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Transformational leadership, job satisfaction, and team performance: A multilevel mediation model of trust☆

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ABSTRACT

In spite of calls for deliberate differentiation between individual and team levels of analysis, leadership research based on well-grounded theory referring to multiple levels is scarce. We seek to fill this gap by analyzing the relations between transformational leadership, trust in supervisor and team, job satisfaction, and team performance via multilevel analysis. Results are based on a sample of 360 employees from 39 academic teams. Transformational leadership was positively related to followers' job satisfaction at individual as well as team levels of analysis and to objective team performance. The relation between individual perceptions of supervisors' transformational leadership and job satisfaction was mediated by trust in the supervisor as well as trust in the team. Yet, trust in the team did not mediate the relationship between team perceptions of supervisors' transformational leadership and team performance. Implications for theory and research of leadership at multiple levels as well as for practice are discussed.

1. Introduction

Nowadays, organizations' predominantly team-based structures require leaders "to lead and motivate not only individuals but also teams as a whole" (Chen, Kirkman, Kanfer, Allen, & Rosen, 2007, p. 331). Leading teams yields several challenges, like aligning individual goals with a shared mission, managing resources, establishing a positive climate of trust and support, and coordinating information transfer and task completion (Zaccaro, Rittman, & Marks, 2001). Yet, while scholars stressed that "the study of leadership is inherently multilevel in nature" (Bliese, Halverson, & Schriesheim, 2002, p. 4), leadership research has been suffering from a dearth of deliberate theoretical and empirical differentiation between levels of analysis (Yammarino, Dionne, Chun, & Dansereau, 2005).

Transformational leadership – arguably the most researched leadership concept to date – is closely related to desired outcomes for individuals (e.g., Casimir, Waldman, Bartran, & Yang, 2006; Judge & Piccolo, 2004; Liu, Siu, & Shi, 2010) and teams (e.g., Bass, Avolio, Jung, & Berson, 2003; Peus, Kerschreiter, Frey, & Traut-Mattausch, 2010; Schaubroeck, Lam, & Cha, 2007; Schaubroeck, Lam, & Peng, 2011). Yet, with some recent exceptions (e.g., Wang & Howell, 2010) research analyzing effects of transformational leadership at individual as well as team levels is still scarce. Thus, the first aim of this study is to further investigate relations between individual and team perceptions of supervisors' transformational leadership and desired outcomes

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for individuals (i.e., job satisfaction) and teams (i.e., team performance). That is, in addition to effects at the individual level, transformational leadership is posited to also have an impact at the team level of analysis. This assertion is based on a direct consensus model, which employs consensus among lower level units to specify another form of a construct at a higher level (Chan, 1998). This model is assumed because transformational leadership (a) comprises individual-focused as well as team-focused behaviors (Wang & Howell, 2010) and (b) as a participative leadership style, it contributes to mental model convergence in teams (Dionne, Sayama, Hao, & Bush, 2010).

Even more limited than insights into the direct relations between transformational leadership and performance at multiple levels is knowledge about multilevel mediators. Strong positive relationships between individual perceptions of supervisors' transformational leadership and trust in the supervisor have been established (Casimir et al., 2006; Jung & Avolio, 2000; Pillai, Schriesheim, & Williams, 1999; Pillai, Williams, Lowe, & Jung, 2003; Podsakoff, MacKenzie, Moorman, & Fetter, 1990). Recent research also revealed trust as a mediator between team perceptions of supervisors' transformational leadership and team performance (Schaubroeck et al., 2011). While research on trust in leader–follower relationships flourished, effects of trust among team members have been "virtually ignored" (Lau & Liden, 2008, p. 1130). Thus, the second aim of this study is to investigate trust in the supervisor and trust in the team as multilevel mediators.

Finally, a lack of context-specificity in leadership research has been widely criticized (Jordan, Dasborough, Daus, & Ashkanasy, 2010; Liden & Antonakis, 2009; Schriesheim, Wu, & Scandura, 2009; Yukl, 1999). Concordantly, the third aim of this study is to extend the investigation of transformational leadership and its effects to a previously understudied context for leadership, that is, the academic one. Our focus lies on academic institutions because they have a major impact on our society (e.g., by building the foundation of our knowledge-based economy and educating future leaders). Moreover, preliminary evidence indicates the relevance of transformational leadership for academic institutions (Bryman, 2007) and innovative work (Eisenbeiss, van Knippenberg, & Boerner, 2008). Unlike most previous research (see Dvir, Eden, Avolio, & Shamir, 2002) our analyses also comprise an objective outcome measure of team performance.

2. Theory and hypotheses

2.1. Transformational leadership at multiple levels

We concur with the view that "leadership is by nature a multiple-level phenomenon" (Chun, Yammarino, Dionne, Sosik, & Moon, 2009, p. 689). It occurs not only between individual leaders and their followers, but also between leaders and teams, and even between multiple teams in an organization. Theoretically defining appropriate levels of analysis is a complex issue (Yammarino et al., 2005) since theoretical constructs and their relations can vary according to (a) differences between teams, (b) differences within teams, or (c) differences between followers independent of their teams (Chun et al., 2009; Klein, Conn, Smith, & Sorra, 2001; Klein, Dansereau, & Hall, 1994). The impact of leadership on organizational outcomes can therefore comprise several plausible levels.

2.1.1. Individual-level relationships

Many studies have investigated the effects of transformational leadership at an individual level (Judge & Piccolo, 2004; Judge, Woolf, Hurst, & Livingston, 2006). In particular, individual perceptions of supervisors' transformational leadership related positively to job satisfaction in numerous investigations (Judge & Piccolo, 2004; Podsakoff, MacKenzie, & Bommer, 1996; Podsakoff et al., 1990). Transformational leaders show individualized consideration, and are thereby able to recognize and respond "to each individual's abilities, aspirations, and needs" (Walumbwa, Orwa, Wang, & Lawler, 2005, p. 238). They adjust their inspirational motivation and idealized influence behavior to the specific goals and interests of individual followers (Chun et al., 2009), and ensure that each individual follower is able to voice concerns through intellectually stimulating behavior (Liu et al., 2010). Therefore, we conclude that followers' job satisfaction will in part rely on these and similar direct, individual experiences with their supervisor. Accordingly, we hypothesize:

Hypothesis 1. Individual perceptions of supervisors' transformational leadership are positively related to individual followers' job satisfaction.

