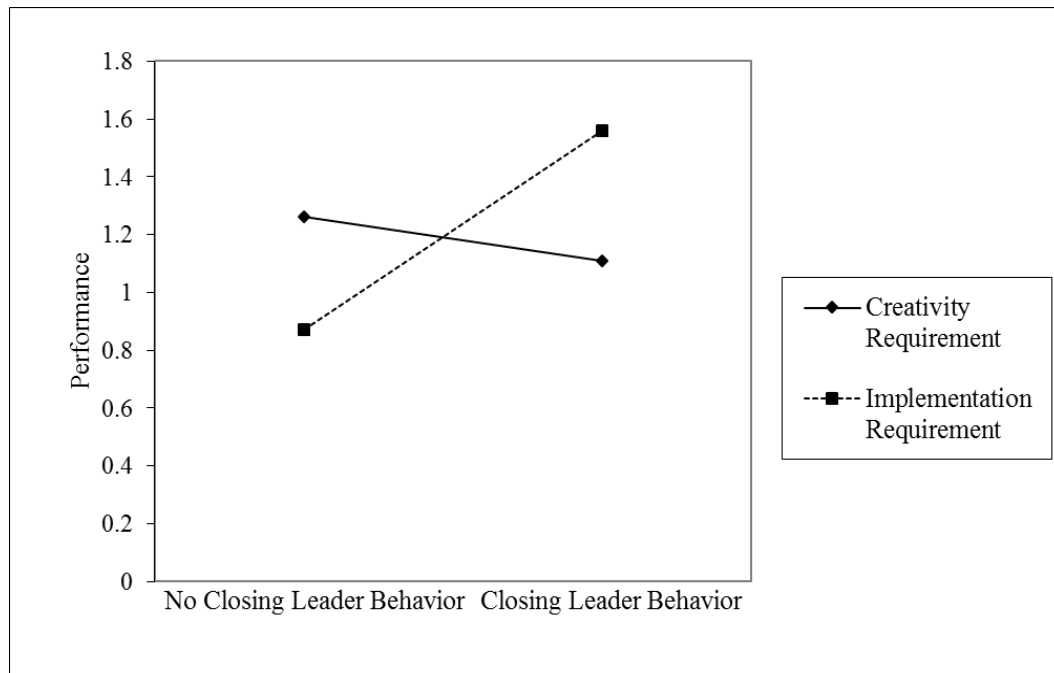


Figure 5: Interaction Effect of Closing Leader Behavior and Requirements on Performance



In the final step of the regression analysis, the three-way interaction of all independent variables was added, but did not show a significant effect. This points to the fact that showing opening and closing leader behaviors simultaneously does not influence the performance outcome.

Table 8: Hierarchical Regression Analysis of Leader Behaviors and Requirements on Performance

	Model 1	Model 2	Model 3	Model 4
STEP 1				
Transformational Leadership	-0.09	-0.10	-0.09	-0.08
Transactional Leadership	-0.10	-0.11	-0.15*	-0.15*
STEP 2				
Opening Leader Behavior ^a		0.08	0.25*	0.23
Closing Leader Behavior ^b		0.11	-0.06	-0.08
Requirements ^c		0.01	-0.02	-0.04
STEP 3				
Opening ^a x Closing ^b			-0.04	-0.00
Opening ^a x Requirements ^c			-0.29**	-0.26
Closing ^b x Requirements ^c			0.36**	0.39*
STEP 4				
Opening ^a x Closing ^b x Requirements ^c				-0.05
ΔR^2	0.02	0.02	0.07	0.00
R^2	0.02	0.04	0.11	0.11
F-Change	2.36	1.44	6.24**	0.10

Note: $N = 245$. ^a0 = No Opening Leader Behavior 1 = Opening Leader Behavior. ^b0 = No Closing Leader Behavior 1 = Closing Leader Behavior. ^c0 = Creativity Requirement 1 = Implementation Requirement. Standardized Regression Coefficients (b) are reported. Dependent variable = Performance. * $p < .05$, ** $p < .01$.

Hypothesis Tests: Follower Behaviors and Requirements

Hypothesis 3 states that exploration behavior is positively related to performance when creativity is required, but not when implementation is required. Hypothesis 4 postulates that exploitation behavior is positively associated with performance when implementation is required, but not when creativity is required. In a hierarchical regression, performance was regressed on follower behaviors, requirements, as well as the interactions of follower behaviors and requirements (Aguinis et al., 2005; Aguinis et al., 2017). Results are reported in Table 9. First, main effects of exploration behavior, exploitation behavior, and requirements were added into the regression equation at Step 1. Only exploitation behavior had a significant positive association with performance ($B = 0.28$, $SE = 0.1$, $p = .007$). In Step 2, the two-way interactions were added, and this step showed a significant increase in R^2 (see Table 9). The interaction between exploration behavior and requirements had a significant negative relationship ($B = -0.86$, $SE = 0.17$, $p < .001$). This interaction effect is displayed in Figure 6. As expected, simple slope analysis revealed a significant positive association of exploration behavior with performance in case of creativity requirements ($B = 0.38$, $SE = 0.14$, $p = .009$). In contrast, the relationship between exploration behavior and performance was negative when implementation was required ($B = -0.37$, $SE = 0.12$, $p = .002$). These results support Hypothesis 3.

The interaction between exploitation behavior and requirements showed a significant positive relationship with performance ($B = 1.06$, $SE = 0.2$, $p < .001$). This interaction effect is displayed in Figure 7. Also consistent with expectations, simple slope analysis showed a significant positive association of exploitation behavior with performance when implementation was required ($B = 0.59$, $SE = 0.12$, $p < .001$). In contrast, the relationship between exploitation behavior and performance was not significant when creativity requirements were present ($B = -0.31$, $SE = 0.16$, $p = .06$). These findings support Hypothesis 4.

Figure 6: Interaction Effect of Exploration Behavior and Requirements on Performance

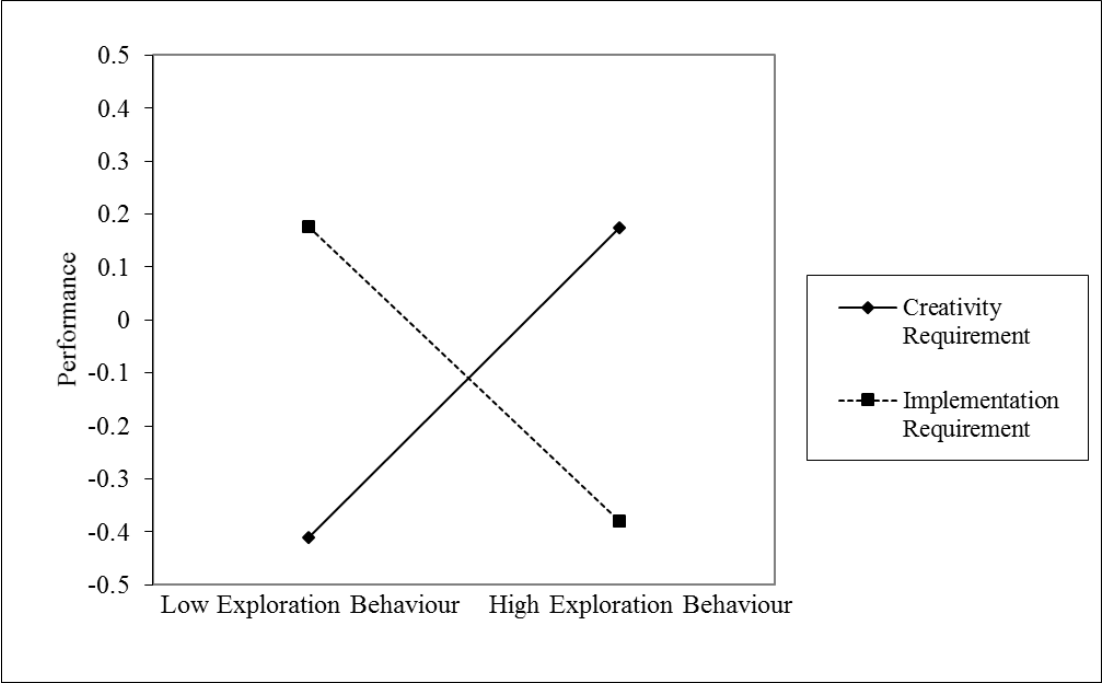


Figure 7: Interaction Effect of Exploitation Behavior and Requirements on Performance

