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Transformational Leadership and Group Interaction as Climate Antecedents: A Social Network Analysis

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In order to test the social mechanisms through which organizational climate emerges, this article introduces a model that combines transformational leadership and social interaction as antecedents of climate strength (i.e., the degree of within-unit agreement about climate perceptions). Despite their longstanding status as primary variables, both antecedents have received limited empirical research. The sample consisted of 45 platoons of infantry soldiers from 5 different brigades, using safety climate as the exemplar. Results indicate a partially mediated model between transformational leadership and climate strength, with density of group communication network as the mediating variable. In addition, the results showed independent effects for group centralization of the communication and friendship networks, which exerted incremental effects on climate strength over transformational leadership. Whereas centralization of the communication network was found to be negatively related to climate strength, centralization of the friendship network was positively related to it. Theoretical and practical implications are discussed.

Keywords: social networks, group leadership, safety climate, climate antecedents

Organizational climate refers to shared perceptions of employees regarding an organization's policies, procedures, and practices, as well as the types of behavior that are rewarded and supported in work settings (Reichers & Schneider, 1990; Schneider, Gunnarson, & Niles-Jolly, 1994). Because policies and practices relate to specific performance facets, climate derives from employees' perceptions of focal facets associated with their work such as safety, ethics, or service quality (Reichers & Schneider, 1990; Zohar, 2003). Socially shared climate perceptions are valuable in situations where it is unclear which performance facet or which behavior should be prioritized. Such ambiguities often arise from a discrepancy between formally espoused policies and enacted practices (Simons, 2002; Zohar, 2000, 2001). For example, safe role behaviors tend to be differentially supported or rewarded under changing task conditions (e.g., falling behind schedule), and supervisors occasionally disregard procedural violations depending on situational demands (Zohar, 2003). Facet-specific climates thus measure convergent employee appraisals or interpretations of enacted policies, procedures, and practices, based largely on observable organizational indicators of true priorities. Individual climate scores are aggregated to the unit of analysis of theoretical interest, that is, to the entire organization, or to subunits such as local branches or workgroups (Kozlowski & Klein, 2000). Facet-specific climates have been shown to better predict performance outcomes than do multifaceted or global organizational climates (Schneider, Bowen, Ehrhart, & Holcombe, 2000).

Reviews of organizational climate research have indicated an emphasis on measurement issues and the prediction of performance outcomes over the study of climate antecedents and moderator variables (Ostroff, Kinicki, & Tamkins, 2003; Schneider et al., 2000). The present study investigates two early propositions regarding climate antecedents: group leadership whose effects are exercised by leaders' actions and practices (Lewin, Lippitt, & White, 1939; Likert, 1967; McGregor, 1960), and group members' social interaction, in particular the exchanges in which group members explore the meaning of their organizational environment and the events they experience (Ashforth, 1985; Schneider & Reichers, 1983). Given the paucity of research regarding these antecedents, this study employs transformational group leadership and social network analysis to test mediated and non-mediated effects of leadership and social interaction patterns on climate development in organizational units. Because this study uses military field units undergoing advanced boot camp training (platoons), theoretical and analytical frameworks are adjusted to group-level analysis (Klein et al., 2000; Klein, Dansereau, & Hall, 1994). Furthermore, given the primacy of safety issues in military activities, safety climate serves as the organizational climate under study.

Climate Level and Strength

Once climate has developed in an organizational unit, it can be measured with the unit-level parameters of *level* and *strength*. Climate level refers to the aggregated members' ratings of climate perception items for the focal performance facet (Chan, 1998; Lindell & Brandt, 2000; Zohar & Luria, 2005). A high score indicates higher perceived priority for the focal facet (e.g., employee safety or business ethics), and a low score indicates lower

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priority. Because enacted practices often diverge from formal policies, such priorities are frequently deduced by attending to situations presenting competing operational demands in which it is possible to identify true priorities. Thus, a low safety-climate score indicates that safety is perceived as having a lower priority than productivity or goal accomplishment under conditions in which the two facets exert competing operational demands.