2.1.2. Team-level relationships

If theoretical constructs relate to individuals nested in teams, one must acknowledge the team as a meaningful entity. That is, considering individual values on the construct (e.g., individual perceptions of supervisors' transformational leadership) relative to the team value (e.g., team perceptions of supervisors' transformational leadership) "is not only informative but *necessary* to interpret an individual's placement or standing" (Klein et al., 1994, p. 202). Indeed, it has been suggested that "transformational leaders are often thought to have their greatest effect by changing how work groups (rather than individuals) function" (Lord & Dinh, 2011, p. 31).

Following hitherto published research we therefore assume that team perceptions of supervisors' transformational leadership yield positive relationships with team outcomes. Bass and colleagues (2003) first observed that team perceptions of supervisors' transformational and contingent reward leadership positively predicted unit performance of U.S. Army light infantry units in combat simulations. The importance of team perceptions of supervisors' transformational leadership for team performance was also

demonstrated in financial service teams (Schaubroeck et al., 2007). Eisenbeiss and colleagues (2008) revealed the positive influence of team perceptions of supervisors' transformational leadership on team innovativeness in research and development teams. As mentioned above, Wang and Howell (2010) found that team-focused components of transformational leadership were positively related to team performance. In addition, Schaubroeck and colleagues (2011) showed that team perceptions of supervisors' transformational leadership were positively related to team performance, mediated by followers' cognition-based trust. These studies clearly speak in favor of positive relations between team perceptions of supervisors' transformational leadership and team performance. Yet, none of the above-mentioned studies has employed objective measures of team performance. Instead, subjective judgments were used, which have been criticized as being subject to severe biases (Dvir et al., 2002).

To overcome this gap in earlier research, we test whether team perceptions of transformational leadership affect an objective measure of team performance. We propose that transformational leadership behaviors expressed toward the team ensure that the team meets high performance standards. Transformational leaders seek to transform individual goals into a joint vision for the entire team (Wang & Howell, 2010) and intellectually stimulate the team to develop innovative approaches to problems (Eisenbeiss et al., 2008). They also "communicate a high level of confidence in the team's ability to achieve ambitious collective goals" (Schaubroeck et al., 2007, p. 1021). Further, transformational leadership as a participative leadership style will promote shared mental model convergence in teams because it "emphasize[s] each team member as equally important" (Dionne et al., 2010, p. 1038). Sharing and integrating team members' mental models then gives rise to the effects of team perceptions of supervisors' transformational leadership on subsequent outcomes in teams (Dionne & Dionne, 2008; Dionne et al., 2010). Therefore, team perceptions of supervisors' transformational leadership are assumed to be a major driver of team performance. Accordingly, we hypothesize:

Hypothesis 2. Team perceptions of supervisors' transformational leadership are positively related to objective team performance.

2.1.3. Cross-level relationships

We go beyond earlier research to suggest that team perceptions of supervisors' transformational leadership exert a cross-level main effect on individual followers' job satisfaction. That is, individual followers' job satisfaction will not only be enhanced by transformational leadership experienced in direct interactions with the supervisor, but also by leadership behavior directed toward other team members and the team as a whole. Transformational leaders not only tailor their behaviors to individual followers, but also to the entire team. For instance, to motivate and inspire followers, transformational leaders develop and communicate a persuasive vision of team achievements in the future (Chun et al., 2009; Wang & Howell, 2010). Further, transformational leaders display considerate behavior toward multiple followers when interpersonal conflicts among team members arise, and seek to promote cooperation "to ensure that the whole group is working together toward the same goal" (Wang & Howell, 2010, p. 1136). That is, even though the above-mentioned behaviors are not directed toward each individual follower, but toward the team, they will influence each individual team member. Research conducted by Chen and colleagues (2007) clarified that team perceptions of leadership behavior have the power to alter individual-level leader–follower relationships. The authors showed that team perceptions of leadership climate and team empowerment moderated the individual-level relations between leader–member exchange and individual empowerment, as well as between individual empowerment and individual performance, respectively (Chen et al., 2007). On this basis, we suggest a cross-level effect of transformational leadership on follower job satisfaction. Exemplary transformational leadership behavior directed toward the team, like providing the team with a vision and solving interpersonal conflict, will increase the likelihood that individual followers are satisfied with their jobs. Accordingly, we hypothesize:

Hypothesis 3. Team perceptions of supervisors' transformational leadership are positively related to individual followers' job satisfaction.

2.2. Trust as a mediator

Trust belongs to the most important factors influencing interactions in organizations as well as organizational success (Caldwell & Dixon, 2010; Dirks & Ferrin, 2001). An established model of organizational trust posits that trust is "the willingness of a party to be vulnerable to the actions of another party" (Mayer, Davis, & Schoorman, 1995, p. 712). This propensity originates from three factors of perceived trustworthiness: ability, benevolence, and integrity of the trustee (Mayer et al., 1995). Scholars have devoted much attention to the role of trust in leader–follower relationships (Dirks & Ferrin, 2002), while partly ignoring the effects of trust between team members (Lau & Liden, 2008).

2.2.1. Trust in the supervisor

Numerous studies found trust in the supervisor to mediate the relations between individual perceptions of supervisors' transformational leadership and followers' attitudes (Dirks & Ferrin, 2002). It has been assumed that transformational leaders will particularly foster followers' trust through perceptions of their benevolence (Burke, Sims, Lazzara, & Salas, 2007). Transformational leaders take into account individual followers' needs, goals, and interests (Chun et al., 2009; Walumbwa et al., 2005). This in turn makes followers more willing to be vulnerable to their supervisor.

Further, a clear overlap exists between three typical behaviors of transformational leaders directed toward individuals, that is, engagement in follower development, intellectual stimulation, and personal recognition (Wang & Howell, 2010), and the three components of trustworthiness, that is, ability, benevolence, and integrity (Mayer et al., 1995). Transformational leaders who actively promote individual followers' progress and involvement signal their ability to lead as well as their benevolence and integrity, and will therefore elicit higher levels of trust. Followers who trust their supervisor will be more satisfied in their jobs (Yang & Mossholder, 2010) because they experience high levels of care and consideration. Podsakoff and colleagues (1990) as well as Pillai and colleagues (1999) demonstrated that trust in the supervisor mediated the effects of individual perceptions of supervisors' transformational leadership on followers' job satisfaction. We assume that followers' development of trust will rely upon the direct experiences with their supervisor, which in turn relates positively to followers' job satisfaction. Accordingly, we hypothesize:

Hypothesis 4. Trust in the supervisor mediates the positive relationship between individual perceptions of supervisors' transformational leadership and individual followers' job satisfaction.