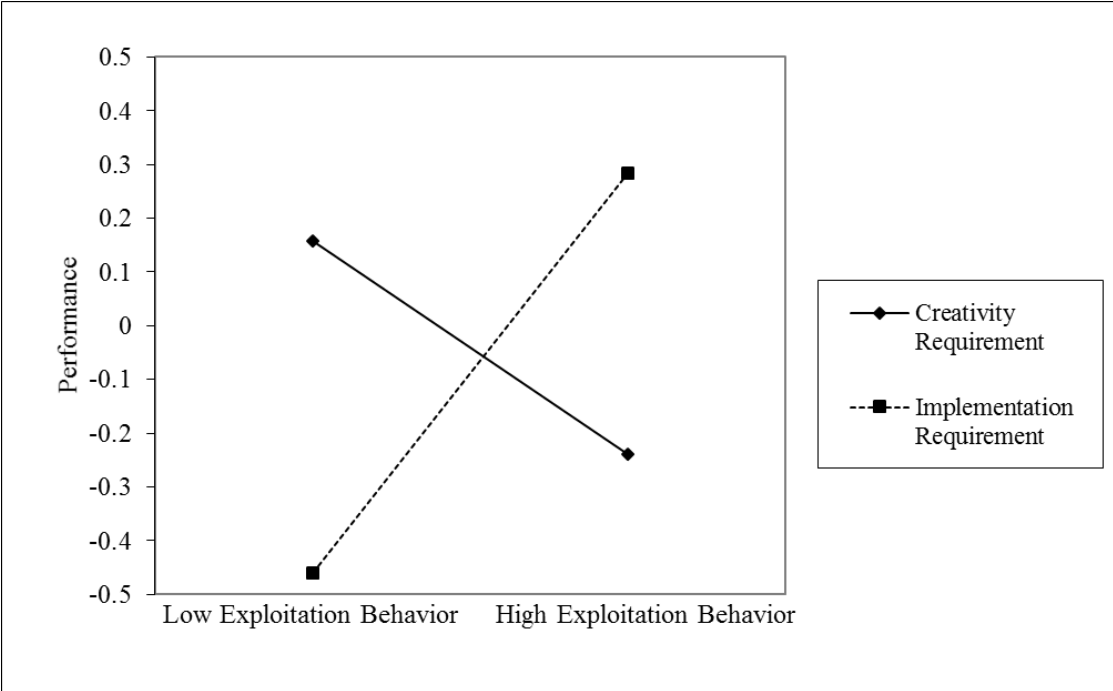


Table 9: Hierarchical Regression Analysis of Follower Behaviors and Requirements on Performance

	Model 1	Model 2
STEP 1		
Exploration Behavior	-0.08	0.16
Exploitation Behavior	0.18*	-0.42
Requirements ^a	-0.07	-0.62
STEP 2		
Exploration Behavior x Requirements ^a		-1.22**
Exploitation Behavior x Requirements ^a		2.02**
Exploration Behavior x Exploitation Behavior		0.24
ΔR^2	0.03	0.16
R^2	0.03	0.19
F-Change	2.69*	15.16**

Note: $N = 245$. ^a0 = Creativity Requirement 1 = Implementation Requirement. Standardized Regression Coefficients (b) are reported. Dependent variable = Performance. * $p < .05$, ** $p < .01$.

Hypothesis Tests: Moderated Mediation Effects

To test the postulated moderated mediating effects of exploration and exploitation behaviors, we used the PROCESS tool (Hayes, 2013) for SPSS to test the indirect effects with a bootstrapping procedure with 5,000 iterations. Hypothesis 5 states that the positive effect of opening leader behavior on performance is mediated by exploration behavior when creativity is required. Opening leader behavior was entered to the mediation model as the predictor, performance as the dependent variable and exploration behavior was regarded as a mediator. Requirements were added as a moderator of the effect of opening leader behavior on performance and as a moderator of the second stage of the mediation, namely the effect of

exploration behavior on performance (see conceptual model in Figure 3). Moreover, we controlled for transformational and transactional leadership. Results are displayed in Table 10. No significant main effect of opening leader behavior on exploration behavior was found ($B = 0.07$, $SE = 0.11$, $p = 0.56$). As in the analysis reported above, the interaction of exploration behavior and requirements had a significant effect on performance ($B = -0.64$, $SE = 0.18$, $p < .001$). However, in contrast to expectations, exploration behavior did neither mediate the effect in case of creativity requirements (conditional indirect effect: $B = 0.02$, $SE = 0.04$, corrected 95% confidence interval $CI [-0.04, 0.14]$ included zero) nor in case of implementation requirements (conditional indirect effect: $B = -0.02$, $SE = 0.04$, corrected 95% confidence interval $CI [-0.12, 0.04]$ included zero). Therefore, Hypothesis 5 could not be supported.

Table 10: Moderated Regression Analysis Predicting Exploration Behavior and Performance

	Model 1 Dependent Variable = Exploration Behavior	Model 2 Dependent Variable = Performance
Transformational Leadership	0.18(0.08) *	-0.14(0.10)
Transactional Leadership	-0.19(0.08) *	-0.09(0.11)
Opening Leader Behavior ^a	0.07(0.11)	0.47(0.19) *
Exploration Behavior		0.32(0.14) *
Requirements ^b		2.18(0.57) **
Exploration Behavior x Requirements ^b		-0.64(0.18) **
Opening Leader Behavior ^a x Requirements ^b		-0.53(0.25) *
R ²	0.06	0.10
F	4.82**	3.88**

Note: $N = 245$. ^a0 = No Opening Leader Behavior 1 = Opening Leader Behavior.

^b0 = Creativity Requirement 1 = Implementation Requirement. Regression Coefficients (b) and standard errors (SE) are reported. Dependent variable = Performance. * $p < .05$, ** $p < .01$.

Hypothesis 6 proposed a mediating effect of exploitation behavior under the condition of implementation requirements. Accordingly, closing leader behavior was entered to the mediation model as a predictor, performance as the dependent variable, exploitation behavior was entered as the mediator. Requirements were added as the moderator of the effect of closing leader behavior on performance and as a moderator to the second stage of the mediation, namely the effect of exploitation behavior on performance (see conceptual model in Figure 3). Again, we additionally controlled for transformational and transactional leadership. All results are displayed in Table 11. Findings revealed no significant effect of closing leader behavior on exploitation behavior ($B = 0.12, SE = 0.09, p = .16$). Again, a significant effect for the interaction of requirements and exploitation behavior was found ($B = 0.75, SE = 0.20, p < .001$). However, exploitation behavior did not mediate the effects, neither in case of implementation requirements (conditional indirect effect: $B = 0.07, SE = 0.05$, corrected 95% confidence interval $CI [-0.02, 0.19]$ included zero) nor in case of creativity requirements (conditional indirect effect: $B = -0.02, SE = 0.04$, corrected 95% confidence interval $CI [-0.14, 0.02]$ included zero). Thus, Hypothesis 6 also did not receive support.

Table 11: Moderated Regression Analysis Predicting Exploitation Behavior and Performance

	Model 1 Dependent Variable = Exploitation Behavior	Model 2 Dependent Variable = Performance
Transformational Leadership	0.08(0.06)	-0.07(0.09)
Transactional Leadership	0.21(0.07) **	-0.30(0.11)
Closing Leader Behavior ^a	0.12(0.09)	-0.14(0.17)
Exploitation Behavior		-0.20(0.16)
Requirements ^b		-2.98(0.71) **
Exploitation Behavior x Requirements ^b		0.75(0.20) **
Closing Leader Behavior ^a x Requirements ^b		0.65(0.24) **
R ²	0.07	0.16
F	5.92**	6.21**

Note: $N = 245$. ^a0 = No Closing Leader behavior 1 = Closing Leader Behavior.

^b0 = Creativity Requirement 1 = Implementation Requirement. Regression Coefficients (b) and standard error (SE) are reported. Dependent variable = Performance. * $p < .05$, ** $p < .01$.

Discussion

Creativity and implementation requirements are highly relevant within innovation processes, as they determine the behavior that is effective for both leaders and followers in a given situation. From our results, we can conclude that opening leader behavior has a positive influence on performance when creativity is required (Hypothesis 1), whereas closing leader behavior leads to better performance in case of implementation requirements (Hypothesis 2). Furthermore, we see that exploration behavior is positively related to performance when creativity is required (Hypothesis 3), whereas exploitation behavior is positively associated with performance when implementation requirements are present (Hypothesis 4). These results suggest that different leader and follower behaviors are effective depending on the presence of either creativity or implementation requirements and, therefore, these situational

demands are highly relevant for innovation success. These findings are in line with the propositions of the ambidextrous leadership model (Rosing et al., 2011). Our results further support the model's propositions, because the effects of opening and closing leader behaviors emerged while controlling for the traditional approaches of transformational and transactional leadership. Therefore, leaders and employees need to attend to situational requirements of creativity and implementation within the innovation process to be able to apply the adequate and relevant behavior and ultimately reach high innovation performance.

Through a rigid ambidexterity lens, one could assume that showing both opening and closing leader behaviors at the same time would increase performance outcomes (He & Wong, 2004; Junni et al., 2013; O'Reilly & Tushman, 2013). In contrast, our results did not reveal a significant effect of the two-way interaction of opening and closing leader behavior or the three-way interaction including task requirements on performance outcomes. This is not surprising when considering that only one requirement of either creativity or implementation was presented and not both at the same time. In line with these results, Shalley (1991) found that applying two different goals does not influence performance, when one of the goals is aligned with the task requirements. Therefore, when a clear requirement of either creativity or implementation is present, the simultaneous application of opening and closing leader behaviors did not have an effect.