Climate strength refers to the consensus or agreement of individual climate perceptions, so that the greater the consensus, the stronger the climate. Consensus can be measured with different homogeneity statistics such as R_{wg} or standard deviation (*SD*), whose values reflect climate strength (Bliese & Halverson, 1998; Chan, 1998; Lindell & Brandt, 2000; Schneider, Salvaggio, & Subirats, 2002). Although climate strength has been traditionally considered a statistical criterion for aggregation of individual scores, it has recently been defined as a descriptive unit-level attribute indicating the extent of cognitive consensus beyond its minimally required level. As with other shared cognitions, the greater the consensus among individual members, the better defined has climate become as a group-level property (Bliese, 2000; Bliese & Halverson, 1998; Chan, 1998; Dickson, Resick, & Hanges, 2006; Lindell & Brandt, 2000; Schneider et al., 2002). It must be emphasized, however, that strong or weak climate may be associated with high or low climate scores reflecting, for example, different levels of prioritization of employee safety or business ethics.

Leadership as a Climate Antecedent

The notion of leadership as a climate antecedent has hardly changed over the past 50 years (Dragoni, 2005; Ostroff et al., 2003), although this has resulted in limited empirical work. Available studies, focusing largely on safety climate, consistently have supported the relationship between transformational leadership (and leader–member exchange; Graen & Uhl-Bien, 1995) and group climate perceptions (Barling, Loughlin, & Kelloway, 2002; Gonzalez-Roma, Peiro, & Tordera, 2002; Hofmann & Morgeson, 1999; Hofmann, Morgeson, & Gerras, 2003; Kozlowski & Doherty, 1989; Zohar, 2002; Zohar & Luria, 2004). A recent meta-analysis suggested that the corrected correlation estimate (r_c) between leadership and safety climate's level is .61 (Nahrgang, Morgeson, & Hofmann, 2006). This relationship can be explained as a social learning process in which group members repeatedly observe and interact with their leader to interpret group- and organization-level practices (Dragoni, 2005). Based on the principle of least effort, members are likely to focus on situations in which the leader faces competing operational demands (e.g., safety vs. productivity), informing them about what is prioritized, valued, and supported (Ashforth, 1985; Zohar, 2003). When such perceptions are shared due to the commonality of the leader's messages and practices, they constitute the core meaning of facet-specific climates.

Once climate has emerged, the extent of agreement among employee perceptions, or climate strength, is expected to be affected by transformational leadership due to a number of reasons. First, such leadership is characterized by higher quality leader–member relationships, stemming from the qualifying attributes of transformational leadership. A transformational leader will foster closer relationships with subordinates, characterized by small power distance and by individualized consideration of members' needs and capabilities (Bass, 1990; Yukl, 2006). This relationship is sustained by mutual trust and openness (House & Shamir, 1993), and by the richness of verbal communication between leaders and members (Klauss & Bass, 1982). Such leaders create more opportunities for sharing and clarifying perceptions (Kozlowski & Doherty, 1989) and offer better articulation of task cues (Kirkpatrick & Locke, 1996), all of which should provide group members with better information for assessing what is prioritized, valued, and supported, promoting the development of shared cognitions, hence a stronger climate.

Second, transformational leaders are expected to exhibit greater consistency across situations in terms of their leadership practices. Given the key role of group leaders' practices as a common and unique referent for group members' climate perceptions, the more consistent a leader's practices in different situations, the more they can reduce variation in group members' perceptions (Ashforth, 1985). The potential for inconsistencies stems from the fact that leaders must often re-interpret organizational policies and procedures before implementing them under diverse conditions in their units (Zohar & Luria, 2005). Such discretion means that group leaders may act with greater or lesser consistency in different conditions. Transformational group leaders who rely on values and visions as their logics of action (Bass, 1990; Burke, Stagl, Klein, Goodwin, Salas, & Halpin, 2006; Conger & Kanungo, 1998; Shamir, House, & Arthur, 1993) are expected to exhibit greater consistency than do non-transformational (or transactional) leaders due to the adoption of such higher-order action referents.