2.2.2. Trust in the team

Trust is not only relevant for leader–follower relationships, but also for interaction among team members (Dirks & Ferrin, 2001). Yet, studies of the antecedents and consequences of team members' trust in each other are relatively scarce (Lau & Liden, 2008). To make inferences about other team members' trustworthiness, followers draw upon social interactions between them and the team's supervisor as a primary source (Lau & Liden, 2008). That is, supervisors hold the propensity to influence trust between team members. As Schaubroeck and colleagues (2011, p. 865) point out "transformational leadership gives the team confidence that all of its members know what the team needs to do to be successful". Concordantly, we propose that team-directed transformational leadership behaviors, that is, emphasizing the team's identity, communicating a team vision, and team-building (Wang & Howell, 2010), ensures that team members also trust each other. By engaging in these behaviors, transformational leaders signal that the team in itself is a trustworthy entity (Wildman et al., 2012). We further propose that team members with transformational leaders will develop similar (i.e., shared) perceptions of the team's trustworthiness over time (Wildman et al., 2012). That is, team members will develop similar trust-related schemas (i.e., shared mental models regarding the trustworthiness of the team; Dionne et al., 2010) and interpret trust-related events in similar ways. Thereby, team members will be more satisfied with their jobs because, for instance, they develop a sense of belongingness to the team (Den Hartog, De Hoogh, & Keegan, 2007) and share resources among each other (Dirks & Skarlicki, 2009). Consequently, followers who trust in their team, and share their perceptions of trust with fellow team members will be more satisfied with their jobs. Accordingly, we hypothesize:

Hypothesis 5. Trust in the team mediates the positive relationship between team perceptions of supervisors' transformational leadership and individual followers' job satisfaction.

Finally, we propose that teams whose supervisors display transformational leadership, and in which team members share perceptions of trust, will achieve higher levels of performance. Schaubroeck and colleagues (2011) found that team perceptions of supervisors' transformational leadership were positively related to team potency, and in turn, to team performance through the mediating influence of cognition-based trust in the supervisor. We build upon this research and extend it by (1) suggesting that trust in the team mediates the relationship between team perceptions of supervisors' transformational leadership and team performance, and by (2) obtaining an objective measure of team performance. Successful task completion in teams requires trustful interaction and communication between team members, which can be fostered through transformational leadership (Dionne, Yammarino, Atwater, & Spangler, 2004). Team members need to agree on goals and approaches to goal achievement, establish and adhere to high quality standards, and integrate individual knowledge, abilities, and experiences. This mutual support in teams is particularly relevant when innovative and creative solutions to non-routine tasks are needed (Eisenbeiss et al., 2008). We suggest that transformational leaders foster shared perceptions of trust within the team, such that team members will rely on each other's abilities (Arnold, Barling, & Kelloway, 2001), even in uncertain environments or if problems arise (Cordery, Morrison, Wright, & Wall, 2010), and support each other through sharing of task-relevant information or resources (Dirks & Skarlicki, 2009). Therefore, we assume that teams, which perceive their supervisor as transformational and develop shared perceptions of trust in the team, will achieve higher levels of performance. Accordingly, we hypothesize:

Hypothesis 6. Trust in the team mediates the positive relationship between team perceptions of supervisors' transformational leadership and team performance.

2.3. Transformational leadership in academia

Research tends to ignore leadership as it enfolds in specific contexts (Jordan et al., 2010; Liden & Antonakis, 2009; Schriesheim et al., 2009; Yukl, 1999). Yet, academia appears to be a particularly relevant context for investigating the proposed relationships between transformational leadership, trust in the supervisor as well as the team, job satisfaction, and team performance. Transformational leaders will (1) intellectually stimulate their followers to develop innovative research ideas, (2) motivate them to pursue challenging research endeavors based on long-term goals (i.e., publication), (3) promote their followers' academic

success by coaching and teaching (e.g., providing advice in early career stages), and (4) display value-based behavior, which encourages followers to hold on to the academic career path. Even though initial research substantiates the importance of transformational leadership in academic contexts (Brown & Moshavi, 2002), more rigorous empirical investigations of transformational leadership in academia are clearly needed.

In addition, successful research requires high levels of creativity and innovativeness, often stemming from productive teamwork (Keller, 2006). As Maier-Leibnitz and Schneider (1991, p. 38) stress "teamwork is a prominent part of everyday work in scientific research", especially in the German academic context, which our study was set in (see also Muller-Camen & Salzgeber, 2005). Finally, academic work contexts are characterized by high levels of uncertainty (Smith & Hughey, 2006). Many researchers work on limited, short-term appointments with low income, and are confronted with high probabilities of project failure (Mazzola, Walker, Shockley, & Spector, 2011). Therefore, trust in one's supervisor as well as one's team is particularly important.

To summarize, our study goes beyond earlier research since (1) we investigate trust in the supervisor and trust in the team as mediators of the relationship between transformational leadership and outcomes, (2) we theoretically derive and empirically test differential hypotheses on how these mediators will function at individual and team levels of analysis, (3) we employ an objective measure of team performance, and (4) we investigate the relations in an academic work context, which suffers from a dearth of empirical consideration (Fig. 1).

3. Method

3.1. Participants and procedure

Data for this study stem from 39 teams at a large German research university, and comprise ratings of 360 employees and their direct supervisors. Supervisors were professors leading research laboratories or other teams at the university. Team members were part of the scientific (e.g., postdocs and PhD students) and non-scientific (e.g., technical assistants) personnel. We recruited teams by means of a university leadership program that offered a leadership profile to supervisors of academic teams. Employees working under the supervision of the same leader were considered a team.

