Adapting Leadership Perceptions across Tasks: Micro-Origins of Informal Leadership Transitions

Alexandra (Sasha) Cook[1], Bertolt Meyer[1], Christine Gockel[2], & Alexander Zill[1]

[1]Chemnitz University of Technology, Germany

[2]SRH Hochschule Berlin, Germany

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Relational theories of leadership emphasize the relevance of dynamic changes of informal leadership structures in teams, especially when teams are confronted with new tasks. In this study, we examine how leadership perceptions change in a new task and focus on two potential moderators: interpersonal contact and perceived change in competence allocation. We confronted existing student teams with a new and non-routine task in the laboratory, during which we assessed team members' interpersonal face-to-face contact via infrared using wearable sensors. We conducted multilevel analyses focusing on leadership perceptions on the relational level as outcome. Results show that leadership perceptions were relatively stable across tasks. However, team members changed these leadership perceptions more if they had more interpersonal contact with others and if they perceived a shift in competence relations. We discuss theoretical implications regarding informal and shared leadership research and practical implications regarding leadership development, as well as team diagnostics and interventions.

Keywords: informal leadership, social sensing, leadership perceptions, teams, behavior

Introduction

A team's capacity to coordinate and modify its abilities, resources, and activities to deal with changing situational demands increasingly determines team performance (Burtscher, Wacker, Grote, & Manser, 2010). Current research suggests that a team's performance depends not only on the overall pattern of the leadership network (D'Innocenzo, Mathieu, & Kukenberger, 2014), but also on changes and developments of informal leadership over time (Drescher, Korsgaard, Welpe, Picot, & Wigand, 2014). Hence, the adaptive capability of a team is reflected in its ability to dynamically shift and change internal structures of influence, which depends on variability in a team's informal leadership network.

Informal leadership networks in teams are based on interpersonal perceptions of influence (Carter & Dechurch, 2012) that develop naturally when individuals collaborate in a group (White, Currie, & Lockett, 2016), and reflect subjective perceptions of influence rather than formal authority or power (Neubert & Taggar, 2004). Therefore, if researchers want to understand the dynamics of informal leadership adaptation and change, they need to understand the relational micro-origins on which team members' informal leadership perceptions are based and how they influence the interpersonal perceptions. The degree to which team members perceive each other as high or low in informal leadership can vary across perceivers (Emery, Calvard, & Pierce, 2013; Kenny, 1997; Malloy & Albright, 1990). Information processing theories (Lord, 1985; Lord & Alliger, 1985) propose that people base these perceptions on behavioral information that they have encoded and stored--a process that involves selective attention.

As leadership perceptions are judgments of targets by raters, they rely highly on the raters' retrieval of behavioral information about the targets, which is often stored in schematic ways based on categories and therefore do not necessarily reflect accurate descriptions of the objective behavioral stimuli. Changes in interpersonal perceptions are therefore only possible when the encoding of behavioral information leads to a reevaluation process and if the

respective behavioral information is incongruent with the previous categorization and perception of the target person (Lord, 1985). As updating evaluations of others requires cognitive effort (Fiske & Neuberg, 1990) and controlled, instead of automatic, information processing (Lord & Maher, 1993), it is unlikely that leadership perceptions change without new information about either the respective team member (Lord, 1985; Lord & Maher, 1993), or the situation or task (Aime, Humphrey, DeRue, & Paul, 2014) that makes it seem necessary to the rater.

To date, most of the existing studies do not construe informal leadership (structures) as a relational construct but summarize leadership ratings as team-level or individual-level constructs, which does not allow insight into the development and consequences of interpersonal relations and thereby the change of leadership perceptions. Additionally, up to this point, insights into temporal dynamics of informal leadership perceptions across time and contexts is sparse, as most of the existing research is of a cross-sectional nature (for an overview see Zhu, Liao, Yam, & Johnson, 2018). This static image of informal leadership also results from the assessments of leadership and intra-team processes with self-reports and questionnaires at a single point in time. This is especially critical when investigating varying interpersonal behaviors as predictors of leadership perceptions. Rater biases and categorization processes may impact the perception and rating of interpersonal behaviors (Lord, Binning, Rush, & Thomas, 1978; Phillips, 1984; Phillips & Lord, 1981), which constrains the validity of self-report data for the analysis of interpersonal dynamics.

We attend to these issues by applying a relational focus and by using a dyadic-level behavioral measure while examining the question of when and how people in teams adjust and adapt their perceptions of informal leadership. Drawing on Adaptive Leadership Theory (DeRue, 2011; DeRue & Ashford, 2010), as well as on theories of team adaptation (Burke, Stagl, Salas, Pierce, & Kendall, 2006; LePine, 2003; Zaccaro, Rittman, & Marks, 2001) and dynamic shifts in resources (Aime et al., 2014), we derive individual and relation-level

enablers and catalysts of transitions of leadership perceptions. We propose that dyadic social interactions as well as perceived shifts of competence allocation facilitate changes in team members' perceptions of informal leadership. Especially, a team's competence and expertise structure with respect to situational demands is relevant for the perception, interpretation, and response to novel environments (Barton & Bunderson, 2014; Marks, Zaccaro, & Mathieu, 2000). Thus, our study contributes to leadership and team research by providing evidence for the role of relational-specific interpersonal behavior in the development and adaptation of leadership perceptions. We further introduce objective face-to-face contact as an objective proxy of micro-level social interactions, extending the repertoire of what Meyer and colleagues (2016) call micro-level leadership behaviors. Consequently, we take a first step towards the investigation of behavioral team networks and their impact on perceptual outcomes and team adaptive capacity.

We examine transitions of leadership perceptions in existing student teams as a function of contextual change using a multilevel approach including teams, individuals, and dyadic relations as levels of analysis, therefore providing fine-grained insights into the changes in perceptions. In our study, we emphasize the key role of raters by considering perceiver-specific moderators of leadership change and attend to contextual change by analyzing the change of leadership perceptions across two different task contexts (routine and non-routine). During the non-routine task, we assess the interpersonal behavior by using wearable infrared sensors that provide objective behavioral data to separate observable behavior from its perception in the analysis.

Informal Leadership in Teams

Whenever people work collaboratively towards a common goal, structures of influence and leadership emerge naturally (White et al., 2016) and are crucial for team success (Hong, Catano, & Liao, 2011). The term *informal leadership* describes leadership relations that develop either in the absence of or in addition to structures of formal

hierarchical authority that are rooted in team members' social perceptions (Pielstick, 2000). Informal leadership is based on leadership perceptions, i.e. the magnitude to which team members subjectively attribute leadership to others and themselves.

Interpersonal and interaction aspects of informal leadership have increasingly moved into the focus of leadership research (Denis, Langley, & Sergi, 2012; White et al., 2016). Instead of viewing leadership as a collection of one-directional behaviors within formal hierarchies, theories such as Relational Leadership Theory (RLT, Uhl-Bien, 2006) and Adaptive Leadership Theory (DeRue, 2011; DeRue & Ashford, 2010) construe leadership as a collective phenomenon, which is based on dyadic relations (i.e., between two team members) and manifests as a structure of influence in social networks that can facilitate or constrain team action (Balkundi & Kilduff, 2006). A team's leadership network consists of a set of individuals (in social network analysis represented by nodes) and the perceived leadership relations between those individuals (represented by ties). Network indices describe the position and characteristics of individual actors in the network as well as the entire network structure (D'Innocenzo et al., 2014; Gockel & Werth, 2010).

Such network conceptualizations of team leadership are the focus of research on shared and emergent leadership. Shared leadership investigates how team-level network structures affect team processes and outcomes, whereas emergent leadership focuses on who emerges as an informal leader. Whereas shared leadership focuses on the magnitude and distribution of informal leadership in teams, as well as their predictors and outcomes, emergent leadership research primarily investigates individual-level antecedents of informal leadership emergence (Zhu et al., 2018). Prior studies identified personality traits such as extraversion (Emery et al., 2013), motivation to lead (Hong et al., 2011), need for power (Shaughnessy, Treadway, Breland, & Perrewe, 2016), and self-monitoring (Dobbins, 1990; Kilduff, Mehra, Gioia, & Borgatti, 2017), as well as cognitive abilities (Kickul & Neuman, 2000), emotion recognition abilities (Emery, 2012; Walter, Cole, der Vegt, Rubin, &

Bommer, 2012), narcissism (Brunell et al., 2008), and masculinity (Goktepe & Schneier, 1989) as being correlated with individual leadership emergence.

Target-specific traits, however, can predict leadership emergence at different points of time, as a longitudinal study shows that individuals with more covert and less immediately recognizable attributes, such as cognitive ability and motivation, are only perceived as leaders at later points in the team collaboration (Kalish & Luria, 2016). This is in line with information processing theories of leadership, which state that behavior that is congruent with the perceiver's leadership prototypes or schemas is encoded and memorized more easily (Lord & Maher, 1993). Hence, researchers have attributed the emergence of more masculine, dominant, extraverted, and charismatic individuals as leaders to social stereotypes that enable automated processing and a rapid development of leadership perceptions (Eagly & Karau, 1991; Lemoine, Aggarwal, & Steed, 2016; Offermann, Kennedy, & Wirtz, 1994), which may change over time and as a result of controlled processing (Lord & Maher, 1993).

However, because most studies are of cross-sectional nature, they cannot assess the dynamic nature of leadership within teams (Zhu et al., 2018). Furthermore, informal leadership research does not adequately reflect the reality of many teams in modern organizations, namely the necessity to quickly adapt to new tasks and environments (LePine, Colquitt, & Erez, 2000). Most of the insights from shared leadership and emergent leadership are static and context-dependent, resulting in a mismatch between methods and underlying theories that emphasize dynamics as leadership transitions among team members across contexts and tasks (Burke et al., 2006; Cox, Pearce, & Perry, 2003). Influence patterns in teams are complex, and shifts and changes over time and across tasks are crucial (e.g., in group-decision making processes; Stasser & Davis, 1981). For example, research on the Social Transition Scheme Model in the context of mock juries shows that a group`s first shift is strongly related to the final decision (Kerr, 1981). In the context of informal leadership, however, we know surprisingly little about the microdynamics and mechanisms of informal

leadership change and adaptation (Carter & Dechurch, 2012). Our study is therefore aimed at providing insights into the processes of leadership across different contexts; more specifically the micro-origins of leadership perception change when an existing team is faced with a new and non-routine task.

Stability and Change of Informal Leadership Perceptions

Changing tasks or environments may change the relative importance of team members' skills (Friedrich, Vessey, Schuelke, Ruark, & Mumford, 2009; Kozlowski et al., 2009; Marks et al., 2000). Thus, if a team is confronted with a new task, static leadership structures may have detrimental effects (DeRue, 2011). As dyadic perceptions among team members are the basis for informal leadership, it is a bottom-up emergent phenomenon (DeRue, 2011) and calls for multilevel-investigations of its processes (Zhang, Waldman, & Wang, 2012). This includes dyadic relations between actor and perceiver at the relational level. Therefore, to understand how team-level structures of informal leadership change and adapt, we need to investigate how, why, and when individuals change their perceptions of another individual's leadership.

Adaptive Leadership Theory (ALT; DeRue, 2011; DeRue & Ashford, 2010) emphasizes the role of dyadic interactions for the development and shaping of leadership perceptions. According to ALT, leadership relations do not develop from scratch with every new collaboration in a given dyad. Instead, past behavior and the resulting past leadership perceptions affect future behavior and perceptions (DeRue & Ashford, 2010), hence implying a certain degree of stability in dyadic leadership perceptions across different tasks. This is in part due to categorization processes (Rush, Phillips, & Lord, 1981) that impact perceptions of others' behaviors (DeRue & Ashford, 2010), especially regarding leadership (Epitropaki & Martin, 2005). Once individuals categorize others as leaders, they are more likely to perceive the behaviors of this person as being leader-like (DeRue & Ashford, 2010; Lord, Foti, & Phillips, 1982). Hence, even when a team is confronted with a new and different task, team

members will at least partially transfer their preexisting leadership perceptions into the new task, which is in line with research on member expertise on group decision making. Bonner, Baumann, & Dalal (2002) found that team members who were identified as the best problem-solvers have more influence in their team in comparison to other team members. This relationship between competence of team members and influence suggests that expertise is important for leadership perception, because influence is a key aspect of leadership behavior (DeRue, 2011; DeRue & Ashford, 2010). We therefore propose:

H1: In a team, dyadic leadership perceptions in a previous task are positively associated with leadership perceptions in a new task.