Interestingly, our results did not support the postulated moderated mediation paths (Hypotheses 5 and 6), because opening leader behavior did not influence exploration behavior and, likewise, closing leader behavior did not influence exploitation behavior when transformational and transactional leadership were controlled. These findings need further attention as not only were these effects proposed by the ambidextrous leadership model (Rosing et al., 2011), but recent correlational research has also found associations of opening and closing leader behaviors with exploration and exploitation behaviors (Zacher et al., 2016). Importantly, the divergence of our results can only be observed when we control for

transformational and transactional leadership. If we do not control for these leadership styles, we find the proposed effects of leader behaviors on exploration and exploitation behaviors. As follower exploration and exploitation behaviors, as well as the control variables of transformational and transactional leadership, were rated by participants, the reported non-significant effects might be due to common method bias (Podsakoff et al., 2003). This concept refers to the issue that the same person at the same time provides similar ratings of different constructs (Podsakoff et al., 2003). As the control variables as well as follower behaviors were rated by participants after task completion, this could apply here. Consequently, common method bias with respect to the control variables might have reduced the impact of opening and closing leader behaviors on exploration and exploitation behaviors.

Theoretical Contributions

This research makes two key contributions that yield new insights concerning the study of influences of leader and follower behaviors on innovation performance. First, our study examines the impact of innovation requirements within the innovation process in detail (Shalley et al., 2004). Previous research has either investigated jobs that require innovation as a whole (Shin et al., 2017) or has considered only creativity requirements (Shalley et al., 2000; Unsworth et al., 2005). Until now, researchers have neglected the different requirements of creativity and idea implementation within the innovation process (Janssen, 2000; Shin et al., 2017; Unsworth et al., 2005). From our theoretical viewpoint – and the differential effects found in our experiment underline this argument – it is important to consider both requirements as they establish which leader and follower behaviors are effective in a given situation (Rosing et al., 2011). Therefore, we need this micro-level perspective that incorporates creativity and implementation requirements as they change within the innovation process. Methodologically, we contribute to existing research in this area by manipulating creativity and implementation requirements in an experimental setting. This allows us to draw stronger causal conclusions concerning the differential influences of these requirements,

compared to existing correlational studies (Shin et al., 2017; Unsworth et al., 2005; Zacher et al., 2016).

Second, we studied the influence of specific leader behaviors on performance in two tasks under controlled conditions. Previous research on leadership in innovation processes points to the need for more objective measures as well as the experimental – and thus causal – analysis of the proposed models, including ambidextrous leadership (Hughes et al., 2018; Zacher et al., 2016; Zacher & Rosing, 2015; Zacher & Wilden, 2014). This need has been successfully addressed in our study and shows important additional support for the effectiveness of leader behaviors with respect to the innovation process (Rosing et al., 2011). Experiments have many advantages compared to field studies, particularly that it is easier to control influences that are not of central importance to the research questions under investigation (Antonakis et al., 2010, 2014; Antonakis, 2017; Hughes et al., 2018). Specifically, in this experiment, we controlled for additional situational cues such as performance information that could change the perception of leaders (Lord et al., 1978; Wang et al., 2019). Therefore, causal conclusions can be drawn from our observed results and we can be confident that leader behavior did influence performance and not vice versa. One additional very important aspect in this regard is the objective assessment of performance. In field studies, innovation outcomes are usually rated either by the employees themselves (e. g. Axtell et al., 2000; Zacher et al., 2016; Zacher & Wilden, 2014) or their supervisors (e. g. Janssen, 2000; Zacher & Rosing, 2015). These two methods have a number of limitations (Hülshager, Anderson, & Salgado, 2009). Most importantly, self-ratings of innovation performance are correlated with motivation and self-efficacy for innovation and, therefore, their validity can be questioned (Barbot et al., 2019; Reiter-Palmon et al., 2012; Reiter-Palmon et al., 2019). Within our experimental setting outcome evaluation was more objective since it was rated by independent observers after the task completion (Reiter-Palmon et al., 2019). These raters were blind to the experimental manipulations and the

outcomes for the tasks. This further adds to the strength and robustness of the reported analyses.

Limitations and Future Research

As with all research, this study has some limitations. First, with respect to the unexpected results concerning the influence of opening and closing leader behaviors on exploration and exploitation behaviors, respectively, the possible common method bias of follower behaviors and transformational and transactional leadership needs to be addressed (Podsakoff et al., 2003). A solution could be to construct the experiment in such a way that follower behaviors can be observed during task completion and, accordingly, coded by observers. In this case, a more objective and more precise assessment of exploration and exploitation behaviors would be possible. Unfortunately, the tasks used in this experiment were not suitable for this kind of objective rating of participants' behaviors. Therefore, future research should find and use different tasks to analyze the mediating effects in a more objective manner.

Second, as with all laboratory studies, the generalizability of our results is limited (e. g. Hoyle, Harris, & Judd, 2008). The tasks for creativity and implementation requirements separated the two aspects which is not common to innovation processes in an organizational setting (Bledow et al., 2009; Schroeder et al., 1989). Usually, employees address the different requirements more flexibly and, thus, the separation seems artificial. Nonetheless, a separation of creativity and implementation was central to the aim of this study. Research shows promising results for the effectiveness of ambidextrous leadership behaviors in the field (Zacher et al., 2016; Zacher & Rosing, 2015; Zacher & Wilden, 2014). Thus, in order to provide causal support for the boundary conditions of the effects of opening and closing leader behaviors, the separate manipulation of creativity and implementation requirements was necessary. Another deficiency lies in the student sample which might also limit the generalizability of results. However, there is almost no empirical evidence showing that

student samples actually differ from workplace samples since most studies found similar effects for both samples (Highhouse & Gillespie, 2009). Furthermore, experiments mainly aim to provide support for causes and effects of theoretical constructs (Antonakis et al., 2010, 2014; Highhouse, 2009). Therefore, the first objective is to focus on manipulation strength and sample size to receive sufficient power to detect causal effects (Highhouse, 2009; Highhouse & Gillespie, 2009). Nonetheless, further research should investigate the postulated relationships in the field setting to provide further support for the ambidextrous leadership model.

Finally, as we focused on comparing creativity and implementation requirements as boundary conditions, our study did not consider the dynamic interplay or temporal pattern of creativity and idea implementation. However, the influence of innovation requirements within the innovation process will be especially interesting when considering the flexible interplay of both requirements (Cheng & van de Ven, 1996; Schroeder et al., 1989). Researchers have stated that creativity and implementation do not follow a linear temporal pattern and empirical results support this assumption (Rosing et al., 2018; Rosing & Zacher, 2017; Schroeder et al., 1989). It follows that individuals need to change their behaviors regularly to address the changing requirements, resolve associated tensions within the innovation process and act ambidextrously (Miron-Spektor et al., 2018; Miron-Spektor & Erez, 2017; Rosing & Zacher, 2017). Based on this research, the ambidextrous leadership model also suggests that leaders need to apply opening and closing leader behaviors in a temporally flexible manner (Rosing et al., 2011). With this temporal flexibility, ambidextrous leader behavior should support employees to resolve the paradox of creativity and implementation (Andriopoulos & Lewis, 2009; Miron-Spektor et al., 2018; Rosing et al., 2011). This experiment was conducted with an explicit separation of creativity and implementation because we aimed to compare the influences of behaviors under the different requirements. As pointed out in the section above, this gives us a first insight that using adequate behaviors will be helpful to address the

different requirements. Nonetheless, over time both requirements will be present within the innovation process. Thus, it will be necessary to address the flexible interplay of opening and closing leader behaviors – actual ambidextrous leadership – with the respective requirements in future experimental as well as field studies (Rosing et al., 2011). These studies would advance a more complete understanding of the influence of leader behaviors within the innovation process.

Practical Implications and Conclusion

Results of this study clearly point to the importance of situational demands of creativity and implementation in innovation processes. Innovation processes will be more successful if both requirements are considered and addressed by leaders and followers (Bledow et al., 2009). Leaders who show opening leader behavior set a frame that enables followers to address creativity requirements, whereas leaders showing closing leader behavior will help followers when meeting implementation requirements (Rosing et al., 2011). Furthermore, follower behaviors of exploration and exploitation should also be shown in alignment with situational requirements of creativity and implementation, respectively (Bledow et al., 2009; Rosing et al., 2011). Thus, paying attention to creativity and implementation requirements within the innovation process will contribute to better innovation outcomes.

More research with respect to leadership and innovation needs to be conducted, as we currently cannot draw causal conclusions regarding the flexible interplay and integration of leader behaviors. Nonetheless, our research contributes to the literature in that it points to the importance of a more detailed review of situational aspects such as innovation requirements. Prior literature shows that creativity and implementation are relevant aspects of the innovation process (Rosing et al., 2018; Schroeder et al., 1989). Our study adds to this understanding because we considered creativity and implementation requirements as essential part of the innovation process and provide evidence that differential leader and follower behaviors are

necessary to adequately address creativity and implementation within this process. This is a promising avenue for future research as a more micro-level perspective on the innovation process will allow us to draw conclusions on the conditions under which leader and follower behaviors will lead to successful innovation processes.