Data collection from employees and supervisors took place at two points of measurement separated by approximately six weeks in 2009. The interval of six weeks was chosen to reduce biases pertaining to single sources and common methods (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Before starting data collection, participants were invited to a short informative meeting during which the survey process was introduced. Surveys were administered online. Participants received an e-mail invitation accompanied by a cover letter explaining the purpose of the study and confirming anonymity and voluntary participation. Out of 44 supervisors and their teams invited to take part in the study, 5 did not respond to the invitation, resulting in the overall number of 39 teams in the study sample, and a participation rate of 88.6%. At time 1, team members were asked to rate their supervisor's transformational leadership behavior, and their trust in the supervisor. At time 2, team members rated their perceptions of trust in the team, and their individual job satisfaction.

3.2. Measures

3.2.1. Transformational leadership

Transformational leadership was measured with a composite score consisting of 15 items ($\alpha = .95$) pertaining to the dimensions inspirational motivation (4 items), intellectual stimulation (4 items), individualized consideration (4 items), and idealized influence behavior (3 items) from the validated German version (Felfe, 2006) of the Multifactor Leadership Questionnaire Form 5x-short (Bass & Avolio, 2000). Participants rated these items on 5-point Likert-scales ranging from 1 (not at all) to 5 (frequently, if not always).

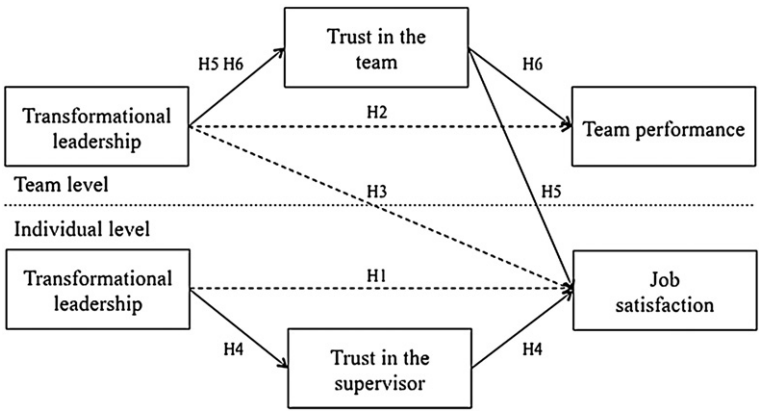

Fig. 1. Multilevel mediation model of transformational leadership, trust in the supervisor, trust in the team, job satisfaction, and team performance. H = Hypothesis. Dashed lines indicate direct relations.

3.2.2. Trust in the supervisor

Participants' trust in their supervisor was assessed using eight items ($\alpha = .97$) adapted from Dirks' (2000) scale which takes both affect- and cognition-based aspects of trust into consideration. A sample item is "If I shared my problems with my supervisor, I know (s)he would respond constructively and caringly". Participants' ratings were based on 7-point Likert-scales ranging from 1 (strongly disagree) to 7 (strongly agree).

3.2.3. Trust in the team

We assessed trust in the team by adapting three items ($\alpha = .80$) following Cook and Wall's (1980) conceptualization of interpersonal trust at work. A sample item is "To what extent is the climate in your team characterized by trust?" Participants' ratings were based on 5-point Likert-scales ranging from 1 (strongly disagree) to 5 (strongly agree).

3.2.4. Job satisfaction

Job satisfaction was measured with five items ($\alpha = .83$) regarding satisfaction with one's supervisor, tasks, working conditions, support of one's professional career, and general job satisfaction by means of a validated job satisfaction scale (Neuberger & Allerbeck, 1978). A sample item is "To what extent are you satisfied with your working conditions?" Participants' ratings were based on 7-point face-scales (Kunin, 1955).

3.2.5. Team performance

Number and quality of peer-reviewed publications are regarded as the most important research performance criterion in academia (Bunz, 2005; McGrail, Rickard, & Jones, 2006). Performance of academic teams was therefore operationalized as the teams' number of publications in peer-reviewed journals weighted by journal impact factor. Publications from 2010 and 2011 (first half) and journal impact factors were identified via ISI Web of Knowledge (© Thomson Reuters) and taken into account for subsequent analyses. The time-lag between the leadership style assessment in 2009 and publication output in 2010/2011 established a logical order among independent and dependent variable. The number of publications included per team ranged from 0 to 25 with an average number of 6.1 ($SD = 5.8$) publications per team in 2010 and 2011 (first half). Journal impact factors ranged from .058 (Der praktische Tierarzt [The applied veterinarian]) to 36.101 (Nature). 64.3% of the teams had five publications or less, 14.3% of the teams had between six and 10 publications, 17.9% of the teams had more than ten publications, and only one team had more than 20 publications in 2010 and 2011 (first half).[2]

Included in our analyses are only publications that were co-authored by the team's supervisor and one or more members of the team. This seems to be an appropriate measure of team performance in the German academic context since supervisors in this context usually develop the direction and framework of the research project, provide necessary resources and monitor its progress — all of which leads to the fact that they co-author virtually all publications of their team members. Moreover, since supervisors usually rely on team members to support each other with the practical aspects of their research, the research process largely takes place in a team-based manner. That is, team members jointly develop and/or improve research materials, teach each other the necessary techniques, jointly recruit participants, and support each other in data analysis and manuscript writing.[3]

Publications were weighted according to two criteria: (1) the 2010 impact factor of the journal in which the respective article had been published and (2) the average journal impact factor in the respective field of research. That is, each academic team received a sum score of the number of its publications in 2010/2011, in which each publication was weighted relative to the specific journal impact factor and the average impact factor of journals in the field. In order to create the score, every publication was assigned one value: 0 for publications in journals which were not included in the ISI Web of Knowledge, Journal Citation Reports, 1 for publications with impact factors lower than the 25th percentile of median impact factors in the given field, 2 for publications with impact factors between the median and the 25th percentile, 3 for publications with impact factors between the median and the 75th percentile, 4 for publications with impact factors higher than the 75th percentile, and 5 for extreme values of the distribution.[4] This approach is in concordance with earlier suggestions to use the box plot method for studying the Journal Citation Reports of ISI Web of Knowledge (Solari & Magri, 2000). As a result of the weighting procedure, each team was assigned a team performance score, which ranged from 0 to 91 with an average of 22.0 ($SD = 21.7$) per team.

3.2.6. Control variables

In order to account for their influence on the proposed outcome variables, we introduced scientific discipline, supervisor tenure with the team, and unit reputation as covariates. For scientific discipline, we differentiated three dummy-coded

[2] Due to a non-scientific focus of some medical teams, subsequent analyses regarding team performance are based on a reduced sub-sample.