Third, the tendency of transformational leaders to exhibit greater consistency has been shown to take place especially when members' safety or welfare is at stake. This finding stems from the motivational base of such leadership, switching from social exchange to individualized empowerment of followers (Bass, 1990), coupled with the alignment of individual goals with those of the group and the larger organization. One relevant study investigated frequently-encountered choices by leaders of army field units facing the competing demands of mission accomplishment and soldiers' safety. Transformational leaders were more consistent in their choices across a diverse range of situations than were low-transformational leaders in prioritizing their soldiers' safety, resulting in a stronger safety climate (Zohar & Luria, 2004). In a related study by the same authors, analyses of mission briefing and debriefing protocols during field training exercises by army platoon leaders indicated that most task-related choices included safety considerations (Zohar & Luria, 2003). In other words, due to the inherent risk in military field operations, leaders of army field units must face the competing demands of mission accomplishment and safety considerations as part of their leadership role. Given that the same daily dilemmas exist in civil organizations whose operations implicate employee safety and health (Reason, 1997), these results suggest that transformational group leadership will promote a stronger climate especially when the focal climate's facet is associated with members' welfare or safety. This discussion leads to the first hypothesis concerning the relationship between transformational leadership and (safety) climate strength (see Figure 1 for the conceptual model):

> *Hypothesis 1:* Transformational group leadership is positively related to the strength of a unit's safety climate.

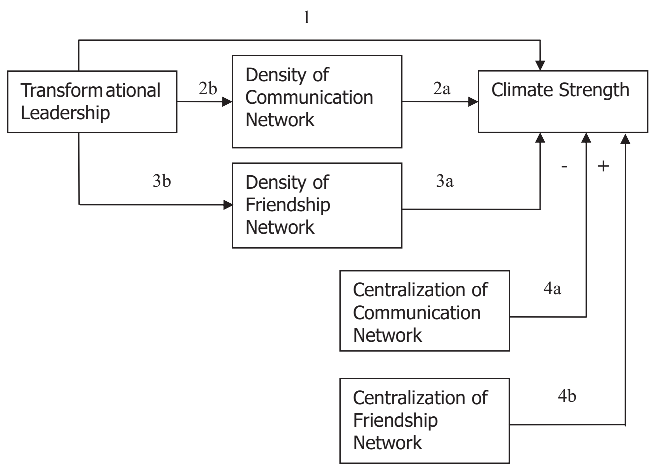

Figure 1. A summary of the theoretical model. Numbers refer to the respective hypotheses.

Social Interaction and Climate Formation

The role of social interaction in group climate formation concerns the fact that group climate signifies *shared* or consensual perceptions of the organizational environment (Schneider, 1975). Although leadership promotes shared perceptions by offering interpretive commonality and action consistency, social interaction among group members must also play an incremental role. In fact, subsequent arguments will suggest that some aspects of social interaction mediate the leadership–climate relationship.

Social interaction plays a key role in climate formation because the relevant perceptions often concern complex or ambiguous organizational information from a variety of sources, presenting conflicting priorities or discrepant messages. That is, although the leader's messages and actions may reduce complexity and ambiguity (Kozlowski & Doherty, 1989; Yukl & Van Fleet, 1992), group members are still exposed to a variety of discrepant organizational information such as formal policies versus enacted practices or job performance versus promotion decisions. Such complexity increases social interaction among group members attempting to make sense of this information and the events that have generated it. This sense-seeking or sense-making interaction is also known as symbolic social interaction (Blumer, 1969; Schneider & Reichers, 1983; Wanous, 1980; Weick, 1995; Zohar, 2001). Unlike instrumental social interaction, which is guided by the application of procedural knowledge to external task demands, symbolic interaction involves inductive and exploratory exchanges concerning the meaning of complex or ambiguous information. Although both interaction modes are often present during the same social interaction, they relate to different issues. For example, instrumental interaction among team members might concern issues such as coordinated action and task-related exchanges. Symbolic interaction might refer to rule compliance or violation in different units or work shifts, or comparisons of senior- and lower-level management practices regarding key work issues.