6. General Discussion

This dissertation provides insights and empirical evidence into leadership in innovation processes. Based on the ambidexterity literature and ambidextrous leadership, a within-process perspective on the innovation process was employed (Bledow et al., 2009; Rosing et al., 2011; Shalley et al., 2004). The situational requirements of creativity and implementation as well as their flexible interplay are considered as integral aspects associated with the effectiveness of certain leader and follower behaviors within the process (Bledow et al., 2009; Rosing et al., 2011; Schnellbacher et al., 2019, 2019).

In Study 1, a positive separate influence of opening and closing leader behavior on innovation performance was found in a longitudinal design across six weeks. This emphasizes the relevance of both leader behaviors for innovation processes (Rosing et al., 2011). Moreover, differential effects of leader and follower behaviors depending on the situational requirements were found (Rosing et al., 2011). Study 3 shows that effects of leader and follower behaviors on performance are moderated by the situational requirements of creativity and implementation. Follower exploration behavior and opening leader behavior are more effective when creativity is required whereas follower exploitation behavior and closing leader behavior are more effective when implementation is required. These results are in line with the ambidextrous leadership model (Rosing et al., 2011) and emphasize the need for a within-process perspective on innovation to identify and address situational requirements. Unfortunately, the flexible interplay as a combination of opening and closing leader behaviors did not show a positive association with innovation performance in Studies 1 and 2. This is surprising because existing research has found initial support in this regard (Rosing et al., 2011; Zacher & Rosing, 2015; Zacher & Wilden, 2014). However, the operationalization of flexible ambidextrous leadership in the dissertation studies as well as other existing literature can be debated. In Study 1 and in line with the ambidexterity literature, flexible ambidextrous leadership was operationalized with an interaction term of opening and closing leader

behaviors (He & Wong, 2004; Zacher & Rosing, 2015; Zacher & Wilden, 2014). With this term, it is analyzed whether a combination of leaders' general tendencies to show opening and closing leader behavior will lead to better innovation performance (Rosing & Zacher, 2017; Tempelaar & Rosenkranz, 2013; Zacher & Rosing, 2015; Zacher & Wilden, 2014). However, this operationalization disregards the appropriateness of opening and closing leader behaviors for the specific situation. Thus, it could be the case that leaders of the sample in Study 1 (or at least not all of them) did not adjust their behavior adequately and in line with situational requirements of creativity and implementation. In this case, the positive effect of the combination of ambidextrous leader behaviors would not unfold like in previous studies. In Study 2, a flexible adaptation of opening and closing leader behavior was manipulated. Even though the confederates were trained, and they showed mostly appropriate changes in leader behaviors, descriptive results indicate that the manipulation was not strong enough. The postulated direction of effects was found in the descriptive results when many appropriate changes in leader behaviors were administered. Consequently, these results further indicate that the appropriateness of leader behavior for a given situation could be the key to the effectiveness of ambidextrous leadership (Rosing et al., 2011). Taken together, this dissertation shows that the alignment of behaviors with situational requirements is essential, especially when regarding the flexible application of leader and follower behaviors in innovation processes (Bledow et al., 2009; Rosing et al., 2011).

6.1 Contributions to Leadership for Innovation

The dissertation studies add to the literature on leadership for innovation in three ways. First, the studies emphasize that creativity and implementation requirements are relevant for the innovation, as they need to be addressed by leaders. In line with this, support for a positive relationship of opening and closing leader behavior with innovation performance was found. A longitudinal survey study supported these relationships in a longitudinal design across six weeks which is important because innovation and leadership

processes unfold in longer time frames than just days (Breevaart & Zacher, 2019; Madrid et al., 2014). Furthermore, the laboratory experiment in Study 3 provides evidence for causal influences of opening and closing leader behaviors on performance.

Second, this dissertation sheds light on flexibility in innovation processes even though it could not provide support for this proposition. It has been suggested that a flexible application, i.e. switching between the contradictory aspects such as creativity and implementation for the innovation process, will lead to better performance (Bledow et al., 2009; Rosing et al., 2011; Schnellbacher et al., 2019). However, it appears that researchers cannot assume that flexibility between behaviors will always lead to better innovation performance. Flexibility alone will not be enough as the appropriateness of leader and follower behaviors also needs to be considered (Rosing et al., 2011).

Third, the need for a more micro-level perspective to understand the influences of leader and follower behaviors within the innovation process is addressed. In line with this, the importance of the alignment of leader and follower behaviors with situational requirements of creativity and implementation is emphasized. Study 3 shows that creativity requirements are best addressed by follower exploration behavior and opening leader behavior whereas implementation requirements are best supported with follower exploitation behavior and closing leader behavior. Consequently, actors within the innovation process will be more effective when they attend to the situational requirements within the innovation process. Existing studies have regarded requirements of innovation and other contextual influences as stable (Johns, 2006; Pignault & Houssemand, 2016; Shin et al., 2017). However, investigating creativity and implementation requirements within the innovation process will lead to more nuanced conclusions of the effectiveness of certain leader and follower behaviors in a given situation.

Following this, the importance of these within-process requirements underlines that distinct leader behaviors such as opening and closing leader behaviors are necessary to

address the specifics of the innovation process. This offers a central advantage compared to traditional leadership approaches such as transformational leadership (Bass, 1985; Bass et al., 2003) or leader-member exchange (Gerstner & Day, 1997; Graen & Uhl-Bien, 1995) as well as contemporary leadership styles such as empowering (Cheong, Yammarino, Dionne, Spain, & Tsai, 2019; Lee, Willis, & Tian, 2018) or authentic leadership (Avolio & Gardner, 2005; Gardner, Cogliser, Davis, & Dickens, 2011). These leadership approaches do not offer solutions for the situational requirements of creativity and implementation as specific advice and concrete leader behaviors are not defined in these approaches (Rosing et al., 2011). For instance, authentic leaders are aware of their own values and needs and thus, they operate in a confident and optimistic way (Avolio & Gardner, 2005; Gardner et al., 2011). This approach is described as a root construct looking at the overarching person of the leader and not at specific leader behaviors (Avolio & Gardner, 2005; Gardner et al., 2011). Thus, it only provides a general theoretical framework disregarding the specifics of distinct processes such as the innovation process (Avolio & Gardner, 2005; Bledow et al., 2009; Rosing et al., 2011). Furthermore, other leadership approaches do not consider the interplay of situational requirements which is especially relevant for innovation processes (Bledow et al., 2009; Rosing et al., 2011; Rosing et al., 2018). Empowering leadership, for instance, provides the follower with the freedom to address the specific requirements (Cheong et al., 2019; Lee et al., 2018). However, the leader does not support the follower in recognizing which situational requirement is present and thus, it is more difficult for the follower to show the appropriate behavior for a given situation (Cheong et al., 2019; Rosing et al., 2011). This is especially relevant for innovation processes, because situational requirements of creativity and implementation within this process determine the effectiveness of leader and follower behaviors.

These situational requirements of creativity and implementation also need to be considered to receive a better understanding for the mechanism that followers use to address

the innovation process (Bledow et al., 2009; Rosing & Zacher, 2017; Schnellbacher et al., 2019). It has been shown that the combination of follower exploration and exploitation behaviors – individual ambidexterity – leads to better innovation performance (Jasmand et al., 2012; Rosing & Zacher, 2017; Zacher et al., 2016). However, individual ambidexterity research has also neglected the alignment of follower behaviors with situational requirements of creativity and implementation. Study 3 of this dissertation provides initial support that the alignment could be a fruitful avenue regarding the mechanism of effectiveness of follower exploration and exploitation behaviors (Schnellbacher et al., 2019; Shalley et al., 2004). This is especially relevant as the concept of contextual ambidexterity relies on individual ambidexterity to resolve the tensions associated with creativity and implementation requirements and consequently, reach higher organizational performance (O'Reilly & Tushman, 2013; Rosing & Zacher, 2017; Schnellbacher et al., 2019). Thus, the within-process perspective on innovation processes enables a more thorough examination of ambidextrous mechanism at the individual level and the integration of creativity and implementation within innovation processes (Bledow et al., 2009; Shalley et al., 2004).

Taken together, the ambidextrous leadership model offers specific leader behaviors that provide advice for addressing creativity and implementation requirements within the innovation process (Bledow et al., 2009; Rosing et al., 2011; Rosing et al., 2018). Furthermore, it has been shown that these behaviors need to be aligned with the requirements of creativity and implementation to reach higher innovation performance (Andriopoulos & Lewis, 2009; Miron-Spektor et al., 2018; Rosing et al., 2011). Thus, the specific advice in opening and closing leader behaviors could be a central mechanism to address the contradictory situational requirements of creativity and implementation within the innovation process (Rosing et al., 2011). It can thus be concluded that the ambidextrous leadership model provides some promising proposition with respect to leadership for innovation.

