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Explaining the heterogeneity of the leadership-innovation relationship: Ambidextrous leadership ☆

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ABSTRACT

The authors review and meta-analytically integrate the existing literature on leadership and innovation to show a complex and inconsistent picture of this relationship. Current research has mostly neglected the complex nature of innovation processes that leads to changing requirements within these processes. The main requirements of innovation are exploration and exploitation as well as a flexibility to switch between those two activities. The authors propose an ambidexterity theory of leadership for innovation that specifies two complementary sets of leadership behavior that foster exploration and exploitation in individuals and teams — opening and closing leader behaviors, respectively. We call this ambidextrous leadership because it utilizes opening and closing leader behaviors and switches between them to deal with the ever-changing requirements of the innovation process. Routes to ambidextrous leadership and opportunities for future research on leadership and innovation are discussed.

1. Introduction

The link between leadership and innovation has gained increasing attention in the literature. Some researchers proposed that leadership is one of the most influential predictors of innovation (Manz, Bastien, Hostager, & Shapiro, 1989; Mumford, Scott, Gaddis, & Strange, 2002). A recent special issue of "The Leadership Quarterly" on organizational learning shows the importance of leadership for innovation and organizational development (Jansen, Vera, & Crossan, 2009; Nemanich & Vera, 2009; Yukl, 2009). In this article, we answer the call by Yukl (2009) for more comprehensive models of the influence of leadership on exploration and exploitation, two activities required within the innovation process. In doing so, we build upon the theoretical framework provided by Bledow, Frese, Anderson, Erez, and Farr (2009) that elaborates a dialectical perspective on innovation.

West and Farr (1990) define innovation 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, designed to significantly benefit the individual, the group, organization or wider society" (p. 9). Thus, there is more to being innovative than just being creative. Creativity is defined as the generation of original and useful ideas (Amabile, 1996; West, 2002). Innovation is distinguished from creativity by the implementation, as opposed to mere generation, of ideas. Implementation requires selling ideas within the organization to other persons and/or groups (Axtell et al., 2000) and to propose the innovation for the market place; therefore, innovation includes

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social processes. What makes innovation processes complex is that creativity and implementation do not neatly proceed in a linear fashion (Anderson, De Dreu, & Nijstad, 2004; King, 1992; Schroeder, Van de Ven, Scudder, & Polley, 1989; Van de Ven, Polley, Garud, & Venkataraman, 1999) and, therefore, cannot be easily split into separate phases or stages. Instead, the requirements to generate and implement ideas alternate throughout the innovation process in an ever-changing manner. This factor makes innovation full of paradoxes and tensions, as described by Miron, Erez, and Naveh (2004). However, much of the literature and research has treated innovation as a rather uniform or linear process by looking for stable and broad antecedents.

The intent of this article is twofold. First, we present an overview of the existing research on leadership in the innovation process with the help of meta-analytic tools where applicable. Given the limited literature base, a full-scale meta-analysis such as Judge and colleagues (Judge & Piccolo, 2004; Judge, Piccolo, & Ilies, 2004) did on leadership and performance or Hülsheger, Anderson, and Salgado (2009) did on team level predictors and innovation is not intended. Instead, we utilize meta-analytic tools to focus and systematize our literature review with the intent to emphasize the high variation of the relationships between leadership and innovation. The heterogeneity of relationships points to inconsistencies in the findings, meaning that leadership styles have very different relationships with innovation depending on third variables.

Second, we explain this heterogeneity by developing a theoretical model towards leadership for innovation. In this theoretical model, we make two main points: First, we propose that the traditionally studied leadership styles are too broad in nature to specifically promote innovation as they might both foster and hinder innovation. For example, a transformational leader who communicates an inspiring vision may foster innovation if the vision includes fostering of experimentation. On the other hand, he or she might hinder innovation if followers are so absorbed in this vision that they stop thinking outside of it. We suggest that the crucial feature of leadership for innovation is the fostering of either exploitation or exploration via the reduction or increase in the variance of follower behaviors. Exploration and exploitation have originally been defined by March (1991) as two forms of organizational learning. In this respect, exploration is connected to increasing variance, experimentation, searching for alternatives, and risk taking; exploitation is linked to reducing variance, adherence to rules, alignment, and risk avoidance (March, 1991). As we explain later in this article, both exploration and exploitation are of crucial importance for innovation. Second, in light of the complexity of innovation endeavors, we propose that a single leadership style cannot promote innovation effectively. Instead, a combination of different leadership behaviors flexibly applied to changing requirements within the innovation process is more effective. In other words, leadership needs to match the complexity and the pace of innovation (Ancona, Goodman, Lawrence, & Tushman, 2001). In the last decades, leadership research and theory has moved away from studying stable leader traits and general leadership styles towards recognizing for the usefulness of situational variability and flexible leadership behavior (e.g., the path-goal theory of leadership; House, 1971) and leadership that is specifically tuned to individual followers (leader–member exchange theory; Graen & Uhl-Bien, 1995). We assume that the less a theory focuses on stable and inflexible leadership styles and the more it incorporates flexibility of leadership behaviors, the better it is able to explain innovation. In our approach, we take this trend one step further by proposing that temporally flexible leadership is needed when it comes to innovation: We assume that the appropriate leadership behavior in each and every situation is dependent not only on the individual follower and the specifics of the situation, but also on the timing within the innovation cycle. That is, time and timing of leadership behaviors are critical in our approach as we assume dynamic relationships between leadership and innovation. Simple linear relationships between leadership and innovation that do not account for temporal dynamics are therefore unlikely (Mitchell & James, 2001). That means that it is not sufficient to show different leadership styles, but also to flexibly adjust the leadership behaviors to the current requirements of the innovation tasks that quickly change over time and, additionally, to integrate these leadership behaviors to be overall consistent in a leadership approach.

It follows from these two assumptions that leaders for innovation need to switch flexibly between complementary leadership behaviors, that is, between reducing and increasing variance in follower behavior, adjusted to the current requirements of the innovation tasks. These leadership behaviors are complementary because each of them corresponds to innovation requirements that the other one is not able to meet. We call this ability to show flexibility of leadership behaviors ambidextrous leadership because of its ability to foster ambidexterity in followers.

Ambidexterity literally means the ability to use both hands with equal ease. In management science ambidexterity has been linked to the balance of explorative and exploitative organizational strategies, that is, the ability to engage in exploration and exploitation equally well (Benner & Tushman, 2003; Gibson & Birkinshaw, 2004; He & Wong, 2004; Raisch & Birkinshaw, 2008). For firms to be successful in the short and long run, it is necessary to be both explorative and exploitative that is, to be ambidextrous. Organizations that achieve a balance of these two activities are more successful than those that do not achieve such a balance (Gibson & Birkinshaw, 2004; He & Wong, 2004). The concept of ambidexterity was originally developed for the organizational level. But what ambidexterity actually means on lower levels of an organization – especially on a behavioral level for teams and individuals – has not been elaborated in the existing literature (for recent exceptions, see Bledow et al., 2009, and Nemanich & Vera, 2009). In other words, although the idea of ambidextrous organizations is not new, it has not been applied to leadership, and the concept of leadership in ambidextrous organizations has not been elaborated. In our theory, we expand the concept of ambidexterity to leadership of teams and individuals. We define ambidextrous leadership as the ability to foster both explorative and exploitative behaviors in followers by increasing or reducing variance in their behavior and flexibly switching between those behaviors. That is, ambidextrous leaders are able to support their followers in the attempt to be ambidextrous. Our conception of leadership embraces both the need for specific leadership behaviors and the requirement to match the complex nature of innovation processes as stated above. We will outline our theory of ambidextrous leadership in the second part of the article. It is important to note that our theory applies mainly to the individual and team level as it is a theory of direct and frequent interaction between the leader and the follower(s); therefore it does not apply to the organizational level. However, in our

literature review, we will also report relationships between leadership and innovation on the organizational level to present a more comprehensive picture of this relationship.

2. Literature review: leadership in the innovation process

We will use the following structure in our review and discussion of the literature. First, we shall show that each particular leadership style is related to innovation, but that this relationship is highly variable and heterogeneous — meaning that the correlations between any particular leadership style and innovation often range from positive to negative correlations. We shall use a heterogeneity index (75% rule, Hunter & Schmidt, 1990) in the meta-analysis to substantiate this point. Second, we then suggest that the heterogeneity of results may be due to the fact that to be a good leader for innovation implies complementary processes. These complementary processes necessitate the leader to follow different task requirements when leading an innovative team. Third, we describe such an ambidextrous leadership theory and suggest a number of propositions that follow from it. Finally, we use the discussion to show similarities and differences of the ambidextrous leadership theory with other leadership and innovation theories.