Because social agreement is construed as empirical validation for individuals dealing with abstract issues, turning subjective experience into objective reality (Hardin & Higgins, 1995), it also explains the emergence of consensual climate perceptions. Social interaction thus explains the transition from individual perceptions into a shared assessment, turning an individual-level construct into a group-level construct, that is, group climate (Klein, Conn, Smith, & Sorra, 2001). The few available studies concur that social interaction among group members is a climate antecedent (Gonzalez-Roma et al., 2002; Roberson, 2006). Using social network methodology to measure employee interaction in work teams and organizations has often been recommended but little applied in empirical research in general and climate research in particular (Balkundi & Harrison, 2006; Borgatti & Foster, 2003; Rentsch, 1990). As discussed below, this methodology offers some new variables and measures allowing the testing of different kinds and/or patterns of social interaction.

Social Networks and Social Influence

The symbolic interaction proposition construes sense-making as a uniform social interaction in which group members interact with each other in a quest for perceptual consensus. However, the social influence framework suggests that this process is often far from uniform because of the effects of social proximity (Marsden & Friedkin, 1993), that is, socially close individuals exert greater influence on each other than do those who are socially distant (Burt, 1976, 1987; Erickson, 1988). Social influence results from two independent processes—communication exchanges among unit members and interpersonal comparisons based on cognitive visibility or friendship (Marsden & Friedkin, 1993; Merton, 1968; Simmel, 1950). The former process results in a communication network and the latter in a friendship network. These two networks differ from each other in most workgroups because group members often exchange communication with some individuals and compare themselves to others with whom they have an individualized relationship, resulting in partial or complete separation. Group-level analysis of interaction patterns, therefore, requires making a distinction between the communication and friendship networks, as well as using two measures for describing different features of these networks' structures: interaction density and centrality. Our discussion will cover these issues in the present and subsequent sections.

Communication is a process that yields contagion when people use other people who are proximal in the social structure as their source of information, in order to manage uncertainty and arrive at socially verifiable interpretations of specific situations (Burt, 1987). The larger or wider the set of communication partners, the more likely it is that information will be shared throughout the entire network and that a common understanding of an issue will be reached. The relationship between communication width and social consensus has been supported in a variety of experimental studies (e.g., Baerveldt & Snijders, 1994; Berelson, Lazarsfeld, & McPhee, 1954; Duncan, Haller, & Porters, 1971; Festinger, Schachter, & Back, 1950; Friedkin, 1984; Hardin & Higgins, 1995; Lazarsfeld, Berelson, & Gaudet, 1968; Roberson, 2006). In the current study, we use work- or task-related communicative exchanges as the unit of measurement for deriving the group's communication network.

Given the primacy of safety issues in daily military field activities and the fact that it often entails making a greater effort, going at a slower pace, or disrupting the flow of activities (Zohar, 2003), unit members are likely to discuss the relative priorities of these competing demands in their daily exchanges. Supportive evidence comes from mission briefing and debriefing protocols conducted routinely after the completion of each field activity (Zohar & Luria, 2003). These protocols reveal extensive discussion of safety versus mission tradeoffs, often characterized by numerous exchanges between soldiers and officers. Consequently, the communication network should influence safety climate's emergence and subsequent strength.

Comparison is an accompanying process, yielding contagion when social actors use other actors with whom they have some personal similarity as their social models in terms of managing uncertainty (Burt, 1987; Erickson, 1988). These similar others are said to have greater cognitive–emotive visibility for their proximal peers (Shah, 1998; Wheeler & Miyake, 1992). Their influence stems from a social identity process in which the focal actor adopts the visible other's views and interpretations as a frame of reference for viewing the situation (Bem, 1972; Burt, 1987; Diederik & Hart, 2004; Wheeler & Suls, 2005). This process uses attitudinal or affective closeness as the source of contagion, by contrast with communication-based influence, which depends on information exchanges among individuals with work-related or instrumental ties. Affective closeness promotes the adoption of the significant other's views and interpretations as one's own in a process akin to social modeling. Social comparisons are thus made with one's close friends rather than with peers or acquaintances (Shah, 1998; Wheeler & Miyake, 1992). Similar explanations are provided in the similarity-attraction theory of social relations (Heider, 1958; Wicklund & Frey, 1981; Zajonc, 1960). Friendship ties constitute the key for deriving the group's friendship network, describing the connections among individuals between whom social comparison processes take place.