6.2 Contributions to Experimental Research in Applied Psychology

Over and above these contributions to the literature on leadership for innovation, this dissertation also adds to the literature on experimental set-ups in applied psychology. Experimental studies are important to investigate causal effects of leadership in general and leadership for innovation more specifically (Antonakis, 2017; Hughes et al., 2018; Podsakoff & Podsakoff, 2019). If researchers use correlational data, conclusions concerning the causal direction of effects cannot be drawn as reverse causality could also be true (Antonakis et al., 2010, 2014; Hughes et al., 2018). This is relevant to leadership research, because we should be explicitly interested in the influence that leaders have on their followers (Fischer et al., 2017). Moreover, the use of self-report measures in the context of leadership and innovation has been criticized (Antonakis, 2017; Reiter-Palmon et al., 2012; Robinson-Morrall et al., 2013). It has been found, for example, that the knowledge about leader performance influences ratings of leader behavior (Lord et al., 1978; Wang et al., 2019). In this dissertation, two experiments were conducted to address these shortcomings and draw causal conclusions on the influence of ambidextrous leader behaviors on innovation performance.

First, the two experiments provide ideas on how to manipulate flexible leader behaviors (i.e. confederates in Study 2) and static leader behaviors (i.e. video messages in Study 3). In Study 2, confederates were used as leaders to realize flexible ambidextrous leadership. In general, this leadership manipulation worked, as the confederates showed opening and closing leader behaviors according to the scripts. Leadership literature has used confederates to manipulate different constructs before (Avolio, Reichard, Hanna, Walumbwa, & Chan, 2009). However, usually these manipulations are stable in that only one leadership approach or even just one aspect of a leadership approach is manipulated (Avolio et al., 2009). However, in today's business world that is becoming more complex and dynamic, leadership should also be considered as a dynamic construct (Halbesleben et al., 2003; Yukl & Mahsud, 2010). Taking this into consideration, leadership needs more flexible approaches

that also need to be tested and, thus, manipulated (Antonakis et al., 2010; Antonakis, 2017; Yukl & Mahsud, 2010). This is especially relevant for innovation processes with dynamic shifts between situational requirements of creativity and implementation (Halbesleben et al., 2003; Havermans et al., 2015; Rosing et al., 2018). Although this manipulation is not without limitations (see limitation section of Study 2), it is a first step towards manipulating flexible leadership approaches in experiments and thus, provides researchers with new opportunities for future studies. In Study 3, a stable approach to manipulating leadership in the laboratory is used. Here a leader sent a video message including directions for task completion. Existing leadership literature has also used this approach (Avolio et al., 2009; Jacquart & Antonakis, 2015; Stam et al., 2016). However, the experiment in Study 3 is the first to manipulate opening and closing leader behaviors in this manner and thus, this approach can be used to further analyze causal influences of ambidextrous leadership for innovation processes. These two experimental manipulation methods provide ideas on how to manipulate leadership in experimental research with respect to dynamic leadership constructs in general as well as ambidextrous leadership more specifically (Antonakis, 2017; Hughes et al., 2018; Podsakoff & Podsakoff, 2019).

Second, the two experimental studies show opportunities on how to measure innovation objectively within a laboratory setting (Highhouse, 2009; Reiter-Palmon et al., 2012). A measure for innovation performance (Study 2) as well as measures for creativity and implementation performance were employed in the laboratory (Study 3). While scholars have examined creativity in experimental tasks (Bledow et al., 2013; De Dreu et al., 2008; Fong, 2006), research on implementation and innovation performance in the laboratory is scarce. Existing research has mostly relied on self-reports of creativity, implementation and innovation performance (Anderson et al., 2014; Barbot et al., 2019; Junni et al., 2013). However, these measures are subject to biases (Podsakoff et al., 2003; Reiter-Palmon et al., 2012; Robinson-Morrall et al., 2013). Consequently, we need to objectify these outcomes

(Podsakoff et al., 2003). In Study 2, a construction task that includes a creative problem solving as well as the implementation of a construction from craft materials to reproduce the innovation process was used. Subsequently, for an innovation measure the construction was tested in line with the task's goal. Further, independent raters assessed the construction on innovation criteria. There is still room for improvement for this innovation task (see limitation of Study 2). Nonetheless, this type of task offers a possibility for an innovation performance measure in laboratory experiments. In Study 3, the separating of creativity and implementation performance in two tasks provides a sufficient addition. As already pointed out, a creativity task as well as the creativity performance measure could be used from existing literature (Bledow et al., 2013; De Dreu et al., 2008). However, Study 3 of this dissertation additionally examines implementation in an experiment. During the implementation task, participants finished a brochure of the university marketing that still included mistakes. To measure implementation performance, a count of the corrected mistakes per minute was used to represent an efficiency measure. Although this task and the associated implementation performance measure can also be improved (see limitations in Study 3), the opportunity to investigate the factors influencing implementation within the innovation process can be addressed with this method. This is central to innovation literature as causal conclusions on the influences within innovation processes for both creativity and implementation requirements are relevant (Anderson et al., 2014; West, 2002a, 2002b). In this regard, the dissertation offers tasks as well as measures for creativity, implementation and innovation performance which will enable research to draw causal conclusions on these processes.

6.3 Limitations

Notwithstanding these theoretical and methodological contributions, this dissertation has some limitations that need to be discussed. First, the operationalizations of flexible leadership did not work satisfactorily. The most commonly used operationalization for

ambidextrous leadership is the interaction term of opening and closing leader behaviors (Zacher et al., 2016; Zacher & Rosing, 2015; Zacher & Wilden, 2014). This operationalization follows the ambidexterity literature that, among others, used interaction terms to combine measures of follower exploration and exploitation behaviors (He & Wong, 2004; Junni et al., 2013; Tempelaar & Rosenkranz, 2013). However, the interaction term has been criticized (Jansen, Kostopoulos, Mihalache, & Papalexandris, 2016; Junni et al., 2013; Rosing & Zacher, 2017). Especially regarding ambidextrous leadership, this operationalization holds some downsides. In this specific case, the interaction term is not sufficient as it only indicates the effectiveness of both high levels of opening and closing leader behaviors (Rosing & Zacher, 2017; Zacher & Rosing, 2015; Zacher & Wilden, 2014). It disregards the temporal aspects of flexibility (when and how often do they change behavior?) as well as the appropriateness aspect (is the behavior aligned with situational requirement?). This is problematic because the flexibility component is central to the effectiveness of ambidexterity and more specifically, ambidextrous leadership (Rosing et al., 2011; Schnellbacher et al., 2019). Consequently, an appropriate operationalization is necessary for the empirical investigation of ambidextrous leadership. To fill this gap, we aimed to reproduce flexible ambidextrous leadership in the laboratory using confederates. This manipulation was successful in that confederates showed opening and closing leader behavior with standardized sentences. They further changed their behavior in the flexible leadership condition and these changes were mostly appropriate. Nonetheless, descriptive results indicate that this manipulation was not strong enough, because the proposed positive effects of flexible leadership are descriptively found, when many appropriate changes were present. It could be that the confederates were unable to show enough appropriate changes in most task executions of the innovation task used in Study 2. Taken together, the studies of this dissertation provide more insights into the operationalization of flexible leadership. However,

new and different operationalizations taking the temporal pattern of opening and closing leader behaviors as well as the situational appropriateness into account are necessary.

Second, the studies are limited in terms of generalizability. The sample in Study 1 is comparably small on level 2 ($N = 54$). However, based on a medium sized effect, the sample size on level 1 ($N = 254$) is sufficient (Breevaart & Zacher, 2019; Scherbaum & Ferreter, 2008). Nonetheless, especially regarding the influences of leadership processes on level 2, investigating these effects with a larger sample will be relevant for future research to reach a complete comparison of the effects of the different leadership approaches (Hughes et al., 2018). Regarding the samples for Studies 2 and 3, both samples consist of students. This could limit the generalizability (Highhouse, 2009; Podsakoff & Podsakoff, 2019). However, investigations have shown that there are no meaningful differences between student and employee samples, especially when actions are taken to motivate the students (Highhouse & Gillespie, 2009). Participants in the experiments, for instance, received performance contingent rewards, that improved the motivation of the students in Studies 2 and 3. Nonetheless, the found relationships, especially regarding the effect of alignment of leader behaviors with situational requirements, should be analyzed in field studies with leaders and employees to provide further proof of the robustness of the results.

6.4 Future Research

Taking these limitations, the results of the studies and further existing research on leadership for innovation into account, some directions for future research can be identified.