For the literature review we used two different strategies to locate studies. First, we searched databases (PsycInfo, Business Source Premier) using the following search terms: leadership and innovation, leadership and innovativeness, leadership and creativity. Second, we examined the reference lists of the located papers as well as those of theoretical papers on leadership and innovation (such as the one by Mumford et al., 2002). In cases where at least 5 independent samples on a leadership style were found, we used meta-analytic tools to integrate the findings. We utilized the usual procedures of meta-analysis (suggested by Hunter & Schmidt, 2004), such as correcting for unreliability of dependent and independent variables, aggregating correlations when several comparable correlations were reported for one sample (e.g., when several operationalizations of innovation were used), and weighting correlations by sample size to calculate a weighted and corrected mean correlation (Hunter & Schmidt, 2004). We calculated a 95% confidence interval around this mean correlation and considered the correlation significant if the confidence interval did not include zero. To test for homogeneity of findings, we applied the 75% rule proposed by Hunter and Schmidt (1990). This rule states that if at least 75% of the observed variance is due to sampling error, a relationship can be considered homogenous. In case of heterogeneity (i.e., less than 75% of variance due to sampling error), moderator analysis may be conducted. In those cases, where enough studies existed for moderator analyses, we used z-tests to test for differences between correlations (Hunter & Schmidt, 1990).

In those cases where we found less than 5 independent samples on a particular leadership style, we still reviewed the results of the studies, but we did not integrate them meta-analytically. Table 1 provides a list of all findings, whereas Table 2 presents the meta-analytic results.

2.1. Transformational and transactional leadership

Transformational leadership has been most strongly suggested to be related to innovation. Transformational leadership, defined as "moving the follower beyond immediate self-interests through idealized influence (charisma), inspiration, intellectual stimulation, or individualized consideration" (Bass, 1999, p.11), motivates followers to reach high performance. It seems plausible to expect a positive relationship between transformational leadership and innovation because transformational leadership enhances motivation and may encourage the followers to challenge the status quo (Keller, 2006). In contrast, transactional leadership establishes an exchange-based relationship by clarifying goals, rewarding goal achievement, and by intervening only when necessary (Bass, 1999). Transactional leadership does not encourage experimentation and we, therefore, do not expect a positive relationship with creativity and innovation.

2.1.1. Transformational leadership

Transformational leadership has been hypothesized to be a positive force in the innovation context. The meta-analytic integration of the 31 existing studies on the link between transformational leadership and innovation supports this hypothesis as we find a weighted and corrected mean correlation of .28 (see Table 2). However there is a broad range of results varying from −.31 to .84 (see Table 1): Osborn and Marion (2009) detected a correlation of −.31 between transformational leadership of the alliance head with innovation performance of international corporate alliances, whereas Dayan, Di Benedetto, and Colak (2009) reported a correlation of .84 between transformational leadership and product success in their research and development (R&D) teams. The range of findings is illustrated in Fig. 1. In this figure we display the aggregated correlations that we used for the meta-analysis, not the original correlations of the studies that are partly nonindependent; therefore, the results vary from −.31 to .64 (instead of from −.31 to .84). This variation cannot be explained only by sampling error, as only 15.97% of the observed variance is due to sampling error; this is considerably lower than the 75% required to assume homogeneity (Hunter & Schmidt, 1990).

To test whether this heterogeneity might be due to either differences in the level of analysis (i.e., organization, team, and individual level), type of dependent variable (i.e., creativity, innovation, and performance in R&D teams) or source of innovativeness rating (i.e., self rating vs. other rating), we conducted three moderator analyses. Results of these moderator analyses show: First, correlations at the organizational level (mean $r = .42$) were significantly higher than correlations at the individual level (mean $r = .17$; $z = 3.09$, $p < .05$). However correlations at the team level (mean $r = .28$) did not differ significantly from either correlations at the organizational level ($z = 1.29$, $p > .10$) or individual level ($z = 1.06$, $p > .10$). Thus, transformational

Table 1
Relationships of Innovation with leadership styles.

Source	N	r	Dependent variable
Transformational leadership			
Jaussi and Dionne (2003)	364 individuals	**−.03**	Individual creative performance
Lee (2008)	201 individuals	**.02**	Innovativeness
Basu and Green (1997)	225 individuals	**.03**	Innovative behavior
Hirst, van Dick, and van Knippenberg (2009)	111 individuals	**.11**	Creative performance
Gumusluoglu and Ilsev (2009)	163 individuals	**.17***	Creativity
Gong, Huang, and Farh (2009)	200 individuals	**.18***	Individual creativity
Stoker et al. (2001)	242 individuals	**.19****	Perceived team effectiveness (service organization)
Shin and Zhou (2003)	290 individuals	**.22****	Individual creativity
Moss and Ritossa (2007)	263 individuals	**.23***	Creativity
Chen, Li, and Tang (2009)	320 individuals	**.30*****	Creativity
Stoker et al. (2001)	359 individuals	**.31*****	Perceived team effectiveness (manufacturing organization)
Jaussi and Dionne (2003)	79 teams	**−.28****	Group creative performance
Eisenbeiss et al. (2008)	33 teams	**−.07**	Team innovation
Waldman and Atwater (1994)	40 teams	**.07**	Project effectiveness
Kearney and Gebert (2009)	62 teams	**.10**	Team performance
Sosik, Kahai, and Avolio (1998)	36 teams	−.06	Fluency
		.01	Flexibility
		.39*	Originality
		.21	Elaboration
		.14	*Mean*
Shin and Zhou (2007)	75 teams	**.28***	Team creativity
Keller (2006)	118 teams	.40** to .46**	Technical quality
		.27** to .30**	Schedule performance
		−.13 to .24**	Cost performance
		.28* to .42**	Profitability
		.18 to .30**	Speed to market
		.28	*Mean*
Keller (1992)	48–66 teams	.27* to .40**	Project quality
		.20 to .39**	Budget/schedule performance
		.32	*Mean*
Boerner, Eisenbeiss, and Griesser (2007)	91 teams	**.36*****	Team innovativeness
Reuvers, van Engen, Vinkenburg, and Wilson-Evered (2008)	41 teams	**.48****	Team innovative behavior
Pirola-Merlo, Härtel, Mann, and Hirst (2002)	53 teams	**.32***	Team effectiveness
Dayan et al. (2009)	107 teams	.43*	Speed-to-market
		.84*	Product success
		.64	*Mean*
Osborn and Marion (2009)	93 organizations	**−.31****	Innovation performance
Jung et al. (2008)	50 organizations	**.09**	Organizational innovation
Jansen et al. (2009)	89 organizations	.24*	Exploratory innovation
		.16	Exploitative innovation
		.20	*Mean*
Jung, Chow, and Wu (2003)	32 organizations	.18	Number of patents
		.36**	R&D expenditure
		.27	*Mean*
Jaskyte (2004)	19 organizations	**.29**	Number of innovations
Gumusluoglu and Ilsev (2009)	43 organizations	**.30***	Organizational innovation
Elenkov and Manev (2009)	153 organizations	.19** to .33***	Innovation adoption
		.31	*Mean*
Aragón-Correa, García-Morales, and Cordón-Pozo (2007)	408 organizations	**.39*****	Firm innovation
García-Morales, Lloréns-Montes, and Verdú-Jover (2008)	900 organizations	**.46*****	Innovation
García-Morales, Matias-Reche, and Hurtado-Torres (2008)	164 organizations	**.49*****	Innovation
Transactional leadership			
Moss and Ritossa (2007)	263 individuals	−.06 to .14	Follower creativity
Dayan et al. (2009)	107 teams	.07	Speed-to-market
		.25*	Product success
Jansen et al. (2009)	89 organizations	−.27*	Exploratory innovation
		.30*	Exploitative innovation
Initiating Structure			
Williams (2004)	127–208 individuals	−.13 to .12	Novelty
		−.13 to .13	Creativity
		−.02	*Mean*

(continued on next page)

Table 1 (*continued*)