The relevance of friendship ties to safety climate's strength is based on contextual factors. Namely, in physically demanding or risky situations the prioritization of safety versus performance efficiency or effort reduction considerations has been shown to constitute a key assessment issue as long as risk prevails (Weick, Sutcliffe, & Obstfeld, 1999). The literature on social relations among individuals performing hazardous tasks (e.g., military units, civil emergency services, construction, or offshore drilling) has shown extensive personal engagement when individuals attempt to assess the correct behavior (Eakin & MacEachen, 1998; Rochlin, 1999; Wright, 1986). Other relevant literature has shown the strong effect of social relationships and, especially, getting social support on coping with physically and/or mentally demanding situations (Folkman & Moskowitz, 2004; Hobfoll, 2002). Thus, a friendship network is assumed to influence safety climate's strength as long as physical risk prevails, posing ongoing adaptive demands.

As noted above, communication and comparison are different mechanisms of social influence, often coexisting as partially overlapping or distinctively different social networks in the same group (Johanson, 2001; Wasserman & Faust, 1994). Thus, the individuals with whom one communicates are not necessarily the same individuals one befriends. Similarly, although friends communicate and exchange symbolic information, social influence in this case is largely based on observational learning or modeling of affectively visible individuals. Given that the two networks often vary in terms of their structural features, resulting in different outcomes, it is necessary to measure these features and test them as antecedents of climate's strength. The two most relevant features for this study are a network's density and centrality.

Network Density

Structural density is a group-level variable defining social proximity in terms of the number, length, and strength of paths connecting actors in a social network (Balkundi & Harrison, 2006; Scott, 2000). A path is a sequence in which every actor is associated with the ties following and preceding him or her, and all actors and ties are distinct (Wasserman & Faust, 1994). Density is the ratio between direct ties in a network and the total number of possible direct ties in this network (Scott, 2000; Wasserman & Faust, 1994). In a communication network, density indicates the proportion of actors participating in work-related exchanges, sharing the same information; in a friendship network, density indicates the extent to which actors establish direct personal relationships, comparing themselves to each other. In both cases, higher density promotes social contagion, enhancing shared cognitions, including climate.

Network density offers a measure for testing the symbolic interaction proposition, whereby work-related exchanges among group members are required for climate emergence and subsequent maintenance. Furthermore, the proposition's emphasis on symbolic or sense-making exchanges suggests they belong to the communication network (i.e., exchanges among friends would result in partial overlap between the two networks). Before outlining the relevant hypothesis, it should be noted that this section of the discussion is intended to test the role of symbolic member–member interactions, rather than leader–member interaction, as a climate antecedent. Hence, the social network does not include the group leader, who remains a separate antecedent variable. This approach agrees with the methodologies of available studies on this subject (Gonzalez-Roma et al., 2002; Klein et al., 2001; Rentsch, 1990). The same practice will be maintained for subsequent hypotheses concerning network centralization and the friendship network. Our second hypothesis is as follows (see Figure 1):

> *Hypothesis 2a:* The density of a unit's communication network is positively related to its safety-climate strength.