Flexibility in Innovation Processes. A central topic in this regard is the flexibility component within ambidexterity and innovation processes. As pointed out in the previous section, a sufficient and appropriate operationalization of flexible behavioral adaptation in line with situational requirements of creativity and implementation is lacking (Rosing & Zacher, 2017; Schnellbacher et al., 2019). To begin with, this shortcoming can be attributed to a research gap regarding temporal dynamics within the innovation process. Some initial

studies have investigated the temporal patterns of creativity and implementation (Rosing et al., 2018; Schroeder et al., 1989). However, we do not know enough about the flexibility component of ambidexterity within in the innovation process (Schnellbacher et al., 2019; Shalley et al., 2004). Multiple studies show that the simultaneous pursuit of creativity and implementation is relevant at the organizational (Gibson & Birkinshaw, 2004; He & Wong, 2004; Junni et al., 2013), team (Jansen et al., 2016; Rosing et al., 2018) and individual level (Good & Michel, 2013; Jasmand et al., 2012; Mom, Fourné, & Jansen, 2015). Nonetheless, it remains unclear what simultaneous means in this case. Regarding the ambidexterity literature, there is only scarce information on how employees, teams or leaders reach this goal (Schnellbacher et al., 2019; Swart et al., 2017). Consequently, more research is necessary to understand how individuals and leaders attend to creativity and implementation requirements throughout the innovation process. In this regard, qualitative methods are needed to get to the ground of those situations, where both follower exploration and exploitation or opening and closing leader behaviors are relevant (Gilhooly et al., 2007; Havermans et al., 2015; Volery, Mueller, & von Siemens, 2015). Qualitative methods will enable researchers to understand how changes in leader and follower behaviors occur and how creativity and implementation are integrated (Andriopoulos & Lewis, 2009; Johns, 2006; Miron-Spektor et al., 2018). For instance, qualitative research could investigate the characteristics of situations that require creativity and situations that require implementation. Research could then analyze the temporal patterns of these situational cues to provide more information on when and how leaders and followers need to adapt their behavior (Havermans et al., 2015; Rosing et al., 2018). In addition, considering emotional and cognitive processes associated with the changes in leader and follower behaviors is necessary. Some initial research has regarded this with respect to creativity (Gilhooly et al., 2007; Jankowska, Czerwonka, Lebuda, & Karwowski, 2018). However, we are lacking knowledge about emotional and cognitive processes with respect to the implementation of ideas and the integration of creativity and implementation

(Anderson et al., 2014; West, 2002a, 2002b). Qualitative methods will provide researchers and practitioners with more detailed insights into these aspects.

In line with this conceptual issue, a new approach to operationalizing the flexibility component is necessary. According to the empirical results of this dissertation, this operationalization should include the appropriateness component. One possibility to do this is provided by situational judgement tests (SJT; Guenole, Chernyshenko, & Weekly, 2017; Lievens, 2017; Lievens, Peeters, & Schollaert, 2008). Situational judgement tests (SJTs) use item stems that describe situations and offer different (behavioral) responses to the situations (Lievens et al., 2008). These behavioral responses can be rated on a Likert-scale or a forced choice format can be implemented, making the respondents choose one of the behavioral options (Bledow & Frese, 2009; Lievens et al., 2018). A central characteristic of SJTs is that the evaluation of the answers, the so called scoring key, is developed prior to the testing during the validation phase (Bergman, Drasgow, Donovan, Henning, & Juraska, 2006; Lievens et al., 2008). For instance, for a situational judgement test on ambidextrous leadership this scoring key could include the appropriateness component and define whether opening or closing leader behavior is best suited for each described situation. Furthermore, a new estimation procedure based on item response theory, which has been implemented for situational judgement tests, could offer a further opportunity to operationalize flexible behavior (Böckenholt, 2012; Lang, Lievens, De Fruyt, Zettler, & Tackett, 2019; Lievens et al., 2018). With this approach, based on item response trees, intraindividual flexibility for each respondent can be estimated (Lang et al., 2019; Lievens et al., 2018). For each respondent this method provides two estimates: (1) the mean on the trait measures, e.g. opening or closing leader behavior, (2) the respondent's tendency to show variability, e.g. on opening or closing leader behavior (Böckenholt, 2012; Boeck & Partchev, 2012; Lievens et al., 2018). These estimates are independent of the item characteristics as item properties are also estimated in the analysis (Böckenholt, 2012; Lievens et al., 2018). Consequently, SJTs

combined with the estimation based on item response trees could offer an opportunity to operationalize flexibility in leadership differently and further, take the appropriateness of behaviors for a situation into account. In addition, with respect to ambidextrous leadership specifically, it will also be necessary to find different experimental manipulations to draw causal conclusions (Antonakis, 2017; Podsakoff & Podsakoff, 2019). In this case, researchers need to construct an experiment that enables more appropriate changes. However, it is important that the confederates in such an experimental set-up do not interfere with the task too much because otherwise followers will not have the opportunity to show the respective behaviors and effects cannot be detected. This could be achieved by using multiple interactions with a confederate leader across a longer time period, for instance an innovation project across several weeks. With this more complex but also more realistic design, better conclusions in terms of the effectiveness of flexibility will be possible.

Mediating Mechanisms for Ambidextrous Leadership. In addition, this dissertation did not find support for mediating mechanisms with respect to the relationship between opening and closing leader behaviors and innovation performance. Existing research shows the relevance of both follower exploration and exploitation behaviors for the innovation process (Good & Michel, 2013; He & Wong, 2004, 2004; Jasmand et al., 2012). Nonetheless, we could not replicate earlier findings that opening leader behavior is associated with follower exploration behavior and closing leader behavior is associated with follower exploitation behavior (Zacher et al., 2016). We believe that this lack of a significant relationship is rooted in the control variables of transformational and transactional leadership in Study 3. Nonetheless, more experimental research on the influence of leaders on follower exploration and exploitation behaviors relevant to the innovation process is needed. This is important because follower exploration and exploitation behaviors have been associated with higher innovation performance (Good & Michel, 2013; Jasmand et al., 2012; Schnellbacher et al., 2019). Especially, regarding the flexible interplay of follower exploration and exploitation

behavior, individual ambidexterity, this could be a mechanism through which followers are enabled to integrate situational requirements of creativity and implementation (Rosing & Zacher, 2017; Schnellbacher et al., 2019). Thus, follower exploration and exploitation behaviors could be a relevant mediation mechanism for leadership in innovation processes. This is also a central assumption of the ambidextrous leadership model and thus, follower individual ambidexterity needs to be investigated in experimental and field settings as an important mediator in the model (Rosing et al., 2011; Rosing & Zacher, 2017; Schnellbacher et al., 2019).

6.5 Conclusion

This dissertation provides insights into leading for innovation taking a micro-level perspective on innovation processes (Rosing et al., 2011). It has been found that addressing situational creativity and implementation requirements within the innovation process is important for leaders. Creativity and implementation should be regarded as within-process situational requirements because they determine the effectiveness of leader and follower behaviors with respect to innovation performance. Unfortunately, no support for the flexible adaptation of leader behaviors was found. However, this component was not satisfactorily operationalized since the important appropriateness component was disregarded. Thus, an empirical validation of the flexible adaptation of leader behaviors can be reached with different methods. Because the adaptation of leader and follower behavior to the situational requirements of creativity and implementation is central for innovation processes, a further investigation of the ambidextrous leadership model that addresses this issue seems promising for research on leadership for innovation.

7. References

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8. Conference Contributions and Scope of Responsibility

	Contributions	Responsibility
Study 1	<p><u>Conferences:</u> Gerlach, F., & Rosing, K. (September 2019). <i>Spezifische Führungsverhaltensweisen für den Innovationsprozess</i>. Symposium presented at the 11th Tagung der Fachgruppe AOW der Deutschen Gesellschaft für Psychologie, Braunschweig.</p>	<p>Primarily responsible for conceptual development, study design and materials.</p> <p>Solely responsible for data collection and data analysis.</p> <p>Primarily responsible for manuscript development.</p>
Study 2		<p>Jointly responsible for conceptual development.</p> <p>Primarily responsible for study design and materials.</p> <p>Solely responsible for data collection and data analysis.</p> <p>Primarily responsible for manuscript development.</p>
Study 3	<p><u>Conferences:</u> Gerlach, F., Heinigk, K., & Rosing, K. (September 2017). <i>Beidhändige Führung im Innovationskontext – Der Umgang mit unterschiedlichen Anforderungen</i>. Symposium presented at the 10th Tagung der Fachgruppe AOW der Deutschen Gesellschaft für Psychologie, Dresden.</p> <p>Gerlach, F., Heinigk, K., & Rosing, K. (Mai 2017). <i>Ambidextrous Leadership – Meeting Different Innovation Requirements</i>. Symposium presented at the 18th EAWOP Congress 2017, Dublin.</p>	<p>Jointly responsible for conceptual development.</p> <p>Primarily responsible for study design and materials.</p> <p>Solely responsible for data collection and data analysis.</p> <p>Primarily responsible for manuscript development.</p>

Appendix A: Study 2

A1: Experimenter Instructions

Experimenter:

Hello! Welcome to our study. We would like to thank you beforehand for your support. Please don't be surprised because I am reading this text strictly. This is necessary for an objective execution of this study. If you have any question, you can ask at any point.

As part of the experiment today, you will take part in an innovation competition. The three-best solution of the innovation task, that you will be completing in a moment, will receive a prize money as a voucher of 50 Euro. More detailed instruction of the completion of the task will be given to you in written form. The whole study will take about 60 minutes.

Of course, we will anonymize your data and use these data only for scientific purpose. We ask you to turn off your phone during the task completion. Furthermore, we are interested in the way you will complete the task. Thus, we would like to tape your task completion with a video camera to make sure that we do not miss anything during your task completion. Do you agree to the video tape? If so, please sign the consent form

The task execution will take place in another room. We will go over there in a moment and you will meet (name of the confederate). (name of the confederate) will inform you about the task instructions and the task goal. She will stay with you in the room for the whole task execution and will control, if you are adhering to the task instructions. She will further support you and help you with decisions. At the end of the execution time, (name of the confederate) will evaluate your approach and your solution to the task. She will then give you feedback on whether you reached the task goal.