Source	N	r	Dependent variable
Stoker et al. (2001)	359 individuals	**.19****	Perceived team effectiveness (manufacturing organization)
Initiating Structure			
Stoker et al. (2001)	242 individuals	**.24****	Perceived team effectiveness (service organization)
Keller (1992)	48–66 teams	.25* to .27*	Project quality
		.29* to .34*	Budget/schedule performance
		.29	*Mean*
Keller (2006)	118 teams	.23*	Technical quality
		.30**	Schedule performance
		.27*	Cost performance
		.34**	Profitability
		.39*	Speed to market
		.31	*Mean*
Osborn and Marion (2009)	93 organizations	**.29****	Innovation performance
Consideration			
Stoker et al. (2001)	242 individuals	.18**	Perceived team effectiveness (service organization)
Stoker et al. (2001)	359 individuals	.24**	Perceived team effectiveness (manufacturing organization)
Keller (1992)	48–66 teams	.26* to .30*	Project quality
		.19 to .28*	Budget/schedule performance
Osborn and Marion (2009)	93 organizations	.28**	Innovation performance
Leader–Member Exchange (LMX)			
Clegg et al. (2002)	128 individuals	−.09	Idea suggestion
		.30***	Idea implementation
		.11	*Mean*
Scott and Bruce (1994)	172 individuals	**.17****	Innovative behavior
Tierney et al. (1999)	191 individuals	.30**	Creativity rating
		.17*	Invention disclosure form
		.06	Research reports
		.18	*Mean*
Basu and Green (1997)	225 individuals	**.22****	Innovative behavior
Janssen and Van Yperen (2004)	170 individuals	**.34****	Innovative job performance
Supervisor Support			
Tierney and Farmer (2002)	104 individuals	**−.10**	Creativity ratings (operations sample)
Oldham and Cummings (1996)	171 individuals	.14	Rated creativity
		−.14	Patents
		−.19	Suggestions
		−.06	*Mean*
Axtell et al. (2000)	148 individuals	−.04	Suggestions
		.12	Implementation
		.04	*Mean*
Ohly et al. (2006)	278 individuals	.12*	Creativity
		.15**	Innovation
		−.12*	Suggestions
		.05	*Mean*
Tierney and Farmer (2002)	502 individuals	**.05**	Creativity ratings (manufacturing sample)
Frese et al. (1999)	207 individuals	.05	Ideas
		.06	Writing and submitting ideas
		.18*	Rewarded Suggestions
		.10	*Mean*
George and Zhou (2007)	161 individuals	**.13**	Creativity
Unsworth, Wall, and Carter (2005)	1083 individuals	.11***	Product creativity
		.17***	Process creativity
		.14	*Mean*
Basu and Green (1997)	225 individuals	**.17****	Innovative behavior
Choi (2004)	386 individuals	**.17****	Creative performance
Tierney and Farmer (2004)	140 individuals	**.17****	Creativity
Amabile, Schatzel, Moneta, and Kramer (2004)	211 individuals	**.18***	Creativity
Krause (2005)	382–396 individuals	.02	Idea Generation
		.33***	Idea Implementation
		.18	*Mean*
Madjar, Oldham, and Pratt (2002)	265 individuals	**.20****	Creative performance
Krause (2004)	399 individuals	.28***	Idea generation
		.22***	Implementation
		.25	*Mean*
Amabile, Conti, Coon, Lazenby, and Herron (1996)	306 teams	**.34*****	Creativity
Participative Leadership			
Stoker et al. (2001)	242 individuals	.04	Perceived team effectiveness (service organization)
Stoker et al. (2001)	359 individuals	.26***	Perceived team effectiveness (manufacturing organization)

Table 1 (*continued*)

Source	N	r	Dependent variable
Participative Leadership			
Krause et al. (2007)	388 individuals	.49***	Implementation success
Somech (2006)	136 teams	.26**	Team innovation
Noncontrolling Leadership			
Oldham and Cummings (1996)	171 individuals	.28*	Rated creativity
		.07	Patents
		−.20	Suggestions
Supervisor Close Monitoring			
Zhou (2003)	25 individuals	−.45*	Creativity (study 1)
George and Zhou (2001)	149 individuals	−.26**	Creative behavior
Zhou (2003)	123 individuals	−.22*	Creativity (study 2)
Consultative-advisory Leadership			
Krause et al. (2007)	388 individuals	.35***	Implementation success
Directive Leadership			
Somech (2006)	136 teams	.28***	Team innovation

Numbers in bold are used for meta-analytic calculations. Numbers in italics are aggregated values of nonindependent samples.
* $p<.05$.
** $p<.01$.
*** $p<.001$.

leadership has a stronger correlation with innovation at the organizational level than at the individual level of analysis. At the individual level of analysis there are many direct interactions between leaders and followers; the leaders are directly involved in the innovation process. Therefore, more flexibility on the leader's part is necessary to meet the requirements of the innovation tasks at lower levels. Hence, the specific leadership style of transformational leadership is not good enough in the direct interactions; in contrast, on an organizational level less flexibility in the use of different leadership behaviors is necessary so that transformational leadership is better able to explain organizational innovation.

Second, the correlation with creativity as dependent variable (mean $r=.18$) was marginally significantly lower than the correlation with innovation (mean $r=.35$; $z=1.94$, $p<.10$) and marginally significantly lower than the correlation with performance in R&D teams as dependent variable (mean $r=.33$; $z=1.80$, $p<.10$); the correlations with innovation and performance in R&D teams did not differ from each other ($z=0.21$, $p>.10$). This suggests that transformational leadership may help creativity but may also hinder creativity to some extent. In contrast, transformational leadership helps to increase overall innovation and performance in R&D teams.

Third, the correlation with self-rated innovation performance (mean $r=.39$) was significantly higher than the correlation with other-rated innovation performance (mean $r=.21$; $z=2.34$, $p<.05$). However, the moderators did not do away with the heterogeneity of the results. Within each category of the moderators, the amount of variance due to sampling error did not exceed 31%. That means that the moderators account only for a small amount of the observed variation in the findings, leaving room for further moderators.

Some of the primary studies investigated moderators, and in this way they point to boundary conditions for the transformational leadership–innovation relationship. Kearney and Gebert (2009) and Shin and Zhou (2007) found a positive correlation only for high diversity teams. Keller (1992; 2006) revealed in his studies of R&D teams that transformational leadership was more strongly related to quality in research projects compared to quality estimated in development projects. He suggested that transformational leadership fosters unconventional thinking and solutions that go beyond existing knowledge. Scientists in research projects often work on more radical innovations than those in development projects. Therefore, transformational leadership is more effective in research projects than in development projects (Keller, 1992, 2006). Similarly, at the organizational level, Jansen et al. (2009) found a positive correlation of transformational leadership with exploratory innovation (which is more likely in research than in development projects), but they did not find such a correlation with exploitative innovation (which is more likely in development than in research projects). Eisenbeiss, van Knippenberg, and Boerner (2008) observed the relationship between transformational leadership and team innovation to be contingent on high climate for excellence in the teams. They proposed that transformational leadership only leads to the generation and implementation of high quality ideas when team members share an interest for high quality performance. Under conditions of low climate for excellence, ideas may be generated, but rather uncritically, and implementation is more likely to be given up in the face of difficulties (Eisenbeiss et al., 2008). Additionally, Jung, Wu, and Chow (2008) did not find a significant zero-order correlation between transformational leadership and innovation, but showed that the relationship between transformational leadership and organizational innovation was contingent on firm characteristics such as high climate of support for innovation, low centralization and formalization as well as environmental features such as high uncertainty and competition. Similarly, García-Morales, Matias-Reche, and Hurtado-Torres (2008) found a higher correlation between transformational leadership and organizational innovation in organizations with high organizational learning as compared to organizations that emphasize less on organizational learning.

Table 2
Results of meta-analytic integration.

Leadership style moderators	k	N	rw	rwc	Sampling error (% variance)	95% confidence interval
Transformational leadership	31	5113	.263	.291	14.22	.225 to .358
Organizational level	10	1951	.370	.423	10.28	.309 to .537
Team level	12	768	.251	.276	21.04	.133 to .420
Individual level	11	2738	.166	.174	27.14	.104 to .244
Creativity as DV	9	1680	.171	.176	26.01	.085 to .267
Innovation as DV	15	2542	.308	.350	10.29	.244 to.457
R&D performance as DV	8	1014	.292	.325	30.65	.225 to .425
Self-rated DV	8	2281	.346	.389	11.92	.288 to .490
Other-rated DV	23	2832	.197	.213	19.57	.133 to .293
Initiating structure	6	1012	.228	.255	38.56	.162 to .348
Leader–member exchange (LMX)	5	886	.208	.216	97.89	.152 to .279
Supervisor support	16	5111	.139	.150	34.09	.104 to .196
Creativity as DV	10	3296	.145	.156	38.99	.102 to .210
Innovation as DV	8	2352	.128	.141	18.33	.048 to .233

Note. k = number of studies; N = overall number of observations; rw = weighted mean correlation (weighted by sample size); rwc = weighted and corrected mean correlation (corrected for unreliability).

Our literature review on the relationship between transformational leadership and innovation suggests that transformational leadership correlates positively with innovation. But more importantly, there is a high degree of variation in the results. This means that the extant literature does not provide a consistent picture of this relationship (Mumford et al., 2002; Mumford, Hunter, & Byrne, 2009). We suggest that it is insufficient to focus only on the main effect of transformational leadership on innovation without considering the variation of results. The variation of the results suggests that the relationship between transformational leadership and innovation is contingent on other variables, such as the type of dependent variable (e.g., creativity vs. innovation), the level of analysis, and source of innovativeness rating as well as the work tasks (e.g., research vs. development projects) and several features of the individuals, teams, and organizations studied (e.g., climate for excellence, centralization, etc.). Those studies that reported moderator effects suggest that a certain kind of flexibility is necessary on the part of the leader. For example, transformational leadership was only related to team innovation when climate for excellence was also high (Eisenbeiss et al., 2008). That means that transformational leadership only fosters innovation in combination with the social control of goal attainment in the form of a high task orientation and high performance norms within the team. Similarly, transformational leadership was only related to innovation if there was simultaneously a high climate of support for innovation (Jung et al., 2008). These results suggest that a leader with a transformational leadership style needs to complement his or her visionary and stimulating influences by focusing on different aspects of the innovation process, such as social control and an overall supporting environment. These findings imply that transformational leadership is not necessarily related to innovation under all circumstances, but some specific conditions need to be met. Our literature review indicates that more research that focuses more clearly on the mechanisms that link transformational leadership and innovation as well as the conditions that constrain this relationship is needed. In a later part of this article we shall come back to these conditions and argue that ambidextrous leadership may explain some of the moderator results of transformational leadership.