How do Leadership Perceptions Change? Social Interactions as Micro-Processes

In a new task, two team members that form a dyad (re-)negotiate informal leadership through the same processes that cause the initial development of leadership, namely a sequence of interpersonal interactions. In a specific dyadic relation (within a broader team context), behavioral interactions lead to the internalization of a leader or follower identity. The degree to which an individual internalizes the leader (or follower) role determines the relational leadership recognition, hence the perception of the other individual's leadership capacity or behavior (DeRue & Ashford, 2010). By applying these propositions to leadership perceptions (i.e. the recognition of the other's leading), we conclude that changes and adjustments in leadership perceptions occur as a function of within-dyad interpersonal behavior.

Many current conceptualizations of collective or pluralized leadership (Denis et al., 2012) share the presumption of some form of interpersonal relational behavior as the core of leadership perceptions. However, examinations of the specifics of these micro-level behaviors are rare and often vague (Meyer et al., 2016). While DeRue and Ashford (2010) propose reciprocal sequences of claiming and granting leadership as key processes, they note that these processes can consist of indirect behavioral cues that may "vary in their clarity and

visibility to others" (p. 633). As informal leadership lies in the "eye of the beholder" (McIntyre & Foti, 2013, p. 47), the processing of social information that occurs in interactions strongly depends on the perceiver and the interpretation of the behavior, which is affected by the perceivers' traits, dispositions, attitudes, and experiences (DeRue, 2011; Keller Hansbrough et al., 2015; Lord, 1985; Lord & Alliger, 1985). Yet in order to change the perception, new information is needed. If, for example, a team-member perceives another team member as not fitting with his or her cognitive schema of a leader, for example by being female, young, and timid (assuming the rater views a prototypical leader as male, older, and dominant) he or she will likely initially categorize the respective other person as follower or non-leader (Lord & Maher, 1993). Schema-incongruent behavior by the target (e.g. being dominant, being well-prepared, showing dedication; cf. Offermann et al., 1994), and making valuable propositions that influence the team's course of action, would challenge the rater's initial categorization (Lord & Maher, 1993).

As a consequence, predicting increases or decreases in leadership perceptions as a function of narrowly defined observable behaviors is difficult, if not impossible. However, the necessity of social interactions as an enabler of change in leadership perceptions persists. During social interaction, perceivers "distribute attention to various behavioral events . . . and build up memory representations about these events" (Malle & Pearce, 2001, p. 278), which leads to the generation and processing of information (Lichtenstein et al., 2007; Lord, 1985; Marion et al., 2016). Social interactions provide social information as they include verbal and nonverbal communication (e.g. eye gaze, head-body orientation, facial expression) between a sender and an observer (Beyan, Capozzi, Becchio, & Murino, 2016). The availability of such social information is crucial, as perceivers make their leadership judgments through a retrospective social-cognitive evaluation process (Lord, Day, Zaccaro, Avolio, & Eagly, 2017). According to ALT (DeRue, 2011; DeRue & Ashford, 2010), if there is no or sparse new social interaction between two individuals, the relation-specific internalized leadership

identities are not likely to change. However, to socially process behavioral information, it needs to be salient and visible (Fiske, Kenny, & Taylor, 1982) to the receiver.

We propose that one of the minimal requirements for experiencing social interactions in face-to-face teamwork (as opposed to, for example, virtual teams), regardless of their content, is face-to-face contact (i.e., a proximity with eye contact in which verbal and nonverbal behavioral cues can be detected). In other words, we construe face-to-face contact as a condition-sine-qua-non that constitutes a prerequisite for social interactions. Face-to-face contact increases the probability of relevant behavior being perceived and processed (Drolet & Morris, 2000). An absence of face-to-face contact means that there is an absence of new behavioral information about a target. As a result, perceivers need to revert to what they already know about another person instead of reevaluating their impression. When a team is confronted with a new task, we therefore expect change in leadership perceptions in those dyadic relations with high amounts of interaction, and stability of leadership perceptions in dyadic relations with little interaction during the new task. When a team member, who has been previously rated by another as low (high) in leadership, and has only little face-to-face contact with the respective other, his or her rating of the other's leadership regarding the new task should also be low (high). Deviations from the stability across tasks, namely that a change of perceptions of another team member from low (high) in leadership to high (low), are therefore more likely if there is more face-to-face contact within the dyad. We therefore propose the following:

H2: The strength of the association between dyadic leadership perceptions in a previous task and leadership perceptions in a new task is moderated by face-to-face-contact within the dyad. This association is stronger when there is only little face-to-face contact, and weaker when there is a high amount of face-to-face contact within the dyad.

When do Leadership Perceptions Change? The Role Perceived Shifts in Competence Allocation

Whereas face-to-face contact enables the re-evaluation of informal leadership by providing new social information, leadership perceptions are also more likely to change as a function of contextual or task change (DeRue & Ashford, 2010). The notion that different environments and tasks call for shifts in and transference of leadership is a key idea in shared or collective leadership theories, which state that shifts in leadership should occur in accordance with team members' task expertise (e.g., Burke, Fiore, & Salas, 2003; Carter & Dechurch, 2012; Pearce, Hoch, Jeppesen, & Wegge, 2010).

Team adaptation theories provide assumptions regarding cognitive mechanisms and processes that enable a team to reconfigure the task network (cf. Crawford & LePine, 2013), learn new processes, or to modify the existing processes to deal with environmental changes and challenges, such as non-routine tasks (e.g., Burke et al., 2006; Klein, Ziegert, Knight, & Xiao, 2006; Kozlowski, Gully, Nason, & Smith, 1997). This entails changes to team members' mental models (Burke et al., 2003), especially of team member expertise, to meet the situational demands (Barton & Bunderson, 2014). When task-relevant expertise, or rather critical information about how to deal with different tasks, is distributed among the team members (Hollenbeck et al., 1995), static adherence to team processes and plans can have detrimental effects due to the escalation of commitment and poor error detection and management (Kalmanovich-Cohen, Pearsall, & Christian, 2018), especially when the need for a certain kind of expertise is not constant during the entire collaboration and multiple tasks (Faraj & Sproull, 2000).

Individual assessments of the teams' competence and expertise structure provide the cognitive basis for the perception, interpretation, and response to novel environments (Marks et al., 2000). Therefore, team members estimate the degree to which they themselves and the other team member possess the expertise and knowledge to deal with specific situational demands (Aime et al., 2014; Barton & Bunderson, 2014). Research on team member expertise in group decision making suggests that the recognition of expertise is positively related to

reliance on the best team member and to how often teams defer to their best team member (Baumann & Bonner, 2004). For example, team members who were identified as being the best problem solvers in the team showed more influence within their team in contrast to other team members (Bonner et al., 2002). When the context changes, a team member's expertise can become more relevant when dealing with the situation at hand, leading to a shift in the competence distribution or hierarchy within the team and, subsequently, to changes in behavioral expressions and their perception by other team members (Aime et al., 2014). Thus, when perceiving a shift in situational demands, an individual is more likely to question the legitimacy of team members' behaviors and actions based on their resources and relevance in order to deal with the demands, therefore initiating a "meaning-making process" (Aime et al., 2014, p. 334) of team positions and structures. To further illustrate the relevance of this assumption, if a task is novel, yet can be dealt with by team routines and standard operating procedures (Lei, Waller, Hagen, & Kaplan, 2016), team members should neither perceive a shift in competence allocation, nor change their perceptions of legitimacy of actions, nor should they subsequently engage in a re-evaluation process of the team's social structure.

Team members can react differently to situational and contextual demands (Barton & Bunderson, 2014) and to the location of the necessary resources within the team (Aime et al., 2014). When confronted with a new situation, team members "will detect different cues and assign slightly different meanings dependent on existing knowledge structures and each member's vantage point" (Burke et al., 2006, p. 1194), which leads to individual estimations of novelty, information elaboration, and reflection of the existent distribution of competence in the team (van Ginkel & van Knippenberg, 2009). Additionally, individual team members can have different degrees of motivation to engage in re-evaluation processes (Barton & Bunderson, 2014), as adapting one's own mental model of the team is cognitively effortful (LePine, 2003). Experiencing the need and necessity to re-evaluate one's own perceptions of others in terms of competence should also enable less schematic and more controlled

information processing in terms of leadership evaluations (Lord, 1985). During controlled processing, perceivers encode more behavior that they can then memorize and use to revise impressions, which especially applies to schema-inconsistent behavior (Lord & Maher, 1993).

Research on perceived competence and informal leadership further supports the association between cognitive representations of the team and emerging leadership structures (DeRue, Nahrgang, & Ashford, 2015). Building on insights from team adaptation, we propose a perceiver-focused approach to what DeRue (2011) describes as contextual change. Keeping the notion that leadership "depends in part on the perceptual processes of followers" (Lord & Alliger, 1985, p. 47), we propose that it is not the situational change itself which triggers change in leadership perceptions, but a perceived shift in the team's competence structure. Perceivers are more likely to change and adapt their perceptions of leadership (in either direction) if they experience changing situational demands which lead to a shift in the allocation of resources that are necessary to deal with the demands. Individuals who perceive their existing perception of resource allocation in the team to be adequate for the novel situational context should be less motivated to engage in the re-evaluation of interpersonal behaviors and the social structure of the team. Therefore, the perceptions of leadership should remain stable. This leads to a multi-level model of the process leading from situational change to changes in leadership perceptions (see Figure 1).

In summary, a shift in perceived competence allocation requires the perceiver's motivation to actively update his or her assessments of others and thereby to act as a proxy for more controlled instead of automatic processing (Barton & Bunderson, 2014) and the perception that the expertise that is required to tackle the new task is not located in the same way as in the previous task. We hypothesize that the perception of a shift in the competence allocation in a new task (Burke et al., 2006) initiates changes in leadership perceptions. Thus, when one team member rates another as low (high) in leadership in a previous task and that he or she perceives that the allocation of task-relevant competencies and resources within the

team remains stable across task, the rating of the other's leadership in the new task should also be low (high). Initially low (high) leadership ratings should therefore only increase (decrease) when the respective rater experiences a change of the allocation of competence within the team (see Figure 2). We therefore propose:

H3: The strength of the association between dyadic leadership perceptions in a previous task and leadership perceptions in a new task is moderated by the rater's perception of a competence shift within the team. This association is strongest when the rater perceives the competence structure as being stable across tasks and weaker when the rater perceives a strong shift of competence within the team.

Method

Overview and Sample

We recruited 37 existing undergraduate student teams, each consisting of three (12 teams) or four (25 teams) students, over the course of two winter terms at a German university. The teams were formed in mandatory seminars on experimental research methods and worked as teams within the course over a semester. As a part of their curriculum, the teams planned and conducted an experimental study. The specific tasks included researching literature, formulating hypotheses, designing a study to test the hypotheses, recruiting participants, gathering data, analyzing, and interpreting data, and writing a research report that was graded at the end of the semester. Team sizes (i.e., the number of 3 and 4-person teams) were determined by the lecturers according to enrollment numbers. Students selected specific research topics and were then asked to assemble teams on their own according to their research topic.

A total of 133 students agreed to participate in the study. Due to absent values, the data of 3 participants could not be included in the study. The mean age of the remaining 130 participants was 21.88 years (SD = 2.49), with 76.2% female participants (n = 99) and 23.8% male participants (n = 31). Approximately two thirds (67.7%) of the participants were

psychology students, while the other participants studied physics with a special focus on cognitive psychology. The majority of participants (84.6%) were in their third semester at the university. Recruitment took place in early December, after the students had been working together in their teams for eight weeks. All participants received credit points for their participation in the study. In addition, the students had a chance to win a 100 Euro gift certificate for their team.