Leadership and Network Density

The discussion of relationships between leadership and members' interaction density follows the distinction between individual- and group-level effects of transformational leadership found in the literature (Bass, 1995; Ford & Seers, 2006). Individual effects are associated with differentiated person-focused behaviors such as individualized coaching, personal empowerment, and motivational challenge. Group-level effects largely concern the facilitation of team effectiveness through collective goals, shared values, and team empowerment. A relevant meta-analysis has indicated that the group-level effects of transformational leadership on performance criteria such as task quality, team effectiveness, and extra effort are double the magnitude of individual-level effects (DeGroot, Kiker, & Cross, 2000). This means that, unlike traditional meta-analytic interpretations of the leadership–group performance relationship (Judge & Piccolo, 2004; Lowe, Kroeck,

& Sivasubramaniam, 1996), transformational leadership more effectively increases group performance than it does individual performance. These results support the whole-group model, indicating that transformational leaders relate similarly to whole groups (Dansereau, Alutto, & Yammarino, 1984), as opposed to displaying different styles toward different individuals within a group (Yammarino & Bass, 1990).

A recent meta-analysis tested several group-level transformational practices (Burke et al., 2006), one of which concerns promotion of group cohesion stemming from transformational emphasis on collective value- or vision-based goals and common higher-order needs. By way of contrast, the leadership–cohesion relationship has been supported for transformational, but not transactional, leadership (Bass, Avolio, Jung, & Berson, 2003; Burke et al., 2006). Cohesion refers to the group's attractiveness for its individual members (Cartwright, 1968), and to intragroup integration arising from strong commitment to one another and/or the purpose of the group (Gross & Martin, 1952). Consequently, cohesion co-varies with interpersonal communication, establishing a relationship between transformational leadership and communication density. The effect of this relationship on unit performance has been shown to increase under greater coordination and synchronization demands (Zaccaro, Rittman, & Marks, 2001). Although such task demands may vary in magnitude, they are characteristic of work teams in general (Salas, Dickinson, Converse, & Tannenbaum, 1992).

Because transformational leadership should influence the density of the group communication network, promoting the development of shared climate perceptions (and other shared task cognitions; see Hackman & Wageman, 2005), this suggests a partial mediation model whereby density of the communication network mediates the transformational leadership–climate strength relationship. Mediation is expected to remain partial due to direct residual effects of leadership on homogeneity of climate perceptions as discussed above. This leads to the following hypothesis (see Figure 1):

> *Hypothesis 2b:* The density of a unit's communication network partially mediates the relationship between transformational leadership and the safety-climate strength.

The literature on group cohesion suggests that the social interaction it entails can be task- and/or socially-focused (Tziner, 1982; Zaccaro, 1991). Whereas task-focused cohesion influences the number of goal-oriented exchanges (see Hypothesis 2b), social cohesion should influence the amount of friendships among group members. The latter is based on the promotion of shared vision, common values, and collective goals (Bass, 1995), in addition to transforming the individualistic self-concept of members into a higher, group-oriented identification with the group's mission and goals (Shamir et al., 1993). Given the effect of interpersonal similarity and the social identity explanation of friendship ties (Bem, 1972; Burt, 1987; Diederik & Hart, 2004; Wheeler & Suls, 2005), and the similarity-attraction theory of friendship development (Heider, 1958; Wicklund & Frey, 1981; Zajonc, 1960), such group-level effects should promote the density of the unit's friendship network.

Because the density of the friendship network will reflect the extent to which network members compare themselves to each other, adopting the views of significant others as cognitive referents, this network parameter should promote shared group cognitions. Friendship density should thus mediate the leadership–climate strength relationship, leading to the following hypotheses:

> *Hypothesis 3a:* The density of a unit's friendship network is positively related to its safety-climate strength.

> *Hypothesis 3b:* The density of a unit's friendship network partially mediates the relationship between transformational leadership and the safety-climate strength.

Network Centralization

Centrality, the second structural measure, describes the shape of the distribution of social ties among network members (Borgatti, 2005). This is a measure of variability or spread of social ties, ranging from an even distribution to a skewed one focusing on a few members (Wasserman & Faust, 1994). Higher values represent networks in which some members have many social ties, while the remaining members display considerably fewer ties (Tallberg, 2004).