2.1.2. Transactional leadership

Only a few studies have looked at the link between transactional leadership and innovation; therefore, we did not use meta-analytic tools for this relationship. However, Table 1 shows that there is a high degree of variability in this relationship, too. Dayan et al. (2009) reported a positive correlation between transactional leadership and product success in R&D teams, but a nonsignificant correlation with speed-to-market. Another study on the relationship between transactional leadership and innovation indicated a negative correlation between transactional leadership and exploratory innovation under conditions of high

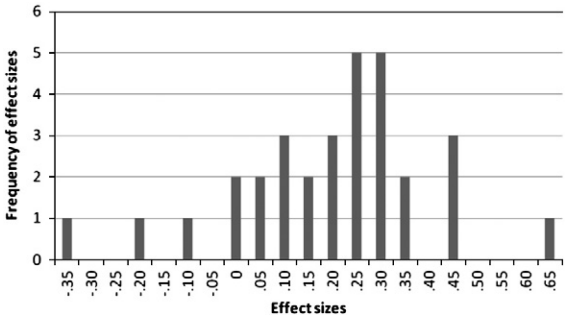

Fig. 1. Range of effect sizes (r) for the relationship between transformational leadership and innovation (aggregated correlations).

environmental dynamism, but a positive correlation between transactional leadership and exploitative innovation which was independent of the environmental dynamism (Jansen et al., 2009). Moss and Ritossa (2007) found correlations between −.06 and .14 for different facets of transactional leadership and follower creativity. Lee (2008) found a significant negative correlation between transactional leadership and innovation. Finally, the experimental studies by Sosik, Avolio, and Kahai (1997) and Kahai, Sosik, and Avolio (2003) discovered a stronger effect for transactional leadership on team creativity than for transformational leadership (these studies are not included in Table 1 as they refer to the comparison of transformational and transactional leadership and do not report the zero-order relationship with creativity). In conclusion, results on the relationship between transactional leadership and innovation are mixed and vary widely. Thus, to be able to draw reliable conclusions, more studies are needed to investigate this link and, more importantly, the boundary conditions of this relationship. Again, we propose moderators are complementary leadership behaviors that focus on different aspects of the innovation process. The study by Jansen et al. (2009) suggests that transactional leadership is more closely related to exploitative activities than to explorative activities, therefore, leadership behavior that fosters exploration is needed to complement transactional leadership.

2.2. Initiating structure and consideration

Initiating structure is defined as leader behaviors that structure tasks, define goals, and control goal attainment (Fleishman, 1953). Consideration refers to the leader's concern and respect for the feelings of the subordinates, and the leader's appreciation and support of subordinates (Fleishman, 1953). Both leadership styles might be argued to be positively related to innovation. Initiating structure concerns the task-related behaviors of leaders that achieve high quality outcomes. Consideration is person-related and represents leader behaviors that support and motivate followers in accomplishing their work. However, our reasoning is that one needs to change from one leadership style to the next depending upon the innovation requirements; simply keeping up with both styles does not lead to higher innovation.

2.2.1. Initiating structure

The integration of the results of six studies on the relationship between initiating structure and innovation yielded a corrected and weighted mean correlation of .26 (see Table 2). But again, only 38.65% of the observed variance was due to sampling error, which is far less than the 75% necessary to assume the relationship to be homogenous (Hunter & Schmidt, 1990). Most of the studies were using performance in R&D teams as the dependent variable (Keller, 1992; 2006; Stoker, Looise, Fisscher, & de Jong, 2001). These studies reported results ranging from .23 to .39 (see Table 1). On the organizational level, Osborn and Marion (2009) provided a positive correlation of initiating structure of the alliance head and the innovation performance of international corporate alliances. However, one study by Williams (2004) used several operationalizations of individual creativity as dependent variables and reported correlations ranging from −.13 to .13 (all of them nonsignificant). Two studies by Keller (1992; 2006) looked for boundary conditions and showed that the correlation between initiating structure and project or technical quality was higher in development projects than in research projects. Keller suggested that, in development teams, the internal coordination of knowledge is most important; therefore, initiating structure is more effective in development teams than in research teams. This means that exploitative activities (i.e., coordination of existing knowledge) are more important than explorative activities for development projects. The streamlining nature of initiating structure supports exploitative activities, but not explorative activities. In contrast, in research projects, exploration is as necessary as exploitation; thus, leadership behavior needs to support both exploitation (related to initiating structure) and exploration. To conclude, overall, initiating structure has a positive relationship with performance in R&D teams, that is, innovation. However, this conclusion is built on only six independent correlations and, more importantly, initiating structure seems not to have a comparable influence on creativity (which requires more exploration). Therefore, moderators, such as complementary leadership behaviors, need to be considered.

2.2.2. Consideration

To our knowledge, only three studies analyzed the relationship between consideration and innovation; therefore, we could not use a meta-analytic integration of results. Keller (1992) found a positive correlation between consideration and both project quality and budget/schedule performance in R&D teams. In addition, the recent study by Osborn and Marion (2009) displayed a positive correlation between consideration of the alliance head and the innovation performance of international corporate alliances. Finally, Stoker et al. (2001) reported positive correlations between consideration and perceived team performance in R&D teams in both a service organization and in the manufacturing industry. Taken together, these studies suggest a small positive relationship of consideration and innovation, although the empirical evidence base is too small to draw reliable conclusions.

2.3. Leader–member exchange (LMX)

As discussed before, we believe that leadership theories that imply a certain degree of fluidity and flexibility can understand the relationship with innovation better than more static leadership theories. Leader–member exchange (LMX) theory may be such a fluid theory because it includes a dynamic viewpoint on leader–follower dyads and on the quality of these relationships (Gerstner & Day, 1997; Graen & Uhl-Bien, 1995). LMX implies that leadership behavior depends on the relationship with the individual follower, and varies between followers. According to LMX theory, high quality exchange relationships are characterized by mutual trust and respect. LMX should be positively related to creativity and innovation because followers in high quality relationships may be inclined to trust their supervisor and to risk something new more so than followers in low quality relationships. In

addition, we expect LMX to be more consistently related to innovation than other leadership styles that do not take into account the calibration of leadership behaviors to individual followers.

The integration of findings of the five studies performed on LMX at the individual level yielded a corrected and weighted mean correlation of .22 (see Table 2). The studies that analyzed this relationship are quite consistent in their results (97.89% of the observed variance is due to sampling error). Thus, leader–member exchange displays a moderate, but consistent relationship with innovation. Nevertheless, some studies looked for moderators of this relationship. The study of Tierney, Farmer, and Graen (1999) presents a more differentiated picture, as they found positive correlations between LMX and both creativity ratings and invention disclosure forms describing inventions, but not for research reports describing discoveries or new ideas. Furthermore, Tierney et al. (1999) observed a significant interaction of LMX and individual cognitive style on creativity, such that LMX had an enabling effect for individuals with low innovative cognitive style. Finally, a study by Clegg, Unsworth, Epitropaki, and Parker (2002) detected a positive correlation with LMX only for idea implementation, but not for idea suggestion.

Thus, we found a positive and consistent relationship of LMX with innovation. Maybe this reflects the fact that LMX includes a person specific approach or maybe this is the result of the small number of studies in this area (the results are based on only five independent correlations). Moreover, some studies found moderators, which suggest some variation in this relationship not detected by the meta-analytic correlation.

2.4. Supervisor support

Supervisor support is not a clearly defined leadership style, but rather a cluster of leader behaviors that are supportive of subordinates' innovative behaviors. Active support by the supervisor to be innovative may enhance subordinates' creative self-efficacy, which in turn may positively relate to creativity and innovation (Tierney & Farmer, 2004). In addition, support of the supervisor provides access to resources, assistance, and encouragement in the face of difficulties. Thus, supervisor support should be positively related to creativity and innovation.

Supervisor support has been studied frequently in the innovation context. The integration of results of sixteen studies leads to a weighted and corrected mean correlation of .15 (see Table 2). Although this integration shows a small positive correlation, results vary from −.10 to .34 (see Table 1). The range of results is displayed in Fig. 2. Sampling error accounts for only 34.09% of the observed variance.