Baseline Assessment (T0)

Approximately two weeks after recruiting, we sent an online survey to participants to assess demographic and baseline data by using the online tool Limesurvey (Limesurvey GmbH, n.d.). Participants were asked to indicate their own initials, the initials of their lecturer, and the initials of their team members. This allowed us to match the individual data to the respective teams. We informed participants about the necessity to assess this data for the study at the beginning of the survey. However, we explicitly informed participants about the possibility of discontinuing their participation in the study at any point, that the initials would be deleted after matching the data, and that the data would be handled by the examiners (the first author and two student research assistants) only. After participants provided their team members' initials, we asked about the competence hierarchy within the team, as well as their leadership perceptions of all other team members. These measures, which we will describe in detail below, were collected again after the laboratory measurement (T1).

Laboratory Measurement (T1)

Laboratory assessments began one week after the baseline assessment. Whereas the teams' ongoing task in the seminar required skills and knowledge about research design and data analyses, we chose a laboratory task that required knowledge about statics and practical skills in construction. The teams were confronted with a new team task in the laboratory, as they had to build a paper bridge in accordance with specific instructions. The instructions were embedded in a story, explaining the laboratory setup and the task. The groups were

asked to build a new bridge for a fictional town. They were instructed to build the bridge at the marked spot (X), using only the materials found on a table in the corner of the room.

The instructions included the minimum measurements for the bridge (at least one meter high and 30 cm wide) and specified that no part of the bridge was allowed to touch the floor within a marked space that symbolized a river. As the laboratory task was embedded in a competition, we defined specific criteria for the teams to determine the winner of the gift certificate. The bridge needed to fulfill the minimum height and width criteria and had to be as stable as possible while using as few sheets of paper as possible. Additionally, the teams could lose points by making mistakes during the building process. Mistakes included: stepping into the river markings or crossing the river anywhere but at a marked area, dropping or placing any material within, or handing or throwing material across the river markings. Every sheet of paper used by the teams needed to be marked on the dash list. We placed the instructions, a notepad, and a pencil on a table in the corner of the room, along with a sign which asked the teams to not remove the notepad from the table. Across the room, there was a one-meter wide space marked with duct tape (the river). Within the river, and approximately in the middle of the room, an x marked a spot on the floor. In close proximity to the door, additional markings formed a narrow path that led across the river. On the other side of the river, there was a second table with additional material (one pair of scissors, one roll of masking tape, 100 sheets of large white paper, a folding rule and a dash list).

Teams participated one team at a time. Upon arrival, team members were asked for their consent to make video and audio recordings. After collecting the consent forms, the examiner gave limited information about the assessment, namely that the group would be given 75 minutes to complete a task, where to find the exact instructions, and that the respective examiner would be in the room next door, which was separated from the laboratory by a one-way mirror. The use of mobile phones was prohibited and the participants were asked to turn them off or keep them in their bags. All participants then received written

information about the sociometric badges, the wearable sensors used in the study (see below for detailed description). All participants gave written consent to audio and video recordings and to the data assessment with the sociometric badges. Subsequently, the examiner equipped each participant with a badge and noted the initials of the team members along with the individual badge numbers. The 75 minutes to work on the task started immediately after the examiner left the room. As there was no clock in the room, the remaining time was announced via speaker every 15 minutes. Once the time was up, the examiner re-entered the laboratory and collected the sociometric badges. The teams then measured the height and width of their bridge and tested their stability by placing small weights onto the bridge until it collapsed. Subsequently, the participants filled out a paper-pencil follow-up questionnaire on their satisfaction with their team's performance, and their perceptions of leadership during the task.

Measures

Informal leadership perceptions. Every team member reported his or her perception of every other team member's informal leadership in a round-robin assessment at t0 and immediately after the laboratory task (T1). Participants stated the initials of the respective target prior to the rating to ensure the correct attribution of the data to the respective team members. We assessed informal leadership using the General Leadership Questionnaire (GLI, Cronshaw & Lord, 1987; Lord, Foti, & De Vader, 1984). The GLI is a five-item questionnaire that asks participants to state the perceived amount of leadership exhibited by another team member and whether the participant would choose this member as a leader in a future team task on a five-point Likert-type scale. In the introductory text, we specifically asked the participants to rate the respective team member with respect to the ongoing collaboration during the seminar (T0) and the collaboration in the laboratory task (T1). The ratings therefore reflect situation context-specific evaluations, rather than general impressions. The scale showed good internal consistencies at T0 (α = .89) and T1 (α = .87).

Face-to-face contact. To assess the time spent in face-to-face contact, we equipped the team members with sociometric badges, which are small devices (ca. 9.5cm x 6cm x 1.3cm) that are worn with a strap around the neck by the participants. These devices are equipped with an accelerometer, microphones, Bluetooth technology, and an infrared sensor (Kim, McFee, Olguín Olguín, Waber, & Pentland, 2012; Olguín Olguín, 2007). The built-in infrared sensors can detect one another when they are less than a meter apart and when they are directly aligned (maximum 15° angle; Olguín Olguín, 2007). Infrared detection of face-to-face interactions is not possible if the signal is interrupted by physical barriers (Chaffin et al., 2017). The validity of the infrared signal detection as measure of face-to-face contact has been established in several studies (Chaffin et al., 2017; Cook & Meyer, 2017), and due to the small size and light weight of the devices, they did not constitute a communication barrier. The examiner adjusted the length of the straps individually to ensure that all badges were located at the same height. The infrared detection data is saved on the devices' internal storage, and the information on the number and the length of the detections between each pair of badges is computed by the software provided by the manufacturer (Sociometric Solutions, 2014). We used the overall duration of contact in seconds within a dyad as measure of face-to-face contact in our analyses. All participants read an information sheet about the sociometric badges and the types of built-in sensors prior to the laboratory task.

Perceived shift in competence structure. We assessed perceived shift in competence structure between the established team task and the new team task by asking participants about perceived changes in competence relations among the team members by means of competence hierarchies. Therefore, we assessed the perceived competence hierarchy at T0 and T1. Participants ranked all members of their team according to their task-relevant expertise regarding the ongoing seminar task (T0) and the bridge-building task (T1). As the rankings were forced-choice and each ranking position could only be given to one team member, we treated the rankings as ordinal-scaled variables, meaning that the intervals

between ranks were not treated as being equally large. We chose this form of assessment over individual round-robin Likert-type ratings of competence to capture the perceived competence relations and to avoid error of central tendencies. We computed a Kendall rank correlation coefficient (Hollander, Wolfe, & Chicken, 2014; Kendall, 1938) for each rater indicating the association between the two rank orders. Kendall's tau values range between -1 and +1 with high coefficients indicating a high association between two rankings. We used the inverted variables as the measure of competence shift in our further analysis, so that higher values indicate a high perceived shift in the rater's perception of competence hierarchy (M = -.24, SD = .53).

Control variables. We controlled for *team size* (3 or 4 members) and *team completeness* on the team level. Team completeness refers to whether the entire seminar team participated in the study. To acquire as many teams as possible for the study, we included teams when at least 3 team members agreed to take part. Ten of the 3-person teams had been working together previously as teams of four. We included completeness as a nominal variable in the analyses. As some groups finished the task before the 75 minutes were over, we additionally controlled for the *work time* in minutes spent on the task.

We also included *gender* (Eagly & Karau, 1991; Lord, Phillips, & Rush, 1980) and *age* as possible control variables for both the rater and the target. To rule out any possible influence based on sympathy or *friendship*, we asked the participants to state whether they considered the respective targets as friends. Additionally, as we had created a competition between the teams, we decided to control for team performance, as we assumed that failing in the team task could lead to a possible bias in the (post-task assessed) leadership perceptions. As the teams knew only whether they themselves had accomplished the task and were given no information on the performance of the other teams, we controlled for the individual subjective satisfaction with the team's performance. The participants stated their *satisfaction regarding the teams' task performance* by means of a single item: "Please indicate your

satisfaction with your team's overall performance", which they answered via a 5-point Likert-type scale from 1 (very low) to 5 (very high).

Missing data. Due to technical difficulties with the badges and missing answers on the paper-and-pencil questionnaire following the laboratory team task, we had to exclude the data of 2 raters, which resulted in a different number of raters and targets. Our data set consisted of 338 data points on the dyadic rating level (level 1), with 128 raters and 130 targets, which were organized in 37 teams.

Results

Descriptive Analyses

Prior to hypothesis testing, we conducted a correlation analysis of all data nested within the same measurement level (Table 1). On the team level (N = 37), team size was positively correlated with work time, r = .27, p < .01. On the rater level (N = 128), team performance satisfaction and perceived competence shift were positively and significantly correlated, r = .21, p < .01. On the relational level (N = 338), baseline leadership perceptions (T0GLI) and post-task leadership perceptions, r = .60, p < .01, as well as face-to-face contact and post-task leadership perceptions, r = .14, p < .05, were significantly correlated. Additionally, we found a positive correlation between friendship and baseline leadership perceptions, r = .16, p < .05. As a supplementary analysis, we correlated the GLI scores at T1 and T2 with the respective dyadic competence rankings. As the rankings were ordinally scaled within different team sizes, we computed the percentage of team members ranked below the target by the target as measure for the correlation analyses. T1 GLI ratings (Level 1) were significantly correlated with the competence ranking at both T1, r = .43, p < .01, and T2, r = .26, p < 0.01. Similarly, T2 GLI ratings were also significantly correlated with competence rankings at T1, r = .38, p < .01, and T2, r = .53, p < .01.

Intraclass-coefficients (ICC) of the leadership perceptions showed that leadership ratings within teams were non-independent at T0, ICC(1) = .08, F(36,301) = 1.85, p < .01,

and T1, ICC(1) = .06, $F(36,301) = 1.61$, $p = .02$. Teams were also distinguishable from each other regarding leadership ratings at T0, ICC(2) = .46 and T1, ICC(2) = .38. Within raters, the ICC values of leadership ratings did not indicate non-independence at either T0, ICC(1) = .03, $F(127,210) = 1.07$, $p = .33$, or T1, ICC(1) < .01, $F(127,210) = 1.00$, $p = .50$. Raters were not distinguishable regarding their leadership ratings at T0, ICC(2) = .06, and T1, ICC(2) < .01. However, we found significant within-target interdependence of ratings at T0, ICC(1) = .58, $F(129,208) = 4.62$, $p < .001$, and T1, ICC(1) = .48, $F(129,208) = 3.45$, $p < .001$, and targets were distinguishable regarding their received ratings at T0, ICC(2) = .71, and T1 ,ICC(2) = .71. We additionally analyzed whether teams were distinguishable regarding the perceived shift in competence structure. Within teams, perceptions of shift in the team's competence structure were non-independent, ICC(1) = .35, $F(36, 301) = 5.96$, $p < .01$, and teams differed in their members' perceptions of competence shifts, ICC(2) = .83.

Analytical Approach

Due to the cross-level nature of Hypothesis 2 and the hierarchical organization of the data set, we tested the hypotheses with mixed models using the lme4 package (Bates, Mächler, Bolker, & Walker, 2014) of the R environment (R Development Core Team, 2015). The analyses span three levels: the relational rating level, the individual level (i.e. the rater and target level), and the team level. As individuals both rate and are rated by their team members, we decided to nest observations in raters and, independently, in targets on level two. As the raters and targets are nested in teams, we specified three-level models with crossed random effects (Baayen, Davidson, & Bates, 2008) on level two. To illustrate the approach, example team X (level 3) has three members A, B, and C (level 2), resulting in three dyads (A and B, B and C, A and C). As illustrated in Figure 3, each dyad produces two dyadic ratings. Within the dyad consisting of A and B, one rating is made about individual A by individual B and vice versa. In the example, each individual functions as rater in two dyadic relational ratings, resulting in six different ratings I to VI on level 1 (Figure 3).

Additionally, each individual is also the target of two ratings. For example, ratings III and V refer to individual A as target. As the perception of a shift in competence is measured on the rater level and leadership ratings are not target-independent as shown by the intraclass-coefficients, there is an indication for crossed random effects models, as they allow rater-and target-specific intercepts (and slopes) to vary freely.