[3] Academic supervisors in Germany rarely have publications that are not co-authored by one or more members of their team. In the instances that supervisors in our sample did, these publications were excluded from analyses.

[4] For example, for a publication in the field of biochemistry and molecular biology, the median journal impact factor according to ISI Web of Knowledge, Journal citation reports in 2010 was 2.799. For demonstration purposes, we consider a team with three publications in 2010 and 2011 (first half): One article was published in the journal "Cell" (2010 impact factor: 32.406), one article was published in the "Journal of Neuroimmunology" (2010 impact factor: 2.901), and one article was published in the journal "Cellular and Molecular Biology" (2010 impact factor: .833). The impact of the first journal (i.e., Cell) falls into the category of extreme values for the field of biochemistry and molecular biology. Therefore, the publication is assigned the value 5. The second publication is assigned the value 3 because the journal impact factor of 2.901 lies between the median and the 75th percentile. The third publication is assigned the value 1 because the journal impact factor of .833 lies below the 25th percentile. Therefore, the team's publication score in this example equals 9 (i.e., the sum of the individual scores for each of the three publications).

Table 1
Means, standard deviations, and correlations of study variables at Level 2.

	M	*SD*	1	2	3	4
1. Transformational leadership	3.54	.56				
2. Trust in the supervisor	5.28	1.02	.86**			
3. Trust in the team	3.57	.50	.32*	.46**		
4. Job satisfaction	4.82	.61	.63**	.67**	.74**	
5. Team performance[a]	22.00	21.66	.32+	.37+	.15	−.02

Note. Level-2 $N = 39$.
Variables were measured on 5-point scales (transformational leadership) or 7-point scales (trust in the supervisor, trust in the team, and job satisfaction). Team performance represents the weighted number of publications in peer-reviewed journals.
[a] Level-2 $N = 28$.
+ $p < .10$.
* $p < .05$.
** $p < .01$ (two-tailed test).

categories: social sciences and humanities, natural sciences, and medicine. Supervisor tenure was indicated on a 3-point Likert-scale with the values 1 (less than 12 months), 2 (between 12 and 24 months), and 3 (more than 24 months). The authors rated unit reputation based on the following criteria: (1) academic achievements in terms of highly regarded awards and honors (e.g., Gottfried Wilhelm Leibniz Prize, the most important research award in Germany), (2) third-party funding, and (3) "excellence status" (i.e., participation in research projects as part of the German Excellence Initiative). Information referring to these three criteria was collected from several sources (i.e., publicly available information on research funding, university and team websites, and surveys of team supervisors). Unit reputation was indicated on a 5-point Likert-scale ranging from 1 (very low unit reputation) to 5 (very high unit reputation).

The means, standard deviations, and correlations of independent and dependent variables at Level 2 are reported in Table 1.

3.3. Data augmentation

Participants who did not answer the first of two questionnaires were excluded from the survey. However, participants who only completed the first questionnaire were retained for subsequent analyses. Overall data missingness was 19.4%, mainly due to a dropout at time 2. Missing values were imputed using multiple imputation procedures in the SPSS "Missing Values" module based on an iterative Markov chain Monte Carlo (MCMC) method. It has been demonstrated that multiple imputation-based procedures are superior to casewise deletion, even if data is not missing at random (Lüdtke, Robitzsch, Trautwein, & Köller, 2007). Multiple imputation of five data sets was chosen in accordance with Rubin (1987).

The resulting data sets comprised 360 members of 39 teams. The average number of participants per team was 9.2 ($SD = 4.5$) with a range from 2 to 20 participants per team. The average response rate per team was 61.0%. Participants in the final sample were 35.7 years old ($SD = 10.2$ years) on average, and 67.5% were female. The majority of participants were PhD students (58.1%), postdocs (14.4%), and non-scientific personnel (16.4%).[5] Supervisors of the 39 teams were on average 45.6 years old ($SD = 7.3$ years), and 69.2% were male. Teams mainly worked in the fields of natural sciences (61.5%) or medicine (30.8%).

3.4. Analytic strategy and levels of analysis

Since we proposed differential relations between transformational leadership, trust, and outcomes at team and individual levels, an analytic strategy was chosen to address effects within teams as compared to effects between teams. We followed Zhang, Zyphur, and Preacher's (2009) approach to multilevel mediation, and analyzed the relations of the independent variable (transformational leadership), mediator variables (trust in the supervisor and trust in the team), and job satisfaction both at individual and team levels. In short, in the context of multilevel mediation tests based on 1-1-1 models (i.e., independent, mediator, and outcome variables measured at the individual level, but Level-1 units nested in Level-2 units) both effects within and between teams may be contained in a single mediation effect estimate. To overcome this confounding of mediation within and between teams, Zhang and colleagues (2009) proposed a multilevel mediation approach based on team-mean centered analyses, also termed 'centered within context' or CWC (Kreft & de Leeuw, 1998). In the special case of CWC(M), the subtracted means of each individual-level variable are reintroduced in the Level-2 equations. Thereby, within-team mediation effects are differentiated from between-team mediation effects. The authors tested their approach in a Monte Carlo simulation study, which yielded promising results concerning reduced confounding, sufficient empirical power, and low Type-I error rates (Zhang et al., 2009).

The CWC(M) approach was the state-of-science choice for testing Hypotheses 1, 3, 4, and 5. We implemented it by applying hierarchical linear modeling in the statistical software package HLM 7. Ordinary Least Squares (OLS) regression in SPSS was applied in order to test the relationship between team perceptions of supervisors' transformational leadership and team

[5] Even though the mentioned forms of employment are different from each other, all of these employees contribute significantly to the completion of research-related tasks. In particular, in the German academic system, PhD students and postdocs usually hold similar contracts and fulfill related tasks, especially with regard to research projects.

performance (Hypothesis 2) and the mediation of this relation by trust in the team (Hypothesis 6) because HLM does not estimate relations with dependent variables at Level 2.

4. Results

4.1. Aggregation issues

As described above, the variables transformational leadership, trust in the supervisor, and trust in the team were introduced at team levels of analysis. Since these variables were measured at the individual level, their aggregation to the team level was required for further analyses. We therefore calculated (1) $r_{WG(J)}$ as a measure of agreement within teams (James, Demaree, & Wolf, 1984), (2) intraclass correlations (*ICC1*), and (3) reliability of team means (*ICC2*) (Bliese, Klein, & Kozlowski, 2000), and (4) F-tests indicating whether average scores differed significantly across teams.