Some studies displayed a more differentiated picture for supervisor support. Ohly, Sonnentag, and Pluntke (2006) detected a positive correlation of supervisor support with creativity and innovation, but a negative correlation with suggestions made as part of an organizational suggestion system. Similarly, Oldham and Cummings (1996) identified a nonsignificant positive correlation of supervisor support with rated creativity and nonsignificant negative correlations with patents and suggestions made. In contrast, Frese, Teng, and Wijnen (1999) found a positive correlation of supervisor support only with rewarded suggestions, but not with having an idea, writing the idea up, or submitting ideas to a suggestion system. They interpreted this to mean that individuals may have ideas and even submit them independently of the support by the supervisor; however, for the outside perception of quality of ideas supervisor support is important. Similarly, Axtell et al. (2000) discovered a small nonsignificant correlation of supervisor support only for implementation, but not for suggestions. Taking these results together, it suggests that supervisor support is more important for acting on ideas (i.e., implementation) than for generating ideas. However, this assumption is not supported when type of dependent variable (i.e., creativity and innovation) is used as a moderator (the mean r for creativity is .16 and for innovation it is .14; $z = 0.32$, $p > .10$). Nevertheless, given the broad range of results, it makes sense to assume that the relationship between supervisor support and innovation is moderated by third variables which we propose might be complementary leadership behaviors.

2.5. Other leadership styles

There are several other leadership styles that were studied in the innovation context. Participative leadership – shared decision making by supervisor and employee – has been studied at the individual and the team level. Krause, Gebert, and Kearney (2007) found a positive correlation between participative leadership and individual implementation success. Somech (2006) observed a

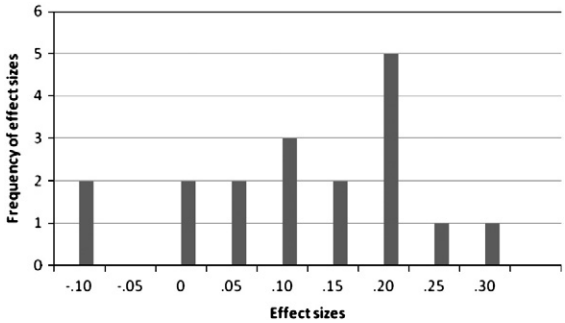

Fig. 2. Range of effect sizes (r) for the relationship between supervisor support and innovation (aggregated correlations).

positive correlation with team innovation. In addition, in a study by Stoker et al. (2001), participative leadership was positively related to R&D performance in a manufacturing sample, but not in a service sample.

Oldham and Cummings (1996) detected a positive correlation between noncontrolling leadership and rated individual creativity, but not with patents or suggestions. George and Zhou (2001) and Zhou (2003) demonstrated detrimental effects of supervisor close monitoring (negative correlations with creativity and creative behavior).

Finally, for consultative-advisory leadership (providing advice and guidance), Krause et al. (2007) found a positive correlation with implementation success. Similarly, Somech (2006) reported a positive correlation between directive leadership (providing a framework for decisions and actions) and team innovation.

2.6. Summary and conclusions

The meta-analytic integration of findings on the relationship between leadership and innovation showed positive corrected and weighted mean correlations for the following leadership styles: transformational leadership, initiating structure, LMX, and supervisor support, with transformational leadership producing the highest and supervisor support being involved in the lowest correlations. In addition, consideration, participative leadership, and noncontrolling leadership seem to be positively related to innovation. However, despite the overall positive correlations, transformational leadership, initiating structure, and supervisor support were found to have a wide range of correlations, with some studies even reporting negative correlations. Only LMX led to a consistent relationship with followers' individual innovation. This may be due to the fact that LMX is the only leadership style in our literature review that explicitly takes into account the need for differing leadership behaviors with different followers. However, LMX theory does not theorize the need for varying leadership behaviors over time. That is, we assume that a high quality and individualized relationship between leader and follower are a good basis for innovation, but more specific (complementary) leadership behaviors that explicitly foster innovation need to build on this basis.

In conclusion, the review on the relationship between leadership and innovation suggests that different leadership behaviors such as transformational leadership and initiating structure may be important for the innovation process. Most meta-analytic correlations are small to moderate in size and, in nearly all cases, the correlations are heterogeneous. The latter implies that the same leadership behaviors were related to innovation in some studies, but not in others. This observation leads us to two conclusions: First, there are different pathways leading to the same result of innovation (Bledow et al., 2009). Second, leadership behaviors may have a wide range of possible consequences, depending upon moderator variables. We suggest that complementary leadership behaviors may be effective moderators and may be necessary for successful leadership for innovation. A leadership style is positively related to innovation when complemented by another leadership style that focuses on and fosters different aspects of the innovation process. The same leadership style may have no or even a negative relationship to innovation when a complementary leadership style is low or missing. This leads us to the question: Which complementary leadership behaviors are necessary for innovation?

3. Ambidexterity in the innovation process

In the following, we will outline two important characteristics of innovative performance that make it different from general task performance. First, innovation encompasses two different and even opposing processes, creativity and implementation, which are linked to two different activities, namely, exploration and exploitation. Second, innovation processes are complex and nonlinear, which leads to an ever-changing cycle of the requirements for exploration and exploitation. Taken together, this leads us to the proposition that innovative performance requires ambidexterity.

Most theoretical models of innovation differentiate at least two processes of innovation: idea generation (or creativity) and idea implementation (e.g., Amabile, 1988; Farr, Sin, & Tesluk, 2003; West, 2002). These two processes encompass very different activities that are linked to very different requirements. First, creativity requires thinking "outside the box", going beyond routines and common assumptions, and experimentation. Creativity is closely linked to explorative activities as defined by March (1991). Second, idea implementation requires efficiency, goal orientation, and routine execution, that is, implementation is linked to exploitative activities as defined by March (1991). However, creativity also requires exploitation, whereas idea implementation also calls for exploration. Creative ideas must not only be new, but also useful and require the exploitation of existing knowledge. Creative tasks are often ill-defined and need some structuring and direction (Bain, Mann, & Pirola-Merlo, 2001). In addition, implementing new ideas can usually not just be executed along existing routines; therefore, implementation also requires exploration of new strategies. Similarly, radically new ideas might require new ways of implementation that need to be explored. Moreover, the implementation of new ideas is often resisted in organizations (Van de Ven, 1986); therefore, new ideas on how to overcome this resistance are often required (thus, exploration is important in implementation as well). Therefore, exploration and exploitation are important for both creativity and implementation, even if creativity is linked more closely to exploration and idea implementation more closely to exploitation.

The second important characteristic about innovation is its complex and nonlinear nature (Anderson et al., 2004; Bledow et al., 2009; King, 1992; Schroeder et al., 1989; Van de Ven et al., 1999). A shortcoming of the existing research on leadership in the innovation context and indeed of the innovation research per se is that it does not take this complex nature of innovation processes into account (Fehr, 2009; Simonton, 2003). Although innovation attempts can be highly structured and planned, the uncertainty involved in innovation processes makes it difficult to anticipate more than the next few steps. The distinction between the creativity and implementation stage of innovation described above is widely accepted in the literature (Farr et al., 2003; King,

1990). However, these stages cannot be easily separated. Cheng and Van de Ven (1996) showed that innovation processes follow complex patterns, especially in the beginning. This means that there are no distinct phases in neat succession, but rather events that unfold in sequences that are often unpredictable. Thus, the timing of events cannot be easily planned, but rather emerges within the process and time plans will need to be incessantly adapted to the unfolding events (Blount & Janicik, 2001). Research needs to account for this temporal variability to explain innovation (Mitchell & James, 2001). This further implies that the requirements for exploration and exploitation alternate consistently within the innovation process. As these activities – that is, exploration and exploitation – are very different in nature, flexibly switching between them is a highly challenging task. March (1991) was explicit in his conceptualization of exploration and exploitation that these activities are fundamentally disparate (Gupta, Smith, & Shalley, 2006). We do not concur with March (1991) that exploration and exploitation are mutually exclusive, but rather suggest them to be mutually dependent (Bledow et al., 2009). However, March's (1991) reasoning underscores that the two activities are difficult to align.

As both exploration and exploitation are fundamental activities inherent to creativity and innovation, we suggest that ambidexterity is a central feature of innovation. It is insufficient to be able to handle the different requirements of the innovation process one at a time, but it is necessary to flexibly switch between those different requirements. That means that teams involved in innovation need to show exploration and exploitation in an unpredictably alternating sequence. This characteristic of innovation processes makes it unfeasible to separate exploration and exploitation, for example, between different teams (i.e., teams that specialize in *either* exploration *or* exploitation). In the literature, there are reports of cases where organizations utilize different teams or even different organizational units for exploration and exploitation (e.g., O'Reilly & Tushman, 2004). However, we assume that even teams that specialize in exploration (e.g., research teams) need to exploit to some extent as they would not be able to produce any tangible results without exploitation. On the other hand, teams that specialize in exploitation also need to engage in some exploration, for example, when problems arise or errors occur that need to be solved. In addition, we propose teams to be more innovative if they engage in both exploration and exploitation, as they are able to take advantage of the synergies of exploration and exploitation (Bledow et al., 2009), than when exploration and exploitation are separated.

Taken together, we assume that it is necessary not only to be able to balance exploration and exploitation, but to be able integrate exploration and exploitation and flexibly switch between both as the situation requires. That is, an integrative form of ambidexterity is necessary in the innovation process that goes beyond merely balancing exploration and exploitation. Thus, what makes innovation different from general performance is its need for ambidexterity.