As a next step, we fitted simple models including only z-standardized pre-change leadership perceptions (T0 GLI) as predictor and post-change leadership perceptions (T1 GLI) as outcome and added random effects step-by-step to identify the best fitting baseline model by comparing model fit indices. Due to the formulation of hypotheses and predictors on the rater-level, we decided to begin with a model that includes all three clustering variables; rater, target, and team. We further specified three models, each including random slopes for one of the levels and compared the AIC and BIC criteria to each other and, subsequently, whether the best-fitting random-slopes model fit the data better than the random-intercept-only model. A model with random slopes for raters fit the data significantly better compared to the random-intercept-only model, $\mathbf{\Delta}\ \chi_{(2)}^2 = 7.67$, $p = .02$. A further addition of random slopes for teams, target, or both did not fit the data better. We therefore identified a 3-level random intercept and slopes model with crossed random effects on level 2 (raters and targets) as baseline model for hypotheses testing, allowing the slopes to vary freely between raters.

Tests of Hypotheses

We tested our hypotheses in a step-wise fashion. In model 1, we added the control variables and the level 1 and level 2 predictors to the baseline model. In model 2, we added both two-way interactions (see Table 2). We z-standardized all numerical variables before fitting the models. Pre-task leadership perceptions, operationalized as baseline scores in the General Leadership Questionnaire (GLI) predicted post-task leadership perceptions (T1 GLI) across all models, therefore supporting Hypothesis 1.

In line with Hypothesis 2, time spent in face-to-face contact moderated the association between baseline leadership perceptions and post-task leadership perceptions, as the interaction was significant in model 2. To analyze the slopes, we plotted the interaction (Figure 4) and conducted simple slope tests with the online tool by Preacher, Curran, and Bauer (2006). In the figure, strong stability between T0 and T1 leadership would constitute a 45° angular slope. The shape of the interaction partly supports Hypothesis 2: The association pre- and post-task leadership perceptions is strongest when the amount of face-to-face contact is low. When the amount face-to-face contact is high, it significantly weakens the association between pre- and post-task leadership perceptions, however only if initial leadership perceptions are low, - 1 *SD*, $z = 2.38$, $p = .02$. When initial perceptions of leadership are high, there is no moderating effect of face-to-face contact, + 1 *SD*, $z = -.52$, $p = .60$. Therefore, Hypothesis 2 was supported for low baseline leadership perceptions only.

The significance of the interaction term in model 2 indicates support for the proposed moderation effect of perceived shift in competence on leadership perception change in Hypothesis 3. The higher the perceived competence shift, operationalized as a change in competence hierarchy between the previous task and the laboratory task, the weaker the association between baseline leadership perceptions and post-task leadership perceptions; see Figure 5. However, whereas the effect of perceived competence shift on change in leadership perceptions was significant when pre-task perceptions were low, $z = -1.98$, $p < .05$, it was only marginally significant if pre-task perceptions of leadership were high, $z = 1.94$, $p = .05$. Therefore, we found support for Hypothesis 3, yet only for low baseline perceptions of leadership.

To evaluate the explained variance, we computed R^2_{GLMM} values that quantify the variance explained by the models' fixed factors (Nakagawa & Schielzeth, 2013) by using the R-package MuMIn (Burnham & Anderson, 2002). The increase of marginal pseudo-R^2 by 3% due to the added two-way interactions is in fact small. However, moderators in social science

field studies typically account for 1% to 3% of variance and can be considered relevant at 1% explained variance (Champoux & Peters, 1987; Evans, 1985; Zhang et al., 2012).

Beyond hypotheses testing, we found a consistent significantly positive effect of the raters' satisfaction with the team performance and post-task leadership perceptions across all three models. Neither time spent in face-to-face contact, nor the perceived competence shift or any of the other control variables had any direct effect on the outcome.

Discussion

By observing the change of leadership perceptions within teams across tasks, we can summarize our results into three key findings. First, individuals do not begin to develop leadership perceptions from scratch when they are faced with a new task. Indeed, as proposed in Adaptive Leadership Theory (DeRue, 2011), we discovered relative stability of leadership perceptions across tasks. Baseline (pre-task) leadership perceptions were the strongest predictor of post-task leadership perceptions in all analyzed models. Second, we found that face-to-face contact impacts the strength of the association between pre-task and post-task leadership perceptions. This finding is also in line with Adaptive Leadership Theory, as it implicates the necessity of an interpersonal exchange between two members of a specific dyad for re-evaluations or adaptation of leadership perceptions. These results are however limited to low baseline leadership levels of leadership perceptions. The amount of face-to-face contact did not impact the strong link between baseline and post-task leadership perceptions if the rater perceived the target as being high in leadership prior to the task. Third, our findings shed light onto the effect of individually perceived context on changes in leadership perception. The association between baseline and post-task leadership perceptions is weaker when the rater perceives a shift in competence relations. The shape of the cross-level interaction indicates that, if a rater experiences that the new context changes the allocation of competence necessary to deal with the task, the association between his or her relation-specific baseline and post-task will be weaker.

Implications for Informal Leadership Research

How and when do we change our perceptions of leadership? Our results support the assumption that leadership is indeed a complex interpersonal adaptive process which is socially constructed and driven by interactions within relations (DeRue, 2011). Keeping within the framework of the social constructivist approach proposing the subjective interpretation of social interaction as a sense-making process (DeRue, 2011), we specified that some social exchange must occur in order to give the rater new information about the leadership of a specific other. Indeed, we discovered that face-to-face contact as a proxy for social interaction increased the probability of a leadership re-evaluation process, therefore stressing the relevance of behavior as a causal factor determining structure. Hence, we change our perceptions through gaining new behavioral information via interpersonal face-to-face contact. In conclusion, it is not what a person does that causes the other's perception of him or her as a leader, but what occurs within a dyad. Our results emphasize the need to attend to the relational level when investigating leadership processes in teams.

However, we were able to identify areas in which leadership perceptions were unaffected by interpersonal behavior. Our findings suggest that once someone has reached a certain leadership status in the eyes of another, this status is not easily lost. Individuals who were perceived as being high in leadership by the respective peer were also perceived as such in the new task, irrespective of the amount of interaction. This finding implies the occurrence of categorization processes (Lord et al., 1982; Phillips, 1984) as they implicate that individuals encode behavior differently when concerning persons whom they have already categorized as leaders. Although DeRue and Ashford (2010) incorporate the relevance of categorization processes based on implicit leadership theories into their theoretical assumptions, they do not limit them to high leadership, but rather consider their effects equal to implicit followership theories. The authors state that individuals are more likely to grant someone a leader or follower identity when he or she sees a consistency between their own

implicit leadership or implicit followership theories. However, we found increased stability for high baseline leadership perceptions only. This implies that low leadership perceptions may not equal high followership perceptions. Although social-cognitive theories are gaining interest in organizational research (Epitropaki, Sy, Martin, Tram-Quon, & Topakas, 2013),there is a lack of conceptualization, especially regarding informal followership. Hence, "definitions of followership are also often constructed in terms of how the concept relates to leadership" (Crossman & Crossman, 2011, p. 482). If the categorization of a person as a follower was complementary to the recognition as a leader, meaning that being recognized as a follower was defined as not being recognized as a leader, we should have found a similar effect of stability for individuals who were previously perceived as being low in leadership by their peers. Therefore, our results do not indicate that perceivers automatically categorize persons that are low in leadership as followers, but that they are open to potential re-evaluation and to the increase in their perception of a team-member's leadership. We therefore conclude that low leadership perceptions do not negate the potential capacity of leadership. Team members may indeed give others a second chance to make an impression as a leader if they gather new information through interaction.

Our additional focus on the perceptions of shifts of the competence allocation and their role in leadership perception change and adaptation adds to Adaptive Leadership Theory. It emphasizes the key role of the perceivers' situational assessment for leadership perception stability and change. We confronted all teams in our study with the same non-routine task that required skills that were very different to those needed for their ongoing seminar task. The change in leadership perceptions was however dependent on whether or not the team members perceived the new task to cause the allocation of task-relevant competence within the team to shift. A shift in the perceived allocation of task-relevant resources as a perceiver-specific cognitive appraisal of the team situation appears to trigger a re-evaluation of leadership perceptions. Furthermore, our results indicate that it is in fact not the changing task

or its demands that induce the re-evaluation of leadership, but rather individual evaluations as to whether the existing team structures are appropriate to deal with the demands. Individually perceived competence structures as an element of individual team and situation mental models (Burke et al., 2003) are not necessarily accurate or congruent to those of the other team members. As the cognitive representations determine transitions of leadership perceptions however, their accuracy (Burke et al., 2003), as well as influencing factors such as cognitive ability and motivation on the individual level (LePine, 2003) and congruence on the team level (Burke et al., 2003), should be more strongly included in informal leadership theories and research. In this context, future research should also examine the influence of self-perceived competence and leadership (van Quaquebeke, van Knippenberg, & Brodbeck, 2011) on a person's cognitive representation of the appropriate team-structure to deal with the situational demands. Additionally, we should put a focus on possible reciprocal effects between leadership structures and mental models over time (McIntyre & Foti, 2013). In our sample, the in-team consensus with respect to the perception of competence shifts was high, however the teams had been working closely together for several months. Over the course of their collaboration, the groups' knowledge about the competences within the teams increases, while routines and structures develop and manifest (Drescher et al., 2014; Kozlowski & Chao, 2012), which should affect the dynamics of informal leadership in teams. We therefore strongly suggest to include the duration of the group's collaboration as a possible moderator of informal leadership transitions in future research. Our supplemental analysis of the correlation between perceived competence and perceived leadership supports the findings from previous research (e.g., Rubin, Bartels, & Bommer, 2002). As our hypotheses focused on the perceived shift of competence allocation of the team as a whole using a forced choice ranking system, future research should attend to the individual level predictors of competence stability across tasks, for example the general cognitive ability.

We found team performance satisfaction to be a strong predictor of leadership performance. The more satisfied the team members were with the final performance of their team, the higher they rated their team members' leadership. Distinguishing perceptions of leadership behavior as the exertion of influence from the evaluations of the results and effects of leadership is a critical issue in leadership research (Meyer et al., 2016; van Knippenberg & Sitkin, 2013). When asked to state their perceptions of leadership, individuals might not be able to distinguish between the behavioral information and cognitive evaluations, or the affective reaction following a task. Although the subjects were unaware of the other teams' performances regarding the stability of the construction, several teams did not succeed in building a self-standing bridge and were therefore fully aware that their team could not win the competition. In tasks with ambiguous performance criteria or without immediate performance feedback, performance satisfaction should have a lower impact on leadership perceptions. A suggestion for future research is therefore to attend to the immediacy and clarity of team performance and to control for individual performance satisfaction in tasks with clear outcomes of success or failure.

Our final contribution is of a methodological nature. In line with the recent call for more objective measures of micro-level leadership behaviors (Meyer et al., 2016), we applied an automated sensor-based measure of dyadic social interaction. The wearable devices used in this study, the sociometric badges (Kim et al., 2012; Olguín Olguín, 2007) allowed the participants to move freely within the laboratory and did not hinder the movement. The behavioral data that was captured by the badges was saved on the internal memory card and was easily accessible for evaluation. However, the utilization of social sensing measures needs to be carefully considered as being dependent on the study setting, team size, and on the type of sensor. In our case, the team size was small, the examiner observed the teams through a one-way mirror, and video and audio recordings were made. We will further discuss the

application of sensor-based measurements for non-laboratory settings in the following limitations section.

Limitations

Despite the interesting findings and the advantage to study leadership in existing teams within their ongoing collaboration, our study does have a few limitations. The first limitation pertains to the new team task. Although we chose a task that required a very different set of skills and knowledge in comparison to the previous (and ongoing) team task, the teams were fully aware that the new task was for research purposes only. In contrast to their collaboration within the seminar, which was scored as an element of their overall grade, the team members knew that a failure to complete the new task would not result in any serious consequences. Although we attempted to address this issue by adding a competitive element in the form of a 100 Euro gift certificate for the best team, we cannot assume that the team members approached the task with the same attitude as they would have a new task or challenge within their coursework. In addition, the team members were aware that changes within the team's coordination structure by the new task were only temporary, as they would return to their task status quo afterwards, which may have led to a weaker motivation when re-evaluating the existing structures. Future research, that includes changing tasks of equal importance and applying them over longer periods of time could also address issues such as the role of team members' prototypicality (Hogg, van Knippenberg, & Rast, 2012), respectively the role of deviations from the group norms in changes of leadership perceptions.