We applied two different distributions (i.e., uniform and slightly skewed) to calculate $r_{WG(J)}$ to account for potential biases in raters' judgments. Applying a slightly skewed distribution yielded out-of-range values ($-4.0 \leq r_{WG(J)} \leq .98$) in several teams. Applying a uniform distribution, in contrast, yielded positive values of $r_{WG(J)}$ with only few exceptions (i.e., one team with $r_{WG(J)} = -.02$ for transformational leadership, one team with $r_{WG(J)} = -.40$ for trust in the team, and four teams with $-.53 \leq r_{WG(J)} \leq -.04$ for trust in the supervisor). In these cases, the value was reset to 0 because it is expected that with a larger sample of raters the values will conform to the common range from 0 to 1.

For transformational leadership, the average $r_{WG(J)}$ was .64 with a range from .00 to .93 between teams. The *ICC1* was .38, and *ICC2* was .85, $F(38,321) = 7.510$, $p < .001$. For trust in the supervisor, the average $r_{WG(J)}$ was .63 with a range from .00 to .98 between teams. The *ICC1* was .39, and *ICC2* was .86, $F(38,321) = 7.691$, $p < .001$. For trust in the team, the average $r_{WG(J)}$ was .72 with a range from .00 to .97 between teams. The *ICC1* was .18, and *ICC2* was .67, $F(38,321) = 2.881$, $p < .001$.

For interpretation of inter-rater agreement, it has been suggested that $r_{WG(J)}$ cut-off values between .60 and .70 should be applied (Bliese et al., 2002) as well as that $r_{WG(J)}$ values between .51 and .70 indicate moderate agreement (LeBreton & Senter, 2008). Based on the considerations of underlying theoretical null distribution, consensus model, and number of raters we conclude that the $r_{WG(J)}$ values in our study indicating moderate agreement within teams are sufficient to justify aggregation of the transformational leadership, trust in the supervisor, and trust in the team scales.

The *ICC1* values for our study variables ranged from .18 (trust in the team), to .38 (transformational leadership) and .39 (trust in the supervisor), indicating medium to large effects. That is, team membership explained considerable variance in individual ratings of trust in the team, transformational leadership, and trust in the supervisor. These results clearly warrant additional investigation of individual-level as compared to team-level effects. Moreover, for our study variables values of *ICC2* indicated acceptable to good levels of reliability between .67 and .86. Overall, we conclude that our results support the aggregation of the individual-level measures of transformational leadership, trust in the supervisor, and trust in the team for further analyses.

4.2. Hypothesis testing

Hypotheses 1 and 3 predicted a significant relationship between transformational leadership and job satisfaction at individual levels (1) and across levels (3). As a necessary precondition, we calculated the amount of variance within and between teams in job satisfaction (null model). Team membership accounted for 21.22% of variance in job satisfaction. A chi-square test confirmed that variance between teams was significant ($\chi^2(38) = 101.50$, $p < .001$). As expected, individual perceptions of supervisors' transformational leadership ($\gamma_{10} = .73$, $p < .001$) as well as team perceptions of supervisors' transformational leadership ($\gamma_{01} = .64$, $p < .001$) were positively related to individual followers' job satisfaction. Thus, Hypotheses 1 and 3 were fully supported.

According to Hypothesis 2, we expected team perceptions of supervisors' transformational leadership to be positively related to team performance. OLS regression revealed a significant positive relationship between team perceptions of supervisors' transformational leadership and team performance ($\beta = .36$, $p < .05$). Thus, Hypothesis 2 was fully supported as well.

Hypothesis 4 predicted that trust in the supervisor mediated the positive relationship between individual perceptions of supervisors' transformational leadership and job satisfaction (i.e., a Level-1 mediation effect), while Hypothesis 5 predicted that trust in the team mediated the positive relationship between team perceptions of supervisors' transformational leadership and job satisfaction (i.e., a Level-2 mediation effect).

The significant relationships at Level 1 and Level 2 between transformational leadership and job satisfaction had already been established in testing Hypotheses 1 and 3. Following the CWC(M) approach, we next predicted the mediators trust in the supervisor and trust in the team from the team-mean centered Level-1 antecedent transformational leadership, while introducing transformational leadership also at Level 2. The relationship between transformational leadership and trust in the supervisor was significant at the individual level ($\gamma_{10} = 1.39$, $p < .001$) as well as at the team level ($\gamma_{01} = 1.59$, $p < .001$). Likewise, the relationship between transformational leadership and trust in the team was significant at the individual level ($\gamma_{10} = .41$, $p < .001$) as well as at the team level ($\gamma_{01} = .27$, $p < .05$).

Next, in order to establish the Level-1 mediation effect of trust in the supervisor and the Level-2 mediation effect of trust in the team, we predicted the Level-1 outcome job satisfaction from the team-mean centered Level-1 antecedent transformational leadership, while introducing transformational leadership also at Level 2, as well as the team-mean centered Level-1 mediator trust in the supervisor and the Level-2 mediator trust in the team. A single equation was used in order to account for the interrelatedness of the mediators and to determine their individual mediating effects. With the aim of differentiating mediation effects at individual and

team levels as suggested by Zhang and colleagues (2009), trust in the supervisor was also introduced into the equation at Level 2 and trust in the team served as a covariate at Level 1. On this basis, the following mediation effects were detected: The relationship between trust in the supervisor and job satisfaction was significant at the individual level ($\gamma_{20} = .35$, $p < .001$), also when trust in the supervisor was introduced at the team level ($\gamma_{02} = .14$, $p = .119$). Sobel's Z with robust standard errors confirmed that the Level-1 mediation effect of trust in the supervisor was significant (Sobel $Z = 5.70$, $p < .001$). Thus, Hypothesis 4 was fully supported. The relationship between trust in the team and job satisfaction was significant at the team level ($\gamma_{02} = .67$, $p < .001$), also when trust in the team was introduced at the individual level ($\gamma_{20} = .47$, $p < .001$). Sobel's Z with robust standard errors confirmed that the Level-2 mediation effect of trust in the team was significant (Sobel $Z = 2.42$, $p < .05$). Thus, Hypothesis 5 was fully supported.