We will now discuss a theoretical model of leadership for innovation that describes the leader behaviors that are supportive of follower ambidexterity: How can leaders help teams and individuals to be innovative?

4. Ambidextrous leadership — towards a theory of leadership for innovation

Extending the concept of ambidexterity to leadership, we suggest that ambidextrous leadership is necessary for an effective innovation process. Our literature review revealed that some leadership styles show positive relationships with innovation. However, most of these leadership styles (except LMX) displayed a broad range of relationships from negative to positive correlations with innovation. Thus, these leadership styles are not consistently related to innovation, but are dependent on moderating conditions. We suggest that these moderating conditions are likely complementary leadership behaviors, that is, leadership behaviors that foster different aspects of the innovation process (i.e., exploration and exploitation), or team characteristics that substitute these leadership functions (e.g., a high climate for excellence that ensures high task orientation to complement transformational leadership; we will come back to this line of reasoning later in the article). In addition, we assume that the traditionally studied leadership styles are too broad in nature as they encompass a multitude of behaviors that might both foster and hinder innovation. Instead, we propose leadership behaviors that specifically match the requirements that teams and individuals face within the innovation process. The requirement of ambidexterity in the innovation process implies that individuals working in an innovation context need to both explore and exploit, and switch between those two activities. Therefore, an effective leader of an innovative workforce needs to foster both exploration and exploitation, and has to be capable of flexibly switching between both. Thus, ambidextrous leadership consists of three elements (1) opening leader behaviors to foster exploration, (2) closing leader behaviors to foster exploitation, (3) and the temporal flexibility to switch between both as the situation requires. Fig. 3 gives an overview of our theoretical model. This figure is meant to state the main relationships of our

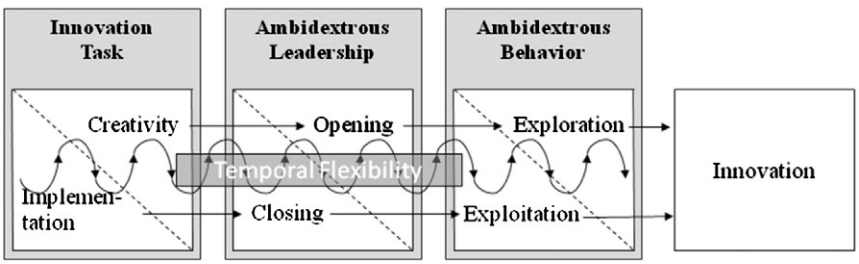

Fig. 3. Overview of the proposed model.

model and shall guide the reader through our theoretical discussion. Nevertheless, it is only a heuristic that simplifies the actual relationships.

4.1. Fostering exploration

The core of exploration is the increase of variance (Gupta et al., 2006; March, 1991). Therefore, fostering exploration means in particular fostering the increase of variance in followers' behavior. The term "opening" may be useful to describe this increase in variance as it figuratively illustrates the breaking up of routines and thinking in new directions. We define "opening leader behavior" as a set of leader behaviors that includes encouraging doing things differently and experimenting, giving room for independent thinking and acting, and supporting attempts to challenge established approaches. Table 3 gives examples for opening leader behaviors. Thus, we propose that in situations that require employees to explore (and these situations are mainly those when the innovation task requires creativity, see Fig. 3), leaders need to show opening leader behaviors.

Proposition 1. *Opening leader behaviors are positively related to follower explorative activities.*

4.2. Fostering exploitation

The core of exploitation is the reduction of variance (Gupta et al., 2006; March, 1991). Therefore, fostering exploitation mainly means fostering the reduction of variance in followers' behavior. The term "closing" figuratively describes the streamlining and narrowing down that is necessary for such a reduction of variance. We define "closing leader behavior" as a set of leader behaviors that includes taking corrective action, setting specific guidelines, and monitoring goal achievement. Table 3 gives examples for closing leader behaviors. In situations that require employees to exploit (and these situations are mainly those when the innovation task requires implementation, see Fig. 3), leaders need to show closing leader behaviors.

Proposition 2. *Closing leader behaviors are positively related to follower exploitative activities.*

4.3. The temporal flexibility to switch

As we discussed above, the requirements to explore and to exploit alternate in a complex manner within the innovation process. To be ambidextrous as a leader it is not enough to show opening and closing leader behaviors to foster exploration and exploitation. That means – in line with our reasoning above – that neither opening nor closing leader behaviors are sufficient. We suggest that, methodologically, opening leader behavior is a moderator of the relationship between closing leader behavior and innovation and, vice versa, closing leader behavior is a moderator of the relationship between opening leader behavior and innovation. However, even the ability to show both opening and closing behavior is not enough. As we argue that there is no systematic process model that predicts when it is useful to explore and when it is useful to exploit, it is difficult to predict when opening leader behaviors are necessary and when closing leader behaviors are required (Bledow et al., 2009). Therefore, these behaviors need to be shown ad hoc. It is the temporal flexibility to adapt these behaviors to the requirements of the innovation tasks that is essential for ambidextrous leadership. With this temporal flexibility we mean that leaders must be able to switch flexibly between behaviors as the current situation requires (M. W. Lewis, Welsh, Dehler, & Green, 2002) because teams need to constantly switch back and forth between different innovation requirements (creativity and innovation). The flexible switching between innovation requirements, between leadership behaviors, and between follower behaviors is represented by the oscillating arrows in Fig. 3. In a similar vein, Quinn and colleagues (Denison, Hooijberg, & Quinn, 1995; Quinn, 1988) suggested a paradoxical use of different leader behaviors to produce good team performance in general, and not just within an innovation context.

The two sets of leadership behavior that we propose to stimulate exploration and exploitation – opening and closing – need to be carried out by the team leader in a well-balanced and integrated way. A first empirical study of a similar idea found that emergent project management styles that take the ambiguity of product development into account and encourage improvisation were positively linked to project innovation (M. W. Lewis et al., 2002). Planned project management styles that manage product development as a top-down process and focus on discipline and structure were positively related to project efficiency (M. W.

Table 3
Examples for opening and closing leader behaviors.

Opening leader behaviors	Closing leader behaviors
◆ Allowing different ways of accomplishing a task	◆ Monitoring and controlling goal attainment
◆ Encouraging experimentation with different ideas	◆ Establishing routines
◆ Motivating to take risks	◆ Taking corrective action
◆ Giving possibilities for independent thinking and acting	◆ Controlling adherence to rules
◆ Giving room for own ideas	◆ Paying attention to uniform task accomplishment
◆ Allowing errors	◆ Sanctioning errors
◆ Encouraging error learning	◆ Sticking to plans

Lewis et al., 2002). Lewis et al. (2002) suggest that these two management styles are not mutually exclusive but rather complementary and that both are necessary for project success. However, Lewis et al. (2002) did not explicitly study the necessity to switch between these management styles.

Proposition 3. *The interplay of opening and closing leadership behavior is positively related to innovation; insofar that innovation is highest when both opening and closing leadership are high.*

Proposition 4. *Leaders need temporal flexibility to switch between opening and closing leader behaviors according to the requirements of the innovation tasks in order to support their followers in switching between exploration and exploitation.*

Taking together Propositions 1 through 4, we propose:

Proposition 5. *Ambidextrous leadership is positively related to follower ambidextrous behavior.*

4.4. The general role of an ambidextrous leader

One important point that we did not discuss so far is the general role of the ambidextrous leader in the innovative effort. Our theory does not make assumptions about the degree of involvement of the leader in the innovation process. Both opening and closing leadership behaviors can be used more or less actively or passively. That means, leaders may only initiate explorative or exploitative behaviors of their followers and then step back to leave them to work on the task. But leaders may also actively engage in explorative and exploitative activities. For closing leader behaviors, this could mean that the leader sets goals and only passively monitors goal attainment or it could mean that he or she actively structures the task, corrects errors, and helps with getting the work done. For opening leader behaviors likewise, this implies that the leader may just encourage experimentation and tolerate deviations from previously made plans, or that he or she actively introduces new perspectives to problems and helps with thinking in different directions. Our point here is that ambidextrous leaders may be more or less involved in the process. This involvement may vary over time, depending on the requirements in a special situation, and it may also vary between teams, depending for example, on the expertise of both the team members and the leader (Kerr & Jermier, 1978), or even within teams, depending on the needs of the individual followers.