Alright, we will go to the other room now. You can leave your personal belongings here.

Experimenter:

You can sit down here. This is (name of the confederate). She will give you the task instructions and support you with the task completion. I will be back in 30 minutes.

The time for the task execution is expired. You are almost done. Please fill out this questionnaire.

Before we end the experiment, we will now check whether your construction works.

		✓
Drop the construction at different heights		
Document the result		

Experimenter:

You are done! Thank you for your time and the support! If your machine is one of the top three, you will win one out of three vouchers. Please fill out this slip of paper with your email address. You will receive an email if you are one of the winners.

Further, you will receive 10 euro for the participation. Please sign here that you received the money.

Experimenter:

Before you can go home, we will now explain what we are examining in this experiment. Above all, we are interested in the influence of the different behaviors that the other person in the room with you showed. We will analyze whether the behavior had an influence on your performance in the innovation task.

Our research is not done, and we are still looking for participants. Therefore, please do not talk about the goal of this experiment with your fellow students. This is very important for the validity of our research results.

If you are interested in the results of this experiment, we will inform you. Please send us an email so we can send you the results once we have completed the study.

Thank you and have a good day!

A2: Leadership Manipulation

General Introduction (the same for all conditions):

First, I will turn on the camera.

Welcome to the task execution! In the following 30 minutes you will work on an innovation task. You will find the instructions on this worksheet. Additionally, you will get a sheet for notes or sketches if you need it. You will find the material for the task on the table and here (point to the edge of the table) you will also find sticky tape. Now read the task so that you know what it is about.

When the subject has finished reading (control for vision and inspirational motivation transformational leadership):

Remember that the goal is to build a machine that is as stable and creative as possible and that protects the egg when falling. To check if you have been successful, it is important that you can see the egg in your machine. A prize money will be awarded for the three best three machines. It's a challenging task, of course, but you can definitely master it. Do you have any questions?

You can start with the task now. I am here to support you.

Opening Leader Behavior

- encourage the participants to experiment with different ideas
 - "Take any material in your hand and consider if it could help protect the egg from breaking."
 - "Also consider if there may be less obvious ways to use the material."

- encourage the participant using different ways to perform the task to break existing routines
 - "Think in different directions."
 - "Keep thinking, other ideas might come up."
 - "The task doesn't need to be done in the traditional way."
 - "There is no right way or right solution to this problem."
 - "Remember, for a successful solution, you need to develop the most original solution possible."
- motivate the participant to take on the risk (before mistakes)
 - "You don't have to be afraid. If you make mistakes, you can learn from them."
 - "If it doesn't work, you're still a step closer to a possible solution."
 - "Think again about the other materials, nothing can happen."
- point out that there are no negative consequences due to errors (after the mistake)
 - "Not bad, keep trying."
 - "No problem, that could happen to anyone."
 - "That's how you learn something. Now you can think about the other possibilities for a solution."
- encourage the participant to learn from their own mistakes
 - "Think about what might have been the reason and then you can develop new ideas from it."
 - "Think again which approach makes the most sense to you."

Closing Leader Behavior

- routines should be established in order to ensure uniform performance of tasks
 - "For a good solution, it makes sense for you to make a plan of how exactly you will put your ideas into practice."

- "Try to see if you can put the ideas into practice."
- check whether the rules are followed
 - "Pay attention to time. At the end you must have a finished machine to participate in the competition."
 - "As soon as you change one of the materials, it's considered used."
 - "Make sure you work hard to build a successful machine."
 - "You still have XXX minutes and need a finished machine at the end to participate in the contest."
- monitor and control the participant in the achievement of objectives
 - "Think of the task goal, the egg must remain intact, so that you get the prize."
 - "Remember that at the end a machine must be ready for you to take part in the competition".
 - "Remember, if you use less material, there is a bigger chance for you to win the contest."
 - "Remember, for a successful solution, the machine must be as safe as possible."
- encourage risk avoidance
 - "For a good solution, make sure you execute it properly and make as few mistakes as possible."
 - "Make sure you don't make any mistakes, so you'll finish with building a successful machine."
 - "It is important for a successful task execution that you make as few mistakes as possible and finish the machine in the given time frame."
- takes corrective action
 - "Note once again that the machine is neatly finished overall."

- "Make sure that you still correct the messy parts of the machine so that you have a successful machine at the end."

No Leadership Sentences

- stays out when it comes to procedural, design or process issues
 - "It's best to decide for yourself how exactly you want to do this."
 - "Unfortunately, I don't have time to deal with it."
- reacts evasively when asked questions
 - "I'm afraid I can't help you, because I have to do another job."
 - "I can't say anything about that right now."
 - "I'm afraid I don't know that either."
 - "Unfortunately, I don't have any ideas for this, and I have to continue working on my tasks here."
- For mistakes in situations where you have to say something:
 - "Doesn't matter, just keep going"

A3: Task Instructions

Egg Machine

As part of the innovation competition it is your task to build a machine for a raw egg. The goal of the task is to prepare the egg in a way that it will survive a fall from 2 meters, without breaking. For this purpose, you have five raw eggs and the material on the table. It is important that the egg is visible, so that we can see at the first sight whether the egg has survived the fall.

It is part of the task to reach the goal with as little materials as possible, but it should be the main goal to secure the egg. Every material that you use will be counted as one unit. One sheet of paper counts as much as the straw. After the task execution we will count the used

materials. You do not need to worry about that. A material counts as used as soon as you change it, independent of whether it is part of the machine in the end. That means, if the material does not look like it does now, we will count it as a used material.

At the end of the task execution time, you should have a machine that secures the egg with as little material as possible. In addition, you should be as creative as possible during the task execution. However, it is most important that the egg survives the fall from 2 meters. The three constructions that are best in the categories of safety, least material and originality will get a price of 50 Euro. You can only take part in the competition if you finish a machine within the task execution time frame.

For the task execution you have 30 minutes. You can use the sheet next to you for notes and sketches. The sketches are only for your own support and are not part of the evaluation at the end.

When the time is over, you are not allowed to touch the construction.

Appendix B: Study 3

B1: Creativity Task

Task Instructions

Please imagine you would be an employee of the marketing department of your university. The war for talent is already starting at the universities. Therefore, it is especially important to recruit students for your university. You just started the position in the marketing team and now you will receive your first independent task.

The goal of your team in the marketing department of the university is to address as many students as possible and to recruit them for your university. Now, as one of your first tasks, you are asked to generate as many ideas as possible on how students can be addressed by your university. Please enter your ideas in the text box on the next page. To give you an idea of what is being done in the field of university marketing, you will get a few details that can serve as a guide.

You have 15 minutes to complete this task. Before you start, the experimenter will provide you with the additional information.

Please consider as many ideas as possible on how students can be approached by your university. Please simply enter them in the text box below.

You have 15 minutes to complete this task. The experiment management will let you know when the time is up, and you can continue with the next task.

Guide for the Creativity Task

To help you to perform best at the task, here are some details concerning previous international university marketing activities aimed at attracting foreign students:

Print Media

- Brochures or leaflets on the university and study programs in German and English;
Distribution of information material for display at institutions abroad

Digital Media

- e-mail counseling for foreign students; University web pages or parts of university web pages in English; PowerPoint presentations for information on Erasmus programs

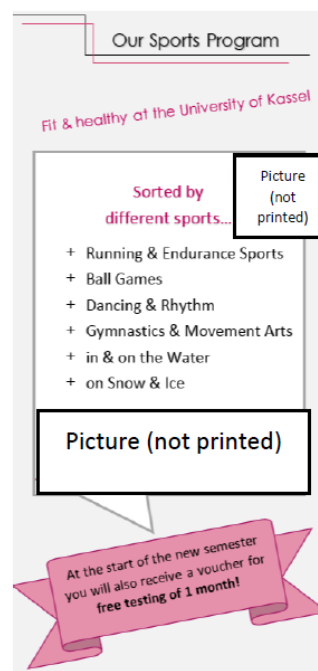
Events

- visit of partner universities; visiting other foreign universities (beyond partner universities); Participation in fairs on topics such as "Semester Abroad" and "Erasmus"

Radio and Movies

- Image films about the International Office; Radio contributions that report on and inform about studying abroad

Here's an example of what international university marketing advertising can look like.



B2: Implementation Task

Implementation Task Instruction

Please imagine you would be an employee of the marketing department of your university. The war for talent is already starting at the universities. Therefore, it is especially important to recruit students for your university. You just started the position in the marketing team and now you will receive your first independent task.

The goal of your team in the marketing department of the university is to address as many students as possible and to recruit them for your university. Now, as one of your first tasks, you are asked to complete the brochure for students. For this task an old version will be provided. Your predecessor started this task, but unfortunately did not have the opportunity to finalise the brochure. Now it is your job to improve and correct the existing brochure to finalise this task. Additional materials are also available. The experimenter will show you shortly where to find them. If you want to change something but do not know how to do it in Word, just write it down in the boxes provided on the last page in the document. To give you an idea on how we usually design these brochures, you'll get a few details that can serve as a guide. In addition, we have put together some tips for you that can help you while editing the brochure in the Word document.