In terms of a communication network, centralization means that most members in the network are socially remote from each other, and the recipients of most work-related exchanges involve only a few individuals. The opposite is true in a decentralized network, representing a wider spread of direct member–member exchanges. Given our objective of testing the validity of the symbolic interaction proposition as a theoretical foundation, it follows that a decentralized network should offer better opportunities for social diffusion of information and, as a result, the emergence of consensual climate perceptions. Social network studies support this prediction, indicating that multiple dyadic communications in a decentralized network offer better diffusion of information than do narrowly-focused communications (Borgatti, 2005). This holds true assuming equal communication densities. Whereas dyadic exchanges in a decentralized network provide ample opportunities for testing (and creating) social consensus due to direct or face-to-face social verification (Hardin & Higgins, 1995), acquiring information from only a few individuals offers fewer opportunities for social verification, resulting in less agreement.

However, the same is not true for a friendship network. The central actors in a friendship network have the highest affective visibility for most group members because of their extensive involvement in personal relationships (Zemljic & Hlebec, 2005). Their influence stems from the social comparison process, whereby each of the actors tied to them adopt their views and interpretations as a frame of reference for interpreting the situation (Burt, 1987; Diederik & Hart, 2004; Wheeler & Suls, 2005). Group members, each engaging in a dyadic comparison process to few significant others, are likely to agree about climate perceptions with each other because they agree with the same (significant) third party. Consequently, members in a centralized friendship network are likely to reach more convergent perceptions than are members in a decentralized network. This idea results from the fact that untied friendship dyads in a decentralized network should have less agreement than if there would have been the same third party providing a common referent to the remainder of the group. This difference between communication- and comparison-based influences highlights the fact that the symbolic interaction proposition applies only to the former but not the latter influence mode.

Methodologically, it should be noted that the two network features—density and centrality—are independent, as each can vary regardless of the other. For example, decentralization might exist in a low density network, in which the few interacting members interact directly with each other, or in a high density network, in which most interacting members conduct social exchanges with multiple recipients. Research has shown that the correlation between the two metrics can vary from zero to positive or negative depending on contextual factors (Burt, 1987). Furthermore, although friendship involves communication, the two network types should not be confused. Although friends do talk and exchange information with each other, influence is generated largely by social comparative and modeling functions of this relationship, rather than by social verification in information exchanges (Turner, 1993). The amount of communication in friendship networks can be measured with the (global and cell-to-cell) correlations between the two network types as is reported in the Results section below.

Whereas transformational leadership has been considered above as affecting the *density* of social networks, resulting in a mediation model, the same is not true for the *centralization* parameter. This distinction arises from the whole-group model of transformational leadership because a single, group-level style cannot explain centrality differences between group members. Such differences are likely to be affected by other factors, most notably individual differences in social skills or professional abilities among members. In this case, leadership and centralization are expected to exert independent effects on climate strength. Given the opposite effects of the communication and friendship centralization, this discussion leads to the following hypotheses (see Figure 1):

> *Hypothesis 4:* Centralization of a unit's communication and friendship networks exerts incremental effects on safety-climate strength over transformational leadership.
>
> *Hypothesis 4a:* Centralization of a unit's communication network is negatively related to safety-climate strength.
>
> *Hypothesis 4b:* Centralization of a unit's friendship network is positively related to safety-climate strength.

The present study was conducted at advanced training camps for army field units. Given the prevalence of safety issues in every activity, we used safety climate as the case in point. Safety climate concerns consensual assessments of the extent to which safety is prioritized, especially in situations presenting competing operational demands (e.g., speed vs. safety). Safety, as some other performance facets, is associated with formal and informal messages that are often conflicting and ambiguous (Zohar, 2003). For example, whereas formal policies and procedures prioritize safety, in reality it is often compromised for the sake of goal accomplishment or efficiency (excluding imminent danger). Such discrepancies create ambiguity, which is compounded by cross-situational variability (e.g., safety rules are better observed in the absence of competing operational demands) and interunit variability (e.g., some unit leaders apply safety rules more strictly than others). These issues point to the emergence of safety climate as a socially verified indicator of the priority of safety during task performance. Safety climate has been extensively studied in civilian and military contexts (e.g., Barling et al., 2002; Flin, Mearns, O'Connor, & Bryden, 2000; Griffin & Neal, 2000; Hofmann et al., 2003; Zohar & Luria, 2004, 2005). Since our study was conducted at military training camps, where procedures in general and safety procedures in particular are highly conspicuous, our climate scale reflects this context.