4.5. An example of ambidextrous leadership

An example may illustrate ambidextrous leadership: A project team gets the assignment to come up with ideas on how to improve an existing work process. The team members are near the completion of their project and in the midst of implementing their ideas. To efficiently implement their ideas, team members have to exploit. Thus, their team leader needs to support them in doing so with closing leader behaviors. While implementing, the team members might encounter some flaws and problems in their ideas. Now, they start to explore ways to handle these flaws by developing new solutions or better ideas. To support this exploration, the leader has to change his behavior and has to display opening leader behaviors to encourage the team members to think in different ways, to go beyond existing patterns, and to risk pursuing even unlikely paths. When getting to solutions, these solutions need to be applied to the problems which again call for closing leader behaviors. Finding alternative ways of implementing the ideas when team members encounter difficulties and barriers again call for exploration and, therefore, for opening leader behaviors. Although this example seems to be in line with a phase model, we want to stress that continuous switching between different requirements and different activities is not organized sequentially, but rather complex and unpredictably. The example demonstrates that the leader has to show both opening and closing leader behaviors, but even more importantly, it illustrates that the leader has to be very sensitive to the situation that requires the temporal flexibility to switch from one kind of behavior to the other one. If the leader switches from opening to closing too early, the team may not have come up with good ideas or solutions yet. If the leader switches from opening to closing too late, the team members may have lost track of their best ideas and get overwhelmed by too many ideas. Therefore, the leader needs to be sensitive to know which leader behavior is situationally appropriate.

4.6. Routes to ambidextrous leadership

This leads us to the next question: How might a leader pursue these two very different opening and closing leader behaviors and switch between them? Behavioral as well as cognitive complexity may be important prerequisites for leaders to be ambidextrous. Although we do not suggest that opening and closing leader behaviors are mutually exclusive, they are still very different behaviors. To be an ambidextrous leader one has to be capable of showing these different behaviors and, therefore, have a wide behavioral repertoire. Behavioral complexity, as defined by Hooijberg (1996), includes the dimensions of repertoire and differentiation. The behavioral repertoire refers to the range of behaviors that a leader is capable of performing while behavioral differentiation denotes the degree of variation between different behaviors according to situational requirements (Hooijberg, 1996). Thus, in terms of ambidextrous leadership, behavioral complexity refers to the capability of having a repertoire of both opening and closing leader behaviors as well as the temporal flexibility to switch between them (differentiation). Empirical support for these assumptions comes from Lubatkin, Simsek, Ling, and Veiga (2006) who found that top management team

behavioral integration – a concept closely related to behavioral complexity – was positively related to firm performance, and this relationship was mediated by an ambidexterity orientation.

In addition, the leader must know that exploration and exploitation are not mutually exclusive. Martin (2007) called this "integrative thinking", that is, "the ability to face constructively the tension of opposing ideas" (p. 15). Integrative thinking refers to refraining from making a decision between two ideas, but to integrate both into one superior idea. Ambidextrous leaders need to hold simultaneously in mind exploration and exploitation as well as opening and closing leader behaviors and integrate them into a coherent overall strategy. Similar to the cognitive integrative capacity needed for creativity (Mumford & Gustafson, 1988), cognitive complexity may help ambidextrous leaders to lead creative and innovative teams and individuals.

Zhou and George (2003) proposed emotional intelligence as a leader characteristic that enables the leader to understand and channel the emotions of followers connected to the innovation process. They suggest that leaders with high emotional intelligence are better able to "help their followers be flexible in their information processing" (p. 564). Thus, emotional intelligence may be helpful with respect to a leader's sensitivity in recognizing what kind of leader behaviors are called for in a given situation and sensibly adjusting the leadership behavior to the requirements of the innovation tasks.

Another activity that might help leaders to decide when to utilize opening and closing leader behaviors is forecasting and planning (Mumford et al., 2002). Although we assume innovation processes to be highly unpredictable, at least some steps can often be anticipated. Scanning the environment, being highly informed about the current activities in the team, and a high level of alertness will help to anticipate some steps ahead and thereby to predict when opening and closing leader behaviors are going to be necessary.

Proposition 6. *Behavioral and cognitive complexity, integrative thinking, emotional intelligence, and forecasting skills are antecedents of ambidextrous leadership.*

4.7. Alternative routes to ambidextrous leadership

In addition to just a single leader switching between opening and closing leader behaviors, different possibilities of how to achieve ambidextrous leadership are conceivable. First, multiple leaders within a team might be responsible for supporting exploration or exploitation. Possibly, several designated leaders or team members that adopt opening or closing leadership functions may exist. However, dispensing ambidextrous leadership behaviors by different people requires a high level of coordination between these individuals (e.g., a high quality transactive memory system, K. Lewis, 2003). As we discussed above, the timing of opening and closing leadership behaviors is of crucial relevance; this is even more so in the case of several leaders performing these behaviors. Thus, when sharing leadership functions in a team, leaders need to know very well when it is appropriate to take the lead, and when to step back to let the others take over. At the organizational level, a recent article similarly suggested that the behavioral complexity of the top management team is crucial for organizational ambidexterity (Carmeli & Halevi, 2009). Second, leadership behaviors may be complemented by team attributes, such as the team culture or climate. We already took note of this possibility when discussing the study by Eisenbeiss et al. (2008) that found a positive correlation between transformational leadership and innovation only for teams with high climate for excellence. In these teams, team members make sure that high standards of performance are maintained and goal attainment is controlled. Thus, one could argue that the team climate takes over closing leadership functions. In combination with the more opening nature of transformational leadership, this climate leads to high innovative performance. Several different combinations of leadership behavior and team climate or culture are conceivable. In any case, the coordination and timing of leadership behaviors are critical.

5. Discussion

Leadership in the innovation process has been studied frequently. Unfortunately, the results of these studies do not add up to a simple conclusion. Instead, our literature review suggests that studies arrive at different results. Different leadership styles are positively related to innovation, but most of them show a broad range of correlations that depend on moderating conditions. We developed a theory of ambidextrous leadership to explain this variation. Ambidextrous leadership consists of two complementary sets of leadership behaviors that specifically match the requirements of exploration and exploitation. The most important characteristic of this ambidextrous leadership, however, is the temporal flexibility that leaders need to have in order to switch between the leadership behaviors as the innovation tasks require. We will now discuss the similarities and differences of our theory to several leadership and innovation theories to answer the question of what is distinct about our theoretical model.

First, our theory makes use of the geneplore model of creativity (Ward, Smith, & Finke, 1999), which differentiates two cognitive processes in creativity, namely, the generation of preinventive structures and the exploration and interpretation of these structures. The generation of preinventive structures has some overlap with exploitation, as it includes the retrieval of information from memory, drawing analogies, and combining information from memory (Ward et al., 1999). Likewise, the exploration and interpretation of the preinventive structures has some similarity with explorative activities. It includes looking for new attributes in the structures or looking at the structures from different angles (Ward et al., 1999). The geneplore model, therefore, is in line with our reasoning that both exploration and exploitation are required for the generation of new and useful ideas. Ward et al. (1999) also explicitly state that both processes included in their model are passed through alternately throughout the creative process, that is, the idea of nonlinearity is also included in their model. However, the geneplore model does not include implementation of ideas and is therefore restricted to creativity. In addition, as it is a model of general creativity and has not been developed for the organizational context, it does not make any assumptions about the leadership for creativity or innovation.

Second, our theory of ambidextrous leadership shares some assumptions with the competing values approach of leadership by Quinn (1988). This model differentiates eight leadership roles that are arranged in a spatial model that is made up by the two orthogonal value dimensions of control–flexibility and internal–external focus (for a detailed description of the leadership roles cf. Quinn, 1988). The idea of this model is that leaders have to meet all of the opposing and contradictory values along the two dimensions. The different leadership roles are matched to these values. For example, the role of the coordinator matches the values of stability and control. The challenge of each leader is to bridge the contradictions implied by the spatial arrangement of values in this model and to reconcile opposing leadership roles (Denison et al., 1995; Quinn, 1988). Our theory of ambidextrous leadership shares the assumption with Quinn's (1988) model that leaders need to unite contradictory leadership behaviors or roles. In addition, both theories suppose that these leadership behaviors or roles need to be incorporated into one integrated whole. However, our theory adds the idea of temporal flexibility to these assumptions. We suggested that it is not enough to show more of each of the opposing leadership behaviors, but it is the temporal flexibility to switch between these leadership behaviors according to the current requirements of the innovation tasks that is crucial. Although Quinn (1988) states that the leader needs to be sensitive to environmental cues in deciding which leadership role is necessary in a given situation, he does not include the idea that the innovation task itself and its changing requirements demand a leader to flexibly switch between leadership behaviors, which is the core of temporal flexibility within a single innovation process as defined by us. In this sense, we build upon and extend Quinn's concept of the competing values approach to leadership.

Third, our approach builds upon and extends leadership theories that take situational contingencies into account. Most importantly, path-goal theory of leadership assumes that leadership behavior must match the situation of the followers to be effective (House, 1996). To be more explicit, leadership should be directive and clarify path-goal relationships in case the followers lack the necessary knowledge or abilities to reach these goals. On the other hand, supportive leadership may be more effective when the subordinates' tasks are stressful or dangerous (House, 1971). Although we share the assumption that leader behavior has to be contingent on the situation, there are several differences between our approach and the path-goal theory of leadership. Most importantly, in contrast to path-goal theory, we assume that the flexibility of the leader and the adjustment of leadership behaviors must not only be matched to the overall (and quite stable) situation, but has to be temporally appropriate for the innovation tasks that change quickly over time. That is, time and timing are explicit components of the theory of ambidextrous leadership, but not in path-goal theory. Furthermore, the path-goal theory concentrates on followers' motivation and makes use of expectancy theories of motivation (House, 1996). We acknowledge that motivation is an important antecedent not only of general performance but also of innovative performance. However, our theory concentrates on specific behavioral activities of followers, that is, exploration and exploitation, and not on motivation. Finally, in path-goal theory, an important function of the leader is to complement followers' behaviors and their environment to enhance satisfaction and general performance, whereas our theory focuses on how leaders may be able to foster specific behaviors to boost innovative performance. To conclude, although the general mechanisms of our theory and path-goal theory are similar – that is, the leader adjusts his or her behavior to the situation – the specifics of the two theories differ in the above-mentioned ways.