According to Hypothesis 6, we expected the positive relationship between team perceptions of supervisors' transformational leadership and team performance to be mediated by trust in the team. The positive relationship between team perceptions of supervisors' transformational leadership and team performance had already been established in testing Hypothesis 2. Yet, OLS regression revealed that there was no significant relationship between trust in the team and team performance ($\beta = -.06$, $p = .79$). Thus, Hypothesis 6 was not supported.

All results are summarized in Table 2 (HLM) and Table 3 (OLS).

5. Discussion

Although supervisors are required to successfully lead individuals and teams, empirical findings about the multilevel nature of leadership and its outcomes have been largely lacking to date. Based on the assumption that transformational leadership comprises individual- and team-focused behaviors (Wang & Howell, 2010) and that shared mental models in teams are likely to converge over time (Dionne et al., 2010), we studied the relations between transformational leadership and relevant outcomes at individual and team levels of analysis, including investigations of mediators at both levels and cross-level effects. We believe that our study advances previous leadership research in a number of ways.

First, the presented research constitutes one of the few studies to have revealed the impact of transformational leadership on relevant outcomes at individual and team levels of analysis. In particular, we found a positive relationship of individual perceptions of supervisors' transformational leadership with an individual outcome (i.e., followers' job satisfaction), a positive relationship of team perceptions of supervisors' transformational leadership with a team outcome (i.e., team performance), and a cross level effect of team perceptions of supervisors' transformational leadership on individual followers' job satisfaction. That is, our findings provide empirical support for the notion that studies on (transformational) leadership should deliberately differentiate individual and team levels of analysis. This result is consistent with earlier claims to incorporate individual and team relations in leadership research (Schriesheim, Castro, Zhou, & DeChurch, 2006; Yukl, 1999).

Second, we provided empirical evidence that trust in the supervisor mediated the relationship between individual perceptions of supervisors' transformational leadership and job satisfaction, while trust in the team mediated the relationship between team perceptions of supervisors' transformational leadership and job satisfaction (cross-level mediation). These results extend earlier findings on the relevance of trust at multiple levels of analysis (Schaubroeck et al., 2011). Indeed transformational leadership appears to signal that the team is a trustworthy entity, such that team members develop similar (i.e., shared) perceptions of the

Table 2
Results of multilevel modeling analyses predicting job satisfaction, trust in the supervisor and trust in the team.

Dependent variable	Model 1		Model 2		Model 3		Model 4	
	Job satisfaction		Trust in the supervisor		Trust in the team		Job satisfaction	
Fixed effects								
Constant	1.61**	(0.47)	−1.22	(0.60)	1.94***	(0.52)	0.41	(0.43)
Level 1								
Transformational leadership	0.73***	(0.09)	1.39***	(0.09)	0.41***	(0.08)	0.02	(0.10)
Trust in the supervisor							0.35***	(0.06)
Trust in the team							0.47***	(0.07)
Level 2								
Scientific discipline 1	0.71	(0.38)	0.30	(0.33)	0.08	(0.26)	0.55	(0.29)
Scientific discipline 2	0.14	(0.15)	−0.05	(0.24)	−0.14	(0.17)	0.20	(0.11)
Supervisor tenure	0.19	(0.11)	0.15	(0.11)	0.06	(0.11)	0.15	(0.08)
Unit reputation	0.11	(0.07)	0.16*	(0.07)	0.19*	(0.08)	−0.03	(0.05)
Transformational leadership	0.64***	(0.09)	1.59***	(0.12)	0.27*	(0.10)	0.24	(0.16)
Trust in the supervisor							0.14	(0.09)
Trust in the team							0.67***	(0.12)
Random effects								
Level 1								
Intercept	0.34	(0.06)	0.69	(0.16)	0.60	(0.10)	0.13	(0.01)

Note. Level 1: $N = 360$; Level 2: $N = 39$. Robust standard errors are in parentheses.
* $p < .05$.
** $p < .01$.
*** $p < .001$ (two-tailed test).

Table 3
Results of Ordinary Least Squares (OLS) regression predicting team performance.

	Team performance		
	B	*SD*	β
Step 1			
Constant	−14.01	26.99	
Scientific discipline 1	−8.50	24.55	−.12
Scientific discipline 2	6.50	21.16	.11
Supervisor tenure	1.30	5.42	.05
Unit reputation	7.70	3.46	.41*
Constant	−79.88	40.37	
Scientific discipline 1	−11.36	22.97	−.17
Scientific discipline 2	6.70	19.77	.11
Supervisor tenure	2.08	5.08	.07
Unit reputation	7.43	3.23	.40*
Transformational leadership	18.38	8.80	.36*
R^2			.26
F			1.98
ΔR^2			.12*
ΔF			4.36*

Note. Level-2 $N = 28$.
* $p < .05$ (two-tailed test).

team's trustworthiness (Dionne et al., 2010; Wildman et al., 2012). These perceptions in turn contribute to individual followers' job satisfaction.

Yet, our data did not confirm the hypothesis that the relationship between team perceptions of supervisors' transformational leadership and team performance was mediated by trust in the team. This finding stands in contrast to previous work that reported trust to mediate the relations between transformational leadership and team performance (e.g., Schaubroeck et al., 2011). The deviation from earlier results may be explained by the fact that we focused on trust in the team (as opposed to trust in the supervisor) and, more importantly, employed an objective measure of team performance in order to meet concerns about subjective and potentially biased measures of outcome variables in leadership research (Dvir et al., 2002). Moreover, the finding emphasizes the instantaneous relationship between the motivating and inspiring behavior of transformational leaders and team performance, while trust in the team may rather influence additional, nevertheless important outcome variables in teams (e.g., lower levels of conflict). Finally, particularly in academic contexts, specific task-related teamwork processes, like knowledge sharing among team members, may be more relevant mediators of the relationship between transformational leadership and team performance than a general sense of trust in the team (Dionne et al., 2004).

Third, we empirically substantiated and extended theoretical propositions (Woods, 2007) and empirical findings (Brown & Moshavi, 2002) pertaining to the positive effects of transformational leadership on team performance in academia. Even though academic institutions shape the future of our society, and leadership as well as teamwork are likely to play an important role in these institutions, research in this context is largely lacking (Braun et al., 2009). Our study is the first to empirically demonstrate the impact of leadership on satisfaction and (objectively measured) performance in academic teams.