The second limitation refers to the assessment of social interactions in general, and face-to-face contact in particular, via infrared sensors. Infrared detection is a rather conservative measure as the sensors require a strict alignment, especially when only one sensor is used. Previous research implies that infrared detection may lead to false negative values if the individuals who are wearing the sociometric badges are not directly facing each other when co-located (Chaffin et al., 2017). However, we based our choice of infrared

detection over the less conservative Bluetooth assessment on the specifics of the laboratory setting. Bluetooth is indeed more reliable when assessing co-location in field settings over longer periods of time. During our laboratory task, all four (three) members were in the same 20m² room. The longest possible distance between two team members within the room could have been no more than 7 meters, if they stood in two diagonally opposing corners of the room. Even using a very conservative Bluetooth detection threshold, the limited space would have led to a risk of co-location overreporting (cf. Chaffin et al., 2017), especially since Bluetooth detection does not take the alignment into consideration (i.e., whether two individuals in proximity are actually facing each other; Olguín Olguín, 2007).

Finally, although we recruited real teams in contrast to ad hoc teams for laboratory purposes, the student sample is very homogenous when it comes to team sizes, age, professional background, and experience, which questions the applicability to action teams or knowledge-based teams. Both of these are often confronted with changing or uncertain environments, especially knowledge-based teams consist of team members with various backgrounds and different expertise and experience.

Practical Implications

Our findings provide several interesting implications for practice, especially for team management and team coaching. First, they highlight the importance of observing interactions within dyadic relations as a promising tool for team diagnostics. Behavioral models of team coaching focus on aiding teams towards the development of effective team behaviors by analyzing the team's behavior, giving the team feedback on their behavior, and helping the team members to practice new and helpful behavior (Hackman & Wageman, 2005). However, many established instruments in team behavior diagnostics are based on self-reports in the form of questionnaires (Wageman, 2005), therefore risking measuring team outcomes instead of behavioral processes (Rosen et al., 2010). Hence, the identification of objectively assessed dyadic interactions could be included in the initial team observations, as they can provide

valuable information on the informal leadership structure. Team managers or coaches can use objective measures of interaction to visualize what actually happens within the team and derive possible starting points for interventions, for example in terms of increasing dyadic interaction between team members with different backgrounds, skills, and abilities. Also, as a part of training and practicing team behavior, encouraging team members to interact with team members who are perceived as non-leaders, for example within a simulation, could allow the team members to experience adjustments in their leadership perceptions, therefore enabling the team as a whole to collect experience in adapting to novel situations. This is in line with evidence from research on team training, which suggests that the adaptive capacity of a team is best trained by confronting teams with disruptive non-routine situations which "counteract habituation and procedural rigidity associated with team interaction" (Gorman, Cooke, & Amazeen, 2010, p. 297).

Additionally, applying objective measurement of social interactions by means of wearable sensors, such as the sociometric badges, can support team trainings by providing a time-economic way of visualizing team interaction processes. Team training approaches that use simulations, such as in healthcare contexts (Burtscher et al., 2010; Rosen et al., 2010), could benefit from this form of measurement. The interaction data gathered by the sensors is rapidly available and can be depicted in the form of interaction networks. Visualizing team behavior and, more importantly, potential changes in team behavior in such a way may aid trainers, coaches, or team managers in monitoring change processes and the team itself by providing visual descriptive feedback on their interpersonal behavior (Dorsey, Russell, Keil, van Buskirk, & Schuck, 2009). This is in line with best practice recommendations regarding simulation-based training, which suggest multisource assessment of data on actual interpersonal processes (Rosen et al., 2008; Salas, Rosen, Held, & Weissmuller, 2009).

Conclusion

Our research builds on the call for microlevel origins of social structures in general and leadership structures in particular (Kilduff et al., 2017; Meyer et al., 2016) by identifying two key factors that affect leadership perception evolvement and change over time. By occupying a perceiver-specific point of view and integrating theories of leadership development and team adaptation, we provide a fine grain view of relational leadership processes. Our findings emphasize the necessity of including relational measurements, especially regarding behavioral interaction data, as well as individual cognitive representations of the team and the context into informal leadership research. Additionally, we demonstrate advantages of the inclusion of observable behavioral data captured objectively by social sensing in investigating dynamic processes of leadership perception development.

References

Aime, F., Humphrey, S., DeRue, D. S., & Paul, J. B. (2014). The riddle of heterarchy: Power transitions in cross-functional teams. *Academy of Management Journal*, *57*, 327–352. doi:10.5465/amj.2011.0756

Baayen, R. H., Davidson, D. J., & Bates, D. M. (2008). Mixed-effects modeling with crossed random effects for subjects and items. *Journal of Memory and Language*, *59*, 390–412. doi:10.1016/j.jml.2007.12.005

Balkundi, P., & Kilduff, M. (2006). The ties that lead: A social network approach to leadership. *The Leadership Quarterly*, *17*, 419–439. doi:10.1016/j.leaqua.2006.01.001

Barton, M. A., & Bunderson, J. S. (2014). Assessing member expertise in groups. *Organizational Psychology Review*, *4*, 228–257. doi:10.1177/2041386613508975

Bates, D., Mächler, M., Bolker, B., & Walker, S. (2014). Fitting linear mixed-effects Models using lme4. *Journal of Statistical Software*, *67*, 1–48. doi:10.18637/jss.v067.i01

Baumann, M. R., & Bonner, B. L. (2004). The effects of variability and expectations on utilization of member expertise and group performance. *Organizational Behavior and Human Decision Processes*, *93*, 89–101. doi:10.1016/j.obhdp.2003.12.004

Beyan, C., Capozzi, F., Becchio, C., & Murino, V. (2016). Identification of emergent leaders in a meeting scenario using multiple kernel learning. Paper presented at the *2nd Workshop on Advancements in Social Signal Processing for Multimodal Interaction 2016, ASSP4MI 2016 - Held in Conjunction with the 18th ACM International Conference on Multimodal Interaction 2016, ICMI 2016*. doi:10.1145/3005467.3005469

Bonner, B. L., Baumann, M. R., & Dalal, R. S. (2002). The effects of member expertise on group decision-making and performance. *Organizational Behavior and Human Decision Processes*, *88*, 719–736. doi:10.1016/S0749-5978(02)00010-9

Brunell, A. B., Gentry, W. A., Campbell, W. K., Hoffman, B. J., Kuhnert, K. W., &

Demarree, K. G. (2008). Leader emergence: The case of the narcissistic leader. *Personality and Social Psychology Bulletin*, *34*, 1663–1676. doi:10.1177/0146167208324101

Burke, C. S., Fiore, S. M., & Salas, E. (2003). The role of shared cognition in enabling shared leadership and team adaptibility. In C. L. Pearce & J. A. Conger (Eds.), *Shared leadership: Reframing the hows and whys of leadership* (pp. 103–122). Thousand Oaks, CA: Sage Publications.

Burke, C. S., Stagl, K. C., Salas, E., Pierce, L., & Kendall, D. (2006). Understanding team adaptation: A conceptual analysis and model. *Journal of Applied Psychology*, *91*, 1189–207. doi:10.1037/0021-9010.91.6.1189

Burnham, K. P., & Anderson, D. R. (2002). *Model selection and multimodel inference: A practical information-theoretic approach.* New York, NY: Springer Verlag.

Burtscher, M. J., Wacker, J., Grote, G., & Manser, T. (2010). Managing nonroutine events in anesthesia: The role of adaptive coordination. *Human Factors*, *52*, 282–294. doi:10.1177/0018720809359178

Carter, D. R., & Dechurch, L. A. (2012). Networks: The way forward for collectivistic leadership research. *Industrial and Organizational Psychology*, *5*, 412–415. doi:10.1111/j.1754-9434.2012.01470.x

Chaffin, D., Heidl, R., Hollenbeck, J. R., Howe, M., Yu, A., Voorhees, C., & Calantone, R. (2017). The promise and perils of wearable sensors in organizational research. *Organizational Research Methods*, *20*, 3–31. doi:10.1177/1094428115617004

Champoux, J. E., & Peters, W. S. (1987). Form, effect size, and power in moderated regression analysis. *Journal of Occupational Psychology*, *60*, 243–255. doi:10.1111/j.2044-8325.1987.tb00257.x

Cook, A. (S.), & Meyer, B. (2017). Assessing leadership behavior with observational and sensor-based methods: A brief overview. In B. Schyns, P. Neves, & R. Hall (Eds.),

Handbook of methods in leadership research (pp. 73–102). Cheltenham, UK: Edward Elgar Publishing.

Cox, J. F., Pearce, C. L., & Perry, M. L. (2003). Toward a model of shared leadership and distributed influence in the innovation process: How shared leadership can enhance new product development, team dynamics, and effectiveness. In C. L. Pearce & J. A. Conger (Eds.), *Shared leadership: Reframing the hows and whys of leadership* (pp. 48–76). Thousand Oaks, CA: Sage Publications.

Cronshaw, S. F., & Lord, R. G. (1987). Effects of categorization, attribution, and encoding processes on leadership perceptions. *Journal of Applied Psychology*, *72*, 97–106. doi:10.1037//0021-9010.72.1.97

Crossman, B., & Crossman, J. (2011). Conceptualising followership: A review of the literature. *Leadership*, *7*, 481–497. doi:10.1177/1742715011416891

D'Innocenzo, L., Mathieu, J. E., & Kukenberger, M. R. (2014). A meta-analysis of different forms of shared leadership-team performance relations. *Journal of Management*, *42*, 1964–1991. doi:10.1177/0149206314525205

Denis, J.-L., Langley, A., & Sergi, V. (2012). Leadership in the plural. *Academy of Management Annals*, *6*, 211–283. doi:10.1080/19416520.2012.667612

DeRue, D. S. (2011). Adaptive leadership theory: Leading and following as a complex adaptive process. *Research in Organizational Behavior*, *31*, 125–150. doi:10.1016/j.riob.2011.09.007

DeRue, D. S., & Ashford, S. (2010). Who will lead and who will follow? A social process of leadership identity construction in organizations. *Academy of Management Review*, *35*, 627–647. doi:10.5465/AMR.2010.53503267

DeRue, D. S., Nahrgang, J. D., & Ashford, S. J. (2015). Interpersonal perceptions and the emergence of leadership structures in groups: A network perspective. *Organization Science*, *26*, 1192–1209. doi:10.1287/orsc.2014.0963

Dobbins, G. H. (1990). The role of self-monitoring and gender on leader emergence: A laboratory and field study. *Journal of Management*, *16*, 609–618. doi:10.1177/014920639001600306

Dorsey, D., Russell, S., Keil, C., van Buskirk, W., & Schuck, P. (2009). Measuring teams in action: Automated performance measurement and feedback in simulation-based. In E. Salas, G. F. Goodwin, & C. S. Burke (Eds.), *Team effectiveness in complex organizations: Cross-disciplinary perspectives and approaches* (pp. 351–381). New York, NY: Taylor and Francis.

Drescher, M. A., Korsgaard, M. A., Welpe, I. M., Picot, A., & Wigand, R. T. (2014). The dynamics of shared leadership: Building trust and enhancing performance. *Journal of Applied Psychology*, *99*, 771–783. doi:10.1037/a0036474

Drolet, A. L., & Morris, M. W. (2000). Rapport in conflict resolution: Accounting for how nonverbal exchange fosters cooperation on mutually beneficial settlements to mixed-motive conflicts. *Journal of Experimental Social Psychology*, *36*, 26–50.

Eagly, A., & Karau, S. (1991). Gender and the emergence of leaders: A meta-analysis. *Journal of Personality and Social Psychology*, *60*, 685–710.