Fourth, a more specific approach to leadership in the innovation process has been taken by Van de Ven et al. (1999). On the organizational level, they distinguish four top management leadership roles that they find important in the “innovation journey”: the sponsors who champion an innovation, the mentors who coach and supervise the innovation team leader, the critics who test the innovation against hard business criteria, and the institutional leaders who balance the power of the other three leadership roles (Van de Ven et al., 1999). In the innovation projects that Van de Ven et al. (1999) studied, these roles were – contrary to their expectations – not accomplished by different persons, but individual members of the top management carried out several of these roles. Thus, managers need to be able to carry out more than one leadership role and must be able to switch between them. Paradoxical use of very different leadership styles or roles (e.g., as a sponsor and critic), therefore, seems to be necessary for innovation success (Cameron & Quinn, 1988). Van de Ven et al. (1999) claim that “the odds of organizational learning and adaptability increase when a balance is maintained among dialectical leadership roles throughout the innovation development” (p. 118). Taking this reasoning to the next level, we propose that the balance of different leadership behaviors is not only important for the top management, but also for leaders of innovative teams and individuals. However, we do not propose distinct leadership roles that need to be balanced within the innovation process, but rather specific leadership behaviors that foster exploration and exploitation — namely, opening and closing leader behaviors as defined above. The advantage of this approach is that these leader behaviors are more specific on the one hand and more flexible to be used on the other hand. Roles generally include a broader cluster of behaviors and are rather stable and less flexible. Therefore, we suggest concentrating on leadership behaviors rather than on leadership roles.

Finally, one has to ask the question of how the specific leadership behaviors proposed in our theoretical model of ambidextrous leadership differ from established leadership styles. The uniqueness of opening and closing leader behaviors lies in their sole focus on increasing and reducing variance in followers' behavior. Other leadership styles have very different foci or goals that might or might not include the increase or reduction of variance. That is, one single leadership style may increase or reduce variance in behavior depending on the specific leadership behaviors used. For example, in the “vision” subfacet of transformational leadership, communicating an inspiring vision might increase variance in followers' behavior if it motivates them to think independently, thus, it would be an opening leader behavior. On the other hand, an inspiring vision might also reduce the variance in behavior, in case the vision incorporates an explicitly stated goal that followers are motivated to follow as closely as possible. In the latter case, communicating a vision would be closing behavior. In Table 4 we give some more examples to show that both transformational leadership behaviors and transactional leadership behaviors can be both opening and closing leadership behaviors.

Table 4
Categorization of transformational and transactional leadership behaviors as opening and closing leadership behaviors.

	Opening leader behaviors	Closing leader behaviors
Transformational leadership	• A vision that motivates exploratory behavior • Stimulation of thoughts in very new directions • Communication of the values of openness and tolerance	• A vision that motivates confirmatory behavior • Stimulation of small improvements and enhancement of efficiency • Communication of the values of conscientiousness and rules adherence
Transactional leadership	• Rewarding experimentation • Focus on errors to learn from errors • Setting and monitoring exploration goals	• Rewarding efficiency • Focus on errors to avoid errors • Setting and monitoring exploitation goals

Similar matrixes could be developed for other leadership styles, for example, initiating structure and consideration. However, for the sake of brevity, we limit this comparison to transformational and transactional leadership. Our point is that although individual opening and closing leader behaviors might also be subsumed under traditional leader concepts (of course, none of these behaviors are in themselves totally "new"), it is the different categorization according to the specific function of opening and closing leader behaviors to increase or reduce variance in follower behavior that makes them distinct.

6. Limitations

Some limitations of our approach need to be mentioned. First, in our literature review, we could not use meta-analytic tools to integrate findings for every leadership style due to the limited number of studies available for some leadership styles. In these cases we had to rely on a narrative review of findings which always bears the risk of subjective biases. More studies on these leadership styles and innovation are needed to more objectively summarize the findings. Second, the variation we found in the relationship between leadership and innovation may not only be due to systematic variance that is caused by moderating conditions, but could also be due to methodological or statistical reasons. For some methodological moderators, such as the level of analysis or the type of dependent variable, we could do moderator analyses (for the relationship of transformational leadership and innovation) that showed that these moderators do explain some of the variation. However, a wide range of variation still needs to be explained by further moderators. In addition, by using meta-analytic tools, we could rule out sampling error by correcting for it. Nevertheless, range restriction might still play a role as some samples of the reviewed studies are more homogeneous (e.g., R&D teams) than others (e.g., college students). However, we do not see strong reasons why the range of leadership styles should vary dramatically across different samples.

7. Future research

Taking into account both our literature review and our theoretical line of reasoning, we make several suggestions for future research in addition to the propositions explicated throughout the article. Most importantly, future research on leadership in innovation contexts needs to systematically consider the complexity of the innovative process. We suggest that we need more studies that take situational contingencies into account. This may be done, for example, by using diary studies that examine daily fluctuations of situational requirements, leadership behaviors, follower behaviors, as well as creativity and innovation. Moreover, as the timing of leadership behaviors plays an important role in our theory, time needs to be considered in the methods used to study the proposed relationships (Mitchell & James, 2001). Another possibility is situation-dependent measurement of leadership behaviors, for example, by using situational judgment tests or similar instruments that utilize situationally anchored items (McDaniel, Morgeson, Finnegan, Campion, & Braverman, 2001; Motowidlo, Dunnette, & Carter, 1990). Both methods allow for the measurement of leadership variability and temporal flexibility which are the heart of our ambidextrous leadership theory.

In addition, we suggest multilevel research to be done on leadership and innovation. Although we did not explicitly focus on level issues in our literature review, differences between relationships at the team level and at the individual level emerged. For example, the correlation between transformational leadership and innovation was higher at the team level (.28) than at the individual level (.17), although this difference was not significant. The only consistent relationship with innovation was shown for LMX, a leadership style that concentrates on leader–follower dyads. We further suggest that studies should look at both individual and team processes simultaneously to identify crucial individual behaviors and group culture in context. In addition, it might be helpful to take the team and the organizational context into account when studying the effect of leadership on individual and team innovation. For example, the overall organizational strategy may tend to either more exploration or exploitation which could impact the frequency of requirements of explorative and exploitative activities at the team level and, therefore, may have consequences for the leadership behaviors needed. Alternatively, the organizational approach on managing the conflict between exploration and exploitation – that is, for example, whether the organization separates R&D strictly from production (Tushman & O'Reilly, 1996) or tries to make use of synergies of both departments – is likely to influence how exploration and exploitation need to be handled at lower levels of the organization. Finally, on an even higher level on analysis, the national culture that provides a context for an innovating organization may play a role in what way ambidextrous leadership is performed (Bledow et al., 2011).

8. Conclusion

In this article we propose that research on innovation needs to take the specifics of the innovation process into account in order to make reliable predictions about the influence of leadership in the innovation context. The complex nature of the innovation process that leads to a complex sequence of events is probably its most important characteristic. Complex explorative activities may be more important in the beginning and periodic exploitative activities may be more central at the end of an innovation process (Cheng & Van de Ven, 1996); similarly, creativity may be more prevalent in the first part of the innovation process and implementation activities may be more frequent in the later part (West, 2002). However, both exploration and exploitation are vital throughout the whole innovation process, and the need for these activities alternates. Indeed, exploration and exploitation are sometimes interwoven activities that cannot be separated (Bledow et al., 2009). For leaders, this means that, on the one hand, they need to foster exploration by opening leader behaviors and to foster exploitation by closing leader behaviors. On the other hand, leaders need to have the knowledge or intuition of when and how to act and – even more importantly – they need to flexibly switch between behaviors according to situational requirements. This threefold competency – opening leader behaviors, closing leader behaviors, and the temporal flexibility to switch – is what we call ambidextrous leadership.

Leading a creative and innovative workforce is a complex matter. Therefore, leaders need to take the complexity of the innovation process into account. The same is true for the innovation research and literature: Only complex and comprehensive models of leader influence in the innovation process are able to embrace this complexity (Mumford & Licuanan, 2004). Breaking down the innovation process into two (or more) separate phases, and looking for what needs to be done in those phases, creates a simplistic view of innovations. This view misses a lot of what is inherent to innovation — the creative tension of opposites. When considering the complexity of the innovation process, both the theory and practice of innovation promise to be more successful.

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