5.1. Practical implications

First, since our results underline the importance of transformational leadership at multiple levels, they should inspire supervisors to reflect on individual and team perceptions of their behavior and how transformational leadership can be facilitated at both levels. Earlier research shows that transformational leadership can be trained (Barling, Weber, & Kelloway, 1996). Our findings suggest that organizations should introduce training approaches that address transformational leader behavior at multiple levels (i.e., individual-directed and team-directed) in order to provide supervisors with necessary knowledge and skills.

Second, our results highlight the impact of trust. To begin with, supervisors ought to pay attention to establishing trust in the relationship with each team member. Moreover, it is important to note that transformational leadership positively influences trust among team members. Thus, it would be valuable to sensitize supervisors with regard to their considerable impact on team members' mutual trust. In particular, they are responsible for fostering an open climate of discussion and exchange with individual followers, as well as between followers working together in one team (Eisenbeiss et al., 2008), for example through continuous team reflection. Supervisors should also be aware of the downsides to their influence, since followers' perceptions of trust breach can have detrimental effects on team and organizational functioning (Schoorman, Mayer, & Davis, 2007).

Third, transformational leadership must be taken into account in hiring, promoting, and training supervisors in academic contexts. In particular, leadership development in academia, which suffers from several shortcomings to date (Peus, Braun, Weisweiler, & Frey, 2010; Rowley & Sherman, 2003; Smith & Hughey, 2006), would profit from implementing combined training and coaching approaches based on the transformational leadership concept (Braun et al., 2009). Overall, our results indicate that the academic context can serve as a role model for other organizations in the for-profit and not-for-profit sector, demonstrating the impact of a culture shaped by transformational leadership and trust at multiple levels.

5.2. Limitations and future research

Our study is not free of limitations that should be kept in mind when interpreting the findings. Since this is one of the first studies explicitly combining multilevel research of transformational leadership with mediating processes via trust in the supervisor and trust in the team, we strongly encourage researchers to further validate and extend our model. Future research is likely to benefit from paying particular attention to the following areas:

First, a major challenge for multilevel leadership research is the suitable assessment of leadership and related constructs (e.g., trust) at multiple levels. Schriesheim and colleagues (2009) criticized the Multifactor Leadership Questionnaire due to its item structure, which does not clearly differentiate individual-levels and team-levels of leader behavior. For future multilevel leadership research it is advisable to develop scales that deliberately capture either leader behavior directed toward single individuals or toward the entire team. While Wang and Howell (2010) made an initial step into this direction, further development and validation of measurement methods is clearly necessary (Yammarino, Schriesheim, Sosik, Jung, & Liu, 2012). In particular, multilevel analyses of leadership and team constructs require more detailed insights into perceptions and behaviors of individual team members to ensure the validity of conclusions drawn about team-level constructs. For this purpose, the use of qualitative approaches (Conger, 1998), like behavioral observation of teams, and comprehensive quantitative methods, like social network analysis (Zohar & Tenne-Gazit, 2008), represent necessary methodological advancements.

Second, our results are predominantly based on questionnaire data, which may be subject to common source and common method biases. We tried to reduce biases pertaining to single sources and common methods (Podsakoff et al., 2003) by applying two points of measurement and by using different response formats. In addition, a major strength of our study is the measurement of team performance via objective data (i.e., number of peer-reviewed publications weighted by journal impact). It may be criticized that this variable was available for a reduced sub-sample of academic teams only. However, the significant results obtained even in this sample underlined the impact of transformational leadership.

Third, investigations of our model in different cultural contexts are important. It is likely that western culture exhibited considerable influence on our results. The impact of transformational leadership has been tested in many different cultures (Judge et al., 2006). However, trust in the supervisor and among team members is sensitive to cultural differences (Casimir et al., 2006). Thus, it could be enlightening to further test the differential effects of trust in the supervisor and trust among team members in other (e.g., Asian) cultures.

Fourth, it would be interesting to broaden our model's theoretical focus concerning the proposed relevance of leadership in academia. Our model was restricted to the positive influence of transformational leadership on team performance and job satisfaction mediated by trust. Thereby, we neglected (a) other forms of leadership, (b) additional mediators, and (c) potential downsides to the proposed relationships. Overall, we know too little about functional and dysfunctional leader–follower relationships in academic contexts (Bryman, 2007). For instance, authentic leadership is likely to play a major role in academia (Peus, Wesche, Streicher, Braun, & Frey, 2012), a work setting which is driven by strong values. Through their work, many academics seek to contribute to improvements in our society (e.g., healthcare, environment, corporate social responsibility). It is viable to assume that they would be inspired and motivated by supervisors, who explicitly address these values (Peus, Kerschreiter, et al., 2010; Walumbwa & Schaubroeck, 2009). At the same time, we cannot rule out that transformational leaders in academia, who are not driven by ethical values, hold the power to exploit the motivation of value-driven followers for their own profit (e.g., increasing number of publications); a phenomenon corresponding to pseudo-transformational leadership or the 'dark side' of transformational leadership (Barling, Christie, & Turner, 2008). It would also be of interest to assess further mediating variables in future research that characterize the specific work environment. For instance, transformational leaders' positive emotional expressions may contribute to the stability of followers' mood in face of difficult situations (e.g., research project failure, manuscript rejection) with a potential to spread at the team level through mood contagion (Johnson, 2009). Also, research on substitutes of formal leadership (De Vries, Roe, & Taillieu, 2002), temporal characteristics (e.g., turnover and team stability; Shamir, 2011), and levels of task interdependence (Staples & Webster, 2008) as potential moderators would contribute to the understanding of facilitators and barriers to the relations between leadership and academic performance.

6. Conclusion

Despite the stated limitations, our study makes several substantial contributions to multilevel theory and research. We demonstrated that transformational leadership enhances job satisfaction and team performance at individual and team levels of analysis, and directed attention to relevance of trust among team members, in addition to trust in supervisors. Thereby, we presented important evidence of the impact of trust in the supervisor and the team at multiple levels, and depicted the positive relations of transformational leadership with an objective measure of team performance in academia. We hope that our results will enrich the field and inspire future multilevel leadership research.

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