Emery, C. (2012). Uncovering the role of emotional abilities in leadership emergence. A longitudinal analysis of leadership networks. *Social Networks*, *34*, 429–437. doi:10.1016/j.socnet.2012.02.001

Emery, C., Calvard, T. S., & Pierce, M. E. (2013). Leadership as an emergent group process: A social network study of personality and leadership. *Group Processes & Intergroup Relations*, *16*, 28–45. doi:10.1177/1368430212461835

Epitropaki, O., & Martin, R. (2005). From ideal to real: A longitudinal study of the role of implicit leadership theories on leader-member exchanges and employee outcomes. *Journal of Applied Psychology*, *90*, 659–676. doi:10.1037/0021-9010.90.4.659

Epitropaki, O., Sy, T., Martin, R., Tram-Quon, S., & Topakas, A. (2013). Implicit leadership

and followership theories ‘in the wild’: Taking stock of information-processing approaches to leadership and followership in organizational settings. *Leadership Quarterly, 24,* 858–881. doi:10.1016/j.leaqua.2013.10.005

Evans, M. G. (1985). A Monte Carlo study of the effects of correlated method variance in moderated multiple regression analysis. *Organizational Behavior and Human Decision Processes, 36,* 305–323. doi:10.1016/0749-5978(85)90002-0

Faraj, S., & Sproull, L. (2000). Coordinating expertise in software development teams. *Management Science, 46,* 1554–1568. doi:10.1287/mnsc.46.12.1554.12072

Fiske, S. T., Kenny, D. A., & Taylor, S. E. (1982). Structural models for the mediation of salience effects on attribution. *Journal of Experimental Social Psychology, 18,* 105–127. doi:10.1016/0022-1031(82)90046-4

Fiske, S. T., & Neuberg, S. L. (1990). A continuum of impression formation, from category-based to individuating processes: Influences of information and motivation on attention and interpretation. *Advances in Experimental Social Psychology, 23,* 1–74. doi:10.1016/S0065-2601(08)60317-2

Friedrich, T. L., Vessey, W. B., Schuelke, M. J., Ruark, G. A., & Mumford, M. D. (2009). A framework for understanding collective leadership: The selective utilization of leader and team expertise within networks. *Leadership Quarterly, 20,* 933–958. doi:10.1016/j.leaqua.2009.09.008

Gockel, C., & Werth, L. (2010). Measuring and modeling shared leadership. *Journal of Personnel Psychology, 9,* 172–180. doi:10.1027/1866-5888/a000023

Goktepe, J. R., & Schneier, C. E. (1989). Role of sex, gender roles, and attraction in predicting emergent leaders. *Journal of Applied Psychology, 74,* 165–167. doi:10.1037//0021-9010.74.1.165

Gorman, J. C., Cooke, N. J., & Amazeen, P. G. (2010). Training adaptive teams. *Human Factors, 52,* 295–307. doi:10.1177/0018720810371689

Hackman, J. R., & Wageman, R. (2005). A theory of team coaching. *Academy of Management Review*, *30*, 269–287. doi:10.5465/AMR.2005.16387885

Hogg, M. A., van Knippenberg, D., & Rast, D. E. (2012). The social identity theory of leadership: Theoretical origins, research findings, and conceptual developments. *European Review of Social Psychology*, *23*, 258–304. doi:10.1080/10463283.2012.741134

Hollander, M., Wolfe, D. A., & Chicken, E. (2014). *Nonparametrical Statistical Methods*. New York, NY: John Wiley.

Hollenbeck, J. R., Ilgen, D. R., Sego, D. J., Hedlund, J., Major, D. A., & Phillips, J. (1995). Multilevel theory of team decision making: Decision performance in teams incorporating distributed expertise. *Journal of Applied Psychology, 80*, 292–316. doi:10.1037/0021-9010.80.2.292

Hong, Y., Catano, V. M., & Liao, H. (2011). Leader emergence: The role of emotional intelligence and motivation to lead. *Leadership & Organization Development Journal*, *32*, 320–343. doi:10.1108/01437731111134625

Kalish, Y., & Luria, G. (2016). Leadership emergence over time in short-lived groups: Integrating expectations states theory with temporal person-perception and self-serving bias. *Journal of Applied Psychology, 101*, 1474–1486. doi:10.1037/apl0000126

Kalmanovich-Cohen, H., Pearsall, M. J., & Christian, J. S. (2018). The effects of leadership change on team escalation of commitment. *Leadership Quarterly*, 0–1. doi:10.1016/j.leaqua.2018.03.004

Keller Hansbrough, T., Lord, R. G., Schyns, B. (2015). Reconsidering the accuracy of follower leadership ratings. *Leadership Quarterly*, *26*, 220–237. doi:10.1016/j.leaqua.2014.11.006

Kendall, M. G. (1938). A new measure of rank correlation. *Biometrika*, *30*, 81–93. doi:10.1093/biomet/30.1-2.81

Kenny, D. A. (1997). PERSON: A general model for understanding interpersonal perception, *Personality and Social Psychology Review*, *8*, 265–280. doi:10.1207/s15327957pspr0803_3

Kerr, N. L. (1981). Social transition schemes: Charting the group's road to agreement. *Journal of Personality and Social Psychology*, *41*, 684–702. doi:10.1037/0022-3514.41.4.684

Kickul, J., & Neuman, G. (2000). Emergent leadership behaviors: The function of personality and cognitive ability in determining teamwork performance and KSAS. *Journal of Business and Psychology*, *15*, 27–51. doi:10.1023/A:1007714801558

Kilduff, M., Mehra, A., Gioia, D. A., & Borgatti, S. (2017). Brokering trust to enhance leadership: A self-monitoring approach to leadership emergence. In J. Glückler, E. Lazega, & I. Hammer (Eds.), *Knowledge and Networks* (pp. 221–240). Chamn, Switzerland: SpringerOpen. doi:10.1007/978-3-319-45023-0

Kim, T., McFee, E., Olguín Olguín, D., Waber, B., & Pentland, A. (2012). Sociometric badges: Using sensor technology to capture new forms of collaboration. *Journal of Organizational Behavior*, *33*, 412–427. doi:10.1002/job

Klein, K. J., Ziegert, J. C., Knight, A. P., & Xiao, Y. (2006). Dynamic delegation: Shared, hierarchical, and deindividualized leadership in extreme action teams. *Administrative Science Quarterly*, *51*, 590–621. doi:10.2189/asqu.51.4.590

Kozlowski, S. W. J., & Chao, G. T. (2012). The dynamics of emergence: Cognition and cohesion in work teams. *Managerial and Decision Economics*, *33*, 335–354. doi:10.1002/mde.2552

Kozlowski, S. W. J., Gully, S. M., Nason, E. R., & Smith, E. M. (1997). Developing adaptive teams: A theory of compilation and performance across levels and time. In D. R. Ilgen & D. Pulakos (Eds.), *The changing nature of work and performance: Implications for staffing, personnel actions, and development* (pp. 253–305). Greenwich, CT: JAI Press.

Kozlowski, S. W. J., Watola, D. J., Jensen, J. M., Kim, B. H., Botero, I. C., Nowakowski, J. M., . . .Botero, I. C. (2009). Developing adaptive teams: A theory of dynamic team leadership. In E. Salas, G. F. Goodwin, & C. S. Burke (Eds.), *Team effectiveness in complex organizations: Cross-disciplinary perspectives and approaches* (pp. 113–155). Mahwah, NJ: LEA. doi:10.4324/9780203889312

Lei, Z., Waller, M. J., Hagen, J., & Kaplan, S. (2016). Team adaptiveness in dynamic contexts: Contextualizing the roles of interaction patterns and in-process planning. *Group & Organization Management*, *41*, 491–525. doi:10.1177/1059601115615246

Lemoine, G. J., Aggarwal, I., & Steed, L. B. (2016). When women emerge as leaders: Effects of extraversion and gender composition in groups. *Leadership Quarterly*, *27*, 470–486. doi:10.1016/j.leaqua.2015.12.008

LePine, J. A. (2003). Team adaptation and postchange performance: Effects of team composition in terms of members' cognitive ability and personality. *Journal of Applied Psychology*, *88*, 27–39. doi:10.1037/0021-9010.88.1.27

LePine, J. A., Colquitt, J. A., & Erez, A. (2000). Adaptability to changing task contexts: Effects of general cognitive ability, conscientiousness, and openness to experience. *Personnel Psychology*, *53*, 563–593. doi:10.1111/j.1744-6570.2000.tb00214.x

Lichtenstein, B. B., Uhl-Bien, M., Marion, R., Seers, A., Orton, J. D., & Schreiber, C. (2007). Complexity leadership theory: An interactive perspective on leading in complex adaptive systems. *Emergence: Complexity and Organization, 8*, 2-12. doi:10.emerg/10.17357.289e129e99e80aa333abfde5fb792d3d

Limesurvey GmbH. (n.d.). Limesurvey. Hamburg, Germany.

Lord, R. G. (1985). An information processing approach to social perceptions, leadership and behavioral measurement in organizations. In L. L. Cummings & B. M. Staw (Eds.), *Research in organizational behavior* (pp. 87–128). Greenwich, CT: JAI Press.

Lord, R. G., & Alliger, G. M. (1985). A comparison of four information processing models of

leadership and social perceptions. *Human Relations, 38*, 47–65. doi:10.1177/001872678503800103

Lord, R. G., Binning, J. F., Rush, M. C., & Thomas, J. C. (1978). The effect of performance cues and leader behavior on questionnaire ratings of leadership behavior. *Organizational Behavior and Human Performance*, *21*, 27–39. doi:10.1016/0030-5073(78)90036-3

Lord, R. G., Day, D. V, Zaccaro, S. J., Avolio, B. J., & Eagly, A. H. (2017). Leadership in applied psychology: Three waves of theory and research. *Journal of Applied Psychology*, *102*, 434–451. doi:10.1037/apl0000089

Lord, R. G., Foti, R. J., & De Vader, C. L. (1984). A test of leadership categorization theory: Internal structure, information processing, and leadership perceptions. *Organizational Behavior and Human Performance*, *34*, 343–378. doi:10.1016/0030-5073(84)90043-6

Lord, R. G., Foti, R. J., & Phillips, J. S. (1982). A theory of leadership categorization. In J. G. Hunt, U. Sekaran, & C. A. Schriesheim (Eds.), *Leadership: Beyond establishment views* (pp. 104–121). Cabondale: Southern Illinois Press.

Lord, R. G., & Maher, K. J. (1993). *Leadership and Information Processing: Linking Perceptions and Performance*. London, England: Routledge.

Lord, R. G., Phillips, J., & Rush, M. (1980). Effects of sex and personality on perceptions of emergent leadership, influence, and social power. *Journal of Applied Psychology*, *65*, 176–182. doi:10.1037/0021-9010.65.2.176

Malle, B. F., & Pearce, G. E. (2001). Attention to behavioral events during interaction: Two actor-observer gaps and three attempts to close them. *Journal of Personality and Social Psychology*, *81*, 278–294. doi:10.1037/0022-3514.81.2.278

Malloy, T. E., & Albright, L. (1990). Interpersonal perception in a social context. *Journal of Personality and Social Psychology*, *58*, 419–428.