You have 25 minutes to complete the task. If you are done earlier, just let the experimenter know. Before you start, the experimenter will provide you with the additional information.

University Ticket

Picture
(not printed)

Did you know that you as a student of the University of XYZ

benefit from our **cultural ticket**:
This allows you to enjoy perks or even in free entry to some cultural highlights here in Kassel and discover your new home. The following institutions participate,
Among Others:

- + theater
- + comedy
- + museum
- + event locations
- + ...und manie more

The city is looking forward to seeing you!

Uniparties

Let's Celebrate!

Picture
(not printed)

"Welcome-Party"

In the first week of the semester, it's time to say 'Welcome dear Freshman!' and the old primary school in XYZ will be converted into the ultimate venue! With hot beats and trendy DJ's from the region you can dance on several floors, celebrate the start of University and get to know new fellow students. Drinks for a small budget will also be waiting for you.

About all other parties, you will always be informed on the campus or through our Facebook group. Bye for now!

Picture
(not printed)

U N I V E R S I T Ä T

After high school is before college life

Here you will find current benefits of the University of XYZ:

- + University sports: Stay in motion!
- + Workshops: Train your Soft Skills!
- + Semester abroad: Around The World!
- + Cultural ticket: Discover your city!
- + Uniparties: Let's Celebrate!

Picture
(not printed)

University sports

Sport is fun and healthy...

... and in XYZ you will find great conditions for a sporty lifestyle.

Our sports program has been expanded to include a number of interesting sports in which you, of course, as a student of the University of XYZ, can participate for free. Look forward to:

- + Full body exercise
- + Power Yoga
- + Women's soccer
- + Ju-Jitsu
- + Hot Iron Workout
- + Strength-endurance.

Further information and all other sports offers can be found on our website: www.sport-uni-xyz.de

Picture
(not printed)

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Workshops

Picture
(not printed)

Picture
(not printed)

Expand your Soft-Skills!

Picture
(not printed)

Nowadays Employers expect not only theoretical knowledge and good grades but a convincing appearance is also crucial for the career start. The University of XYZ emphasizes this with a range of workshops, that you can visit at any time during your studies. For example, the following topics are waiting for you:

- + Presentation techniques
- + Moderation and negotiation techniques
- + Communication & Interviewing

We invite you to our welcome event for this topic!

Picture
(not printed)

Semester abroad

Picture
(not printed)

Picture
(not printed)

around the world – Study abroad!

Ever thought of a stay abroad? Take advantage of the many benefits of studying abroad;

Learn the language the country and meet new people, collect experiences for your life and your CV!

The university not only supports studying abroad, but also continuously expands its network of partner universities around the world. We regularly provide informational events on the subject, such as Erasmus Meet & Greet. You will be informed of upcoming appointments at the latest in the first week informed.

We look forward to seeing you?

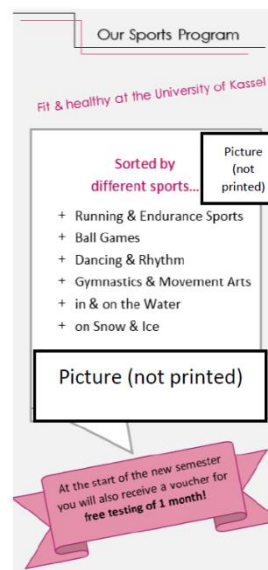
Picture
(not printed)

- The font should be kept consistent within a product. The headline, subheadings and text can be formatted differently. However, all headings (e.g.) or all text elements should be the same.

5. Plausibility of content

- The content of the product should be varied interestingly, but still plausible in content. All content aspects should be presented realistically.

Here's an example of what international university marketing advertising can look like.



B3: Leadership Manipulation

Leadership Manipulation Introduction

Hello,

You do not know me yet and I'd like to briefly introduce myself: My name is Thomas Meier. I am the head of university marketing at the University of XYZ and thus your supervisor. Welcome to my team!

I will give you a task which will be presented to you in detail soon. In general, it's about attracting as many students as possible to our university.

*Leadership Manipulation Text Modules**No Leadership:*

Our department consists of eight staff members, each dealing with different aspects of university marketing, an assistant and myself. Specifically, we work on the development of marketing tools for our university. We do this by differentiating between the various target groups: high school students, university students, academic staff and professors. For each target group, two employees work together, with one colleague who serves the target group "professors" only being in the office half-days. This is the first information I can give you about the team and our work. Regarding your task, you will get more detailed instructions and information in a moment.

Opening Leadership Behavior:

To me, it is especially important that we create high quality products to convince many students to come to our university. I will now give you initial ideas on how we work in our department to achieve this goal.

First of all, our marketing department represents creativity and unconventional ideas. It is important to me that we all work together to act on this maxim. To me, it is important that you try different things and think outside the box, too. Be original and give options a try. I expect you to deal with different opinions and new perspectives. In addition, I value novelties, so that we create high quality products in the end!

The tasks you are going to work on can be done in different ways. Since there are several ways to accomplish this goal, we have very few guidelines for how you handle the tasks. It is important that you experiment with different ideas to improve the quality of the products. In my experience, it is necessary that you try out new ways of thinking and new options. Mistakes may happen in this process. Consider mistakes as a possibility you can use to achieve a better result.

In our department it is necessary to take risks. I expect you to try out different options. In my experience, this energy is well invested. It is important to me, that we are free from old regulations and ideas, to develop original and different products in the end.

Closing Leadership Behavior:

To me, it is especially important that we create high quality products to convince many students to come to our university. I will now give you initial ideas on how we work in our department to achieve this goal.

First of all, our marketing department represents productivity and efficient implementations. It is important to me that we all work together to act on this maxim. To me, it is important that you stick to the given plans, tasks and rules. Be sensitive to the details and work with care. I expect you to proceed in a systematic and goal-oriented manner. In addition, I value the adherence to rules and regulations, so that we create high quality products in the end! The tasks you are going to work on can best be done if you get to know the details of the task at first. It is important that you consider these while carrying out the task to improve the quality of our products. In my experience, it is necessary that you rely on well-tried patterns and routines. This is the best way to avoid mistakes. Freedom from error is important to achieve the best possible result.

In our department it is necessary to work efficiently. Since we have a lot of work, it is important that you get to a faultless result as soon as possible. Focus your power on the essentials. In my experience, this energy is well invested. It is important to me that we develop neat and error-free products in a timely and accurate way in the end.

Opening & Closing Leadership Behavior:

To me, it is especially important that we create high quality products to convince many students to come to our university. I will now give you initial ideas on how we work in our department to achieve this goal.

First of all, our department of university marketing represents creativity and efficient implementation. It is important to me that we all work together to act on this maxim. To me, it is important that you stick to the given plans and rules. At the same time, it is important that you try different options and think outside the box, too. Be original and give something a try. But be sensitive to the details and work with care, too. I expect you to both proceed in a systematic and goal-oriented manner as well as deal with different opinions and new perspectives. On the one hand I value novelties, but on the other hand, the adherence to rules and regulations is important in order to create high quality products in the end!

The tasks we have here can best be done if you get to know the details of the task first and consider these while carrying it out. Different ways can lead to this goal. It is important that you experiment with different ideas, but also consider the instruction in the task while working to improve the quality of the products.

In my experience, you should both try new thinking patterns and new options as well as rely on well-tried routines. Mistakes should be avoided and above all not repeated. If mistakes occur, understand them as a possibility you can use to achieve a better result. In our department it is necessary to take risks and at the same time work efficiently, too. Try to test different options but still try to achieve an error-free result as fast as possible. For this endeavour, it is wise to focus your power on the essentials at some point. It is important to me that we develop original and error-free products in a time-efficient way and free of old regulations and ideas in the end.

General Farewell

I am confident that with our products we will be able to address students more in order to recruit them for our university. Every employee is important and I personally value that everyone can contribute their individual skills and talents. Your job is very interesting for our

team and the university marketing. If we can achieve our goals and recruit more students through the products, I am very satisfied with our work.

Now, I wish you a successful day at work and good luck with the first task!

B4: Measures

Exploration Behavior Scale (original version in German)

During task completion...

1. ... I searched for new opportunities.
2. ... I considered various perspectives.
3. ... I used unconventional ways.
4. ... I tried to think in different directions.
5. ... I questioned established standards.
6. ... in my thoughts, I experimented with diverse options.
7. ... I followed different approaches.
8. ... I made suggestions that are connected to a risk.
9. ... I flexibly dealt with different ideas.
10. ... I approached problems in an unbiased way. (excluded due to low discriminatory power)
11. ... I searched for new solutions to the given task.
12. ... I made an effort to find novel solutions.

Exploitation Behavior Scale (original version in German)

During task completion...

1. ... I completed activities, for which I knew exactly what to do.
2. ... I completed activities for which I could fall back on my existing knowledge.
3. ... I considered the department's existing standards.
4. ... I preceded goal-oriented.

5. ... I was oriented on proven methods.
6. ... I often trusted established routines.
7. ... I used methods that were successful in the past.
8. ... I proceeded systematically.
9. ... I operated on existing knowledge regularly.
10. ... I searched for the most efficient way to reach a solution.