Marion, R., Christiansen, J., Klar, H. W., Schreiber, C., Akif Erdener, M., & Erdener, M. A. (2016). Informal leadership, interaction, cliques and productive capacity in

organizations: A collectivist analysis. *The Leadership Quarterly*, *27*, 242–260. doi:10.1016/j.leaqua.2016.01.003

Marks, M. A., Zaccaro, S. J., & Mathieu, J. E. (2000). Performance implications of leader briefings and team-interaction training for team adaptation to novel environments. *Journal of Applied Psychology*, *85*, 971–986. doi:10.1037/0021-9010.85.6.971

McIntyre, H. H., & Foti, R. J. (2013). The impact of shared leadership on innovation performance. *Group Processes & Intergroup Relations*, *16*, 46–57. doi:10.1177/1368430211422923

Meyer, B., Burtscher, M. J., Jonas, K., Feese, S., Arnrich, B., Tröster, G., & Schermuly, C. C. (2016). What good leaders actually do: Micro-level leadership behaviour, leader evaluations, and team decision quality. *European Journal of Work and Organizational Psychology*, *25*, 773–789. doi:10.1080/1359432X.2016.1189903

Nakagawa, S., & Schielzeth, H. (2013). A general and simple method for obtaining R2 from generalized linear mixed-effects models. *Methods in Ecology and Evolution*, *4*, 133–142. doi:10.1111/j.2041-210x.2012.00261.x

Neubert, M. J., & Taggar, S. (2004). Pathways to informal leadership: The moderating role of gender on the relationship of individual differences and team member network centrality to informal leadership emergence. *Leadership Quarterly*, *15*, 175–194. doi:10.1016/j.leaqua.2004.02.006

Offermann, L. R., Kennedy, J. K., & Wirtz, P. W. (1994). Implicit leadership theories: Content, structure, and generalizability. *Leadership Quarterly*, *5*, 43–58. doi:10.1016/1048-9843(94)90005-1

Olguín Olguín, D. (2007). Sociometric badges: Wearable technology for measuring human behaviors (Master's thesis, Massachusetts Institute of Technology). Retrieved from https://dspace.mit.edu/handle/1721.1/42169

Pearce, C. L., & Conger, J. A. (2003). All those years ago. The historical underpinnings of

shared leadership. In C. L. Pearce & J. A. Conger (Eds.), *Shared leadership: Reframing the hows and whys of leadership* (pp. 1–18). Thousand Oaks, CA: Sage Publications.

Pearce, C. L., Hoch, J. E., Jeppesen, H. J., & Wegge, J. (2010). New forms of management: Shared and distributed leadership in organizations. *Journal of Personnel Psychology, 9*, 151–153. doi:10.1027/1866-5888/a000022

Phillips, J. S. (1984). The accuracy of leadership ratings: A cognitive categorization perspective. *Organizational Behavior and Human Performance*, *33*, 125–138. doi:10.1016/0030-5073(84)90015-1

Phillips, J. S., & Lord, R. G. (1981). Causal attributions and perceptions of leadership. *Organizational Behavior and Human Performance*, *28*, 143–163. doi:10.1016/0030-5073(81)90020-9

Pielstick, C. D. (2000). Formal vs. informal leading: A comparative analysis. *Journal of Leadership Studies, 7*, 99–114. doi:10.1177/107179190000700307

Preacher, K. J., Curran, P. J., & Bauer, D. J. (2006). Computational tools for probing interactions in multiple Linear regression, multilevel modeling, and latent curve analysis. *Journal of Educational and Behavioral Statistics*, *31*, 437–448.

R Development Core Team. (2015). R: A language and environment for statistical computing, version 3.2.3 Computer software. Retrieved from http://www.r-project.org

Rosen, M. A., Salas, E., Wilson, K. A., King, H. B., Salisbury, M., Augenstein, J. S., . . . Birnbach, D. J. (2008). Measuring team performance in simulation-based training: Adopting best practices for healthcare. *Simulation in Healthcare: Journal of the Society for Simulation in Healthcare, 3,* 33–41. doi:10.1097/SIH.0b013e3181626276

Rosen, M. A., Weaver, S. J., Lazzara, E. H., Salas, E., Wu, T., Silvestri, S., . . . King, H. B. (2010). Tools for evaluating team performance in simulation-based training. *Journal of Emergencies, Trauma, and Shock*, *3*, 353–359.

Rubin, R. S., Bartels, L. K., & Bommer, W. H. (2002). Are leaders smarter or do they just

seem that way? Exploring perceived intellectual competence and leadership emergence. *Social Behavior and Personality*, *30*, 105–118. doi:10.2224/sbp.2002.30.2.105

Rush, M. C., Phillips, J. S., & Lord, R. G. (1981). Effects of a temporal delay in rating on leader behavior descriptions: A laboratory investigation. *Journal of Applied Psychology*, *66*, 442–450. doi:10.1037/0021-9010.66.4.442

Salas, E., Rosen, M. A., Held, J. D., & Weissmuller, J. J. (2009). Performance measurement in simulation-based training. *Simulation & Gaming*, *40*, 328–376.

Shaughnessy, B. A., Treadway, D. C., Breland, J. W., & Perrewe, P. L. (2016). Informal leadership status and individual performance: The roles of political skill and political will. *Journal of Leadership & Organizational Studies*, *24*, 83–94. doi:10.1177/1548051816657983

Sociometric Solutions. (2014). *Sociometric Badge 03-02. Preliminary User Guide.* Boston, MA: Author.

Stasser, G., & Davis, J. H. (1981). Group decision making and social influence: A social interaction sequence model. *Psychological Review*, *88*, 523–551. doi:10.1037/0033-295X.88.6.523

Uhl-Bien, M. (2006). Relational leadership theory: Exploring the social processes of leadership and organizing. *Leadership Quarterly*, *17*, 654–676. doi:10.1016/j.leaqua.2006.10.007

van Ginkel, W. P., & van Knippenberg, D. (2009). Knowledge about the distribution of information and group decision making: When and why does it work? *Organizational Behavior and Human Decision Processes*, *108*, 218–229. doi:10.1016/j.obhdp.2008.10.003

van Knippenberg, D., & Sitkin, S. B. (2013). A critical assessment of charismatic—transformational leadership research: Back to the drawing board? *Academy of Management Annals*, *7*, 1–60. doi:10.1080/19416520.2013.759433

Van Quaquebeke, N., Van Knippenberg, D., & Brodbeck, F. C. (2011). More than meets the eye: The role of subordinates' self-perceptions in leader categorization processes. *Leadership Quarterly*, *22*, 367–382. doi:10.1016/j.leaqua.2011.02.011

Wageman, R. (2005). Team diagnostic survey: Development of an instrument. *Journal of Applied Behavioral Science*, *41*, 373–398. doi:10.1177/0021886305281984

Walter, F., Cole, M. S., der Vegt, G. S. Van, Rubin, R. S., & Bommer, W. H. (2012). Emotion recognition and emergent leadership: Unraveling mediating mechanisms and boundary conditions. *Leadership Quarterly*, *23*, 977–991. doi:10.1016/j.leaqua.2012.06.007

White, L., Currie, G., & Lockett, A. (2016). Pluralized leadership in complex organizations: Exploring the cross network effects between formal and informal leadership relations. *Leadership Quarterly*, *27*, 280–297. doi:10.1016/j.leaqua.2016.01.004

Zaccaro, S. J., Rittman, A. L., & Marks, M. a. (2001). Team leadership. *Leadership Quarterly*, *12*, 451–483. doi:10.1016/S1048-9843(01)00093-5

Zhang, Z., Waldman, D. A., & Wang, Z. (2012). A multilevel investigation of leader- member exchange, informal leader emergence, and individual and team performance. *Personnel Psychology*, *65*, 49–78. doi:10.1111/j.1744-6570.2011.01238.x

Zhu, J., Liao, Z., Yam, K. C., & Johnson, R. E. (2018). Shared leadership: A state-of-the-art review and future research agenda. *Journal of Organizational Behavior*, 1–19. doi:10.1002/job.2296

Table 1
Descriptive statistics of and Pearson correlations between the study variables

	N	*M*	*SD*	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. L3 Team size	37												
2. L3 Completeness	37			-.80**									
3. L3 Worktime	37	74.25		.27**	.10								
4. L2 Age (rater)	128	21.86	2.47	.06	-.19	-.30^{+}							
5. L2 Sex (rater)	128			.25	-.16	-.12	.24**						
6. L2 Satisfaction	128	3.84	1.06	.03	.21	.01	.01	-.10					
7. L2 Competence Shift	128	.25	.51	.12	.20	.06	.06	.03	.21**				
8. L1 Friendship	338			.18	-.08	.11	-.18*	.01	.00	.03			
9. L1 T0 GLI	338	3.42	.84	-.37*	.38*	.07	-.12	-.16^{+}	.11	.14	.16*		
10. L1 F2f contact	338	981.12	564.51	-.36*	.55**	.15	-.08	-.06	.13	-.05	.06	.10	
11. L1 T1 GLI	338	3.56	.76	-.37*	.50**	.05	-.10	.13	.37**	.16^{+}	.08	.60**	.14*

$^{+}$ $p < .01$, * $p < .05$, ** $p < .01$; T0: Baseline measurement, T1: Measures within and after the laboratory task; L3 = variable assessed on the team level, L2 = variable assessed in the individual (rater) level, L1 = variable assessed on the relational level; Group size coded 1 = 3 members, 2 = 4 members; Completeness coded 1 = no missing member: 2 = 1 missing member; Worktime stated in minutes; Sex coded 1 = female, 2 = male, friendship coded 0 = no friendship, 1 = friendship; GLI = General leadership impression, F2f = time spend in face-to-face contact (seconds), Correlations between variables on different levels computed with the mean values of the lower level variable

Table 2

Random coefficient models regressing the T1 GLI score on standardized independent and control variables (N = 338 dyadic relational measurements on level 1, N = 128 raters on level 2, N = 130 targets on level 2, N = 37 teams)

	Model 1	Model 2
Fixed Effects Level 3 Team		
Group size	-.20	-.22
Completeness	-.03	-.06
Work time	.01	.01
Fixed Effects Level 2 Rater		
Sex	-.08	-.09
Age	.03	.03
Team Performance Satisfaction	.09*	.10*
Perceived shift in competence hierarchy (PSC)	-.01	.00
Fixed Effects Level 2 Target		
Sex	-.11	-.08
Age	.04	.04
Fixed Effects Level 1 Relation		
Intercept	3.73**	3.75**
T0 Friendship	.05	.04
T0 Leadership perceptions (LP)	.41**	.41**
T1 Face-to-face contact (F2F)	.03	.05
Interactions		
T0 LP x PSC		-.10**
T0 LP x T1 F2F		-.07*
Random Effect Variances		
Intercept (Level 3)	.00	.00
Intercept (Level 2 Rater)	.05	.05
T1 LP (Level 2 Rater)	.03	.02
Intercept (Level 2 Target)	.11	.10
Residual	.18	.18
AIC	657.7639	658.4351
BIC	730.4018	738.719
Marginal Pseudo-R^2	.37	.40

* $p < .05$, ** $p < .01$; T0: Baseline measurement, T1: Measures within and after the laboratory task; Group size coded 1 = 3 members, 2 = 4 members, Completeness coded 0 = no missing member: 1 = 1 missing member; Sex coded 1 = female, 2 = male, Friendship coded 0 = no friendship, 1 = friendship, face-to-face contact stated in seconds.

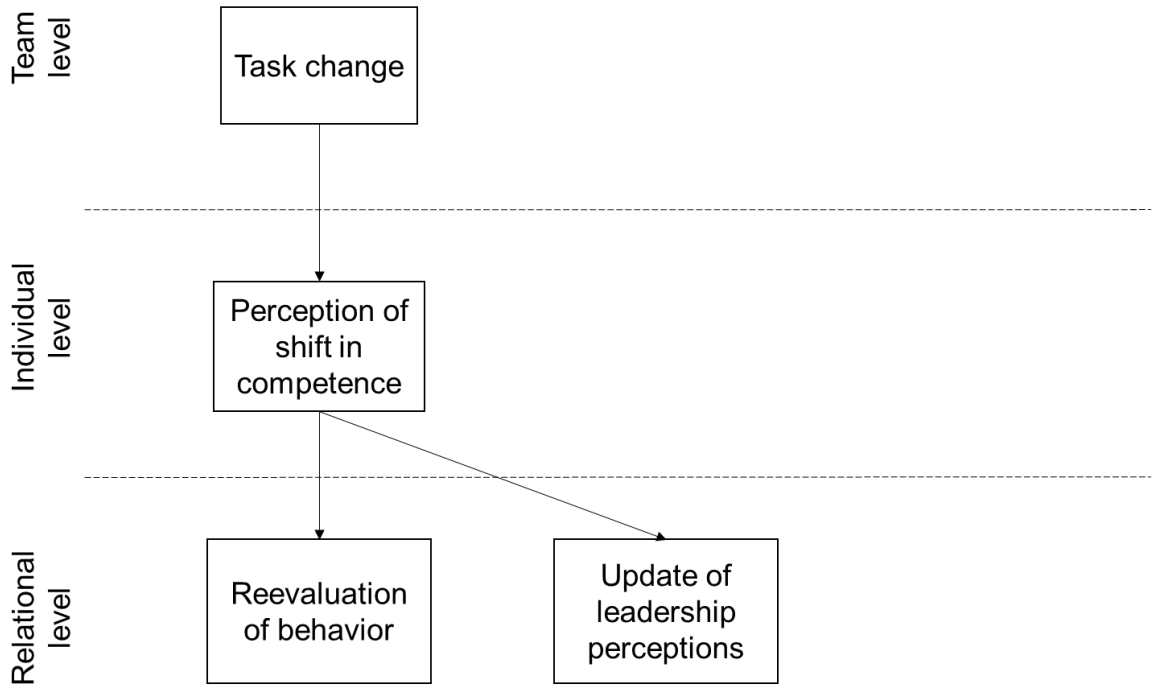

Figure 1. Multilevel-model of the association between contextual change and change in perceptions of leadership

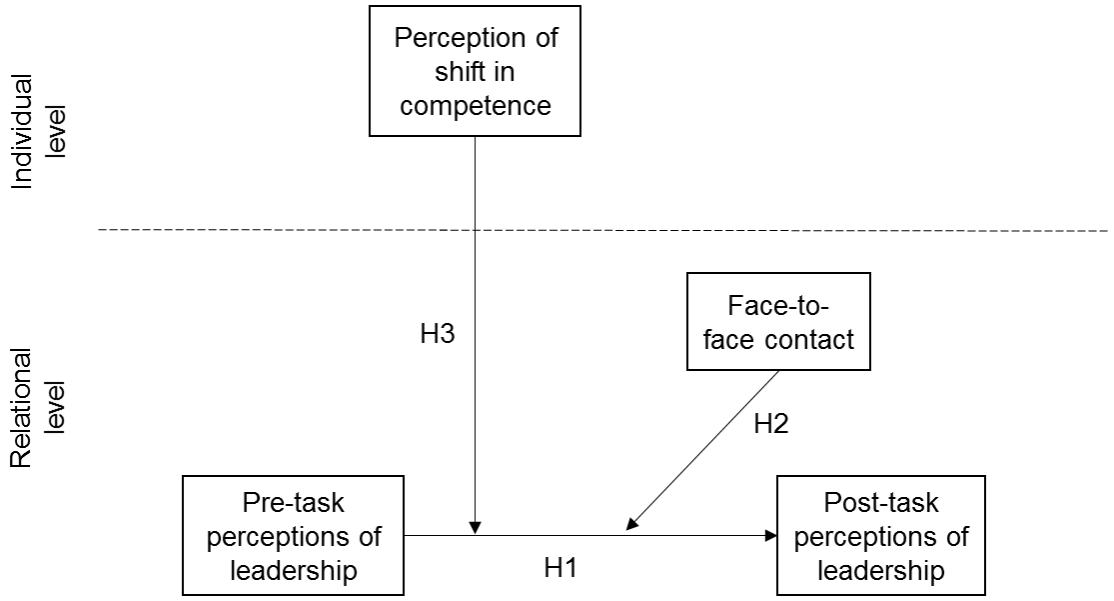

Figure 2. Summary of hypotheses and overall model

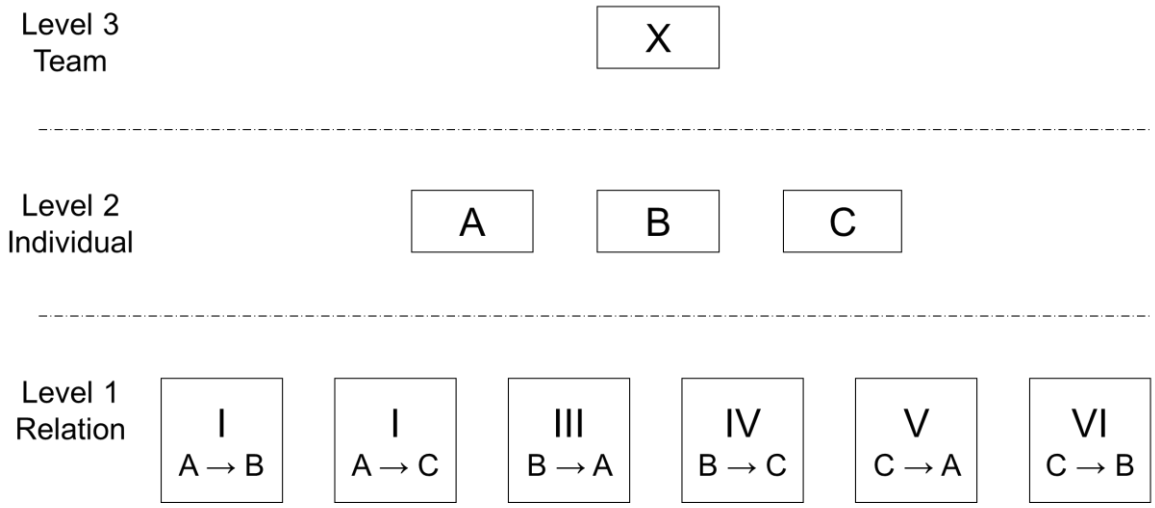

Figure 3. Illustration of the level structure on an example of a team with 3 team members. Arrows within the relational ratings represent the direction of the rating (rater → target).

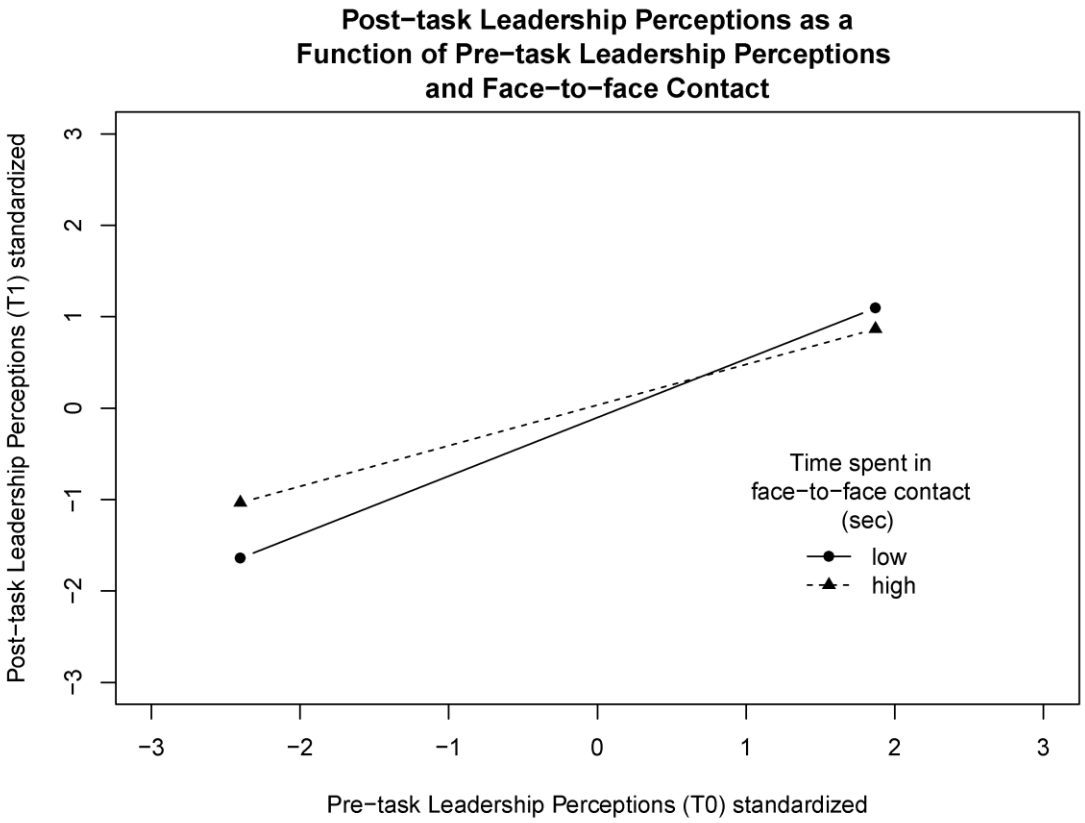

Figure 4. Plot of the interaction between standardized pre-task leadership perceptions (T0 GLI) and time spent in face-to-face contact

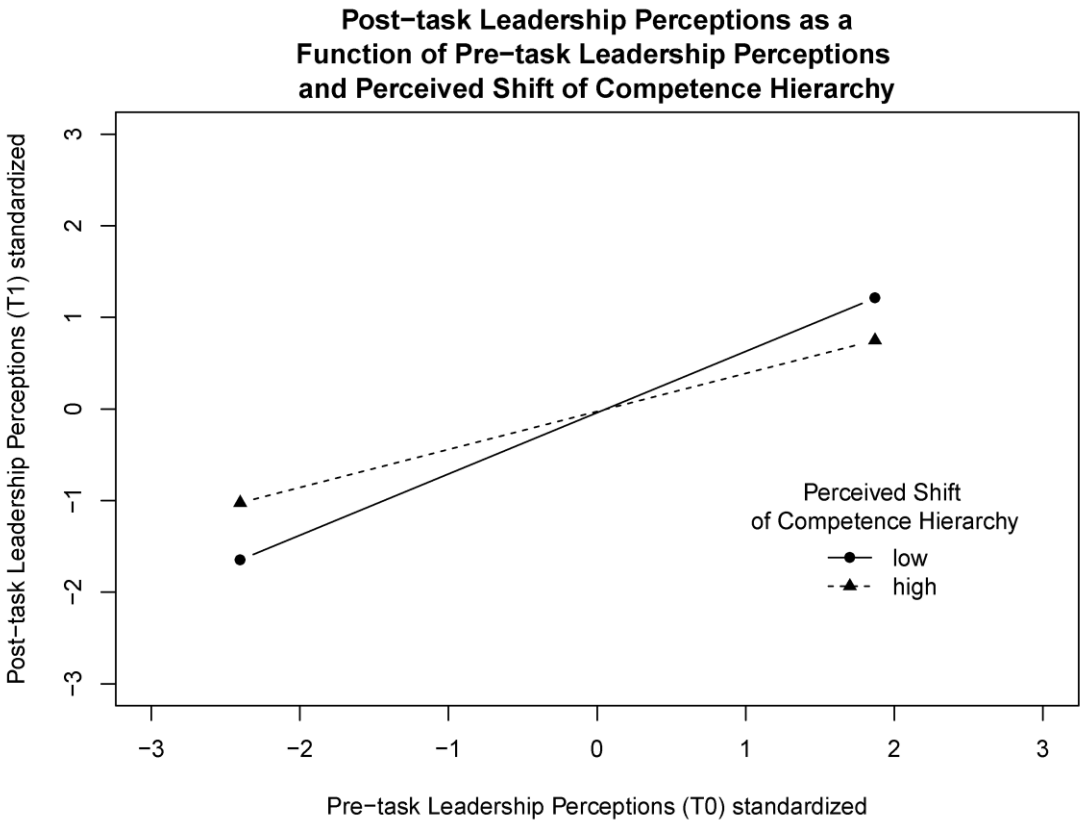

Figure 5. Plot of the interaction between standardized pre-task leadership perceptions (T0 GLI) and perceived shift of competence within the team

Author Biographies

Alexandra (Sasha) Cook is a PhD candidate in organizational and economic psychology at Chemnitz University of Technology, Germany. Her research interests include leadership, team processes, observational methods, and social sensing. In her dissertation, she investigates stability and change of leadership perceptions in teams.

Bertolt Meyer is a professor of organizational and economic psychology at Chemnitz University of Technology, Germany. He holds a PhD in social psychology from Humboldt-University Berlin. His research is focused on team processes, diversity and psychological well-being at work.

Christine Gockel is a professor of work and organizational psychology at SRH Hochschule Berlin, Germany. She holds a PhD from Michigan State University. Her research is focused on team processes and transactive memory systems, as well as humor in organizations.

Alexander Zill is a research fellow at the professorship of organizational and economic psychology at Chemnitz University of Technology, Germany. He holds a PhD from Chemnitz University of Technology. His research interests include leadership, legitimacy, personal uncertainty, and social exclusion in organizations.