Method

Participants and Procedure

The participants in this study were 1,328 infantry soldiers undergoing advanced training in five military boot camps. They were divided into 21 companies and 45 platoons, each averaging 29.5 soldiers ($SD = 7.86$). Overall, 1,108 soldiers completed the questionnaires, resulting in an 83% response rate. The platoon is the main military training unit, with its commander serving as the primary trainer and leader. The 10-week advanced training period follows the basic training program with the same personnel participating in both. By the time the study was conducted, the average platoon membership duration was 5.66 months ($SD = 0.35$), and the average leadership duration was 5.58 months ($SD = 1.08$). Given the temporal exhaustiveness and physical intensity of military training, this time frame is sufficient for creating stable communication and friendship structures. The soldiers were all men, performing their mandatory military service after graduation from high school (average age 18.5 years). Platoon commanders were slightly older (20–23 years old), serving as junior officers after a 6-month officers training course. They began their service as regular soldiers after graduating from high school and were selected for officer training about 1 year later.

Safety climate, transformational leadership, and social network questionnaires were administered on-site in group sessions, supervised by members of the research team. Participants were offered the options of either not attending the sessions or returning a blank or unsigned questionnaire. Because the social network items require individual names, participants received a questionnaire with the first names of platoon members, and each participant had to identify his own name. On completion, the questionnaires were collected by the research team in sealed envelopes, to ensure complete confidentiality.

Social Networks Procedure

Social networks were measured as full or complete networks with each participant referring to all other platoon members when responding to a network item. This procedure resulted in an adjacency matrix, defined as a $g \times g$ binary matrix (g is the number of actors per network). Each cell in the matrix represents the existence or non-existence of a tie between two actors. Since the network items represent the patterns and intensity of interactions among all members, it is important that most individuals complete the questionnaire. The response rate for all 45 platoons exceeded the customary 70% criterion.

Measures

Social networks were measured with two questions adapted to the military context: (a) communication network: "How much do you talk with each of your platoon members on subjects that are activity and/or mission related?" Respondents were asked to write the appropriate number under each soldier's name, using a scale ranging from 1 (*very little*) to 5 (*a great deal*); (b) friendship network: "With which of your platoon members do you consult, or get help from about personal issues?" Respondents were asked to mark the appropriate names appearing in the table below the question with an X. This question is known to record close friendships rather than friendships at large (Wasserman & Faust, 1994).

Social network density was calculated after dichotomizing the communication network. Because military activities require coordination, platoon members must communicate with each other regularly. Thus, frequencies rated between 1 and 3 received the value 0—no tie; whereas 4 to 5 (*much* and *very much*) received the value 1—direct tie. The friendship network that was measured in dichotomous terms required no changes before calculating density. The density coefficient is computed by the sum of all direct ties (L), divided by the maximum possible number of direct ties (Wasserman & Faust, 1994). Since there could be two ties between each pair of actors, there are $g(g-1)$ possible ties in a network (again, g is the number of actors in a network). The density coefficient is computed as $\Delta = L/g(g-1)$. This coefficient may vary between 0 and 1, a shift from no ties to mutual ties for all dyads. We used Ucinet software for Windows to compute this parameter (Borgatti, Everett, & Freeman, 2002).

Social network centralization was calculated with Freeman's (1979) degree-based centralization index, in which the number of adjacent actors per individual actor is the primary data (Tallberg, 2004). Such analysis requires separation between out-degrees (actor's choices) and in-degrees (choices received). The in-degree for the communication and friendship networks measures the centrality of an actor in the network, that is, how many have chosen that actor as their friend or to communicate with. The first step for calculating centralization is to identify the highest in-degree in the network and then calculate the distance between one's in-degree and the highest in-degree per actor. All distances must then be summed up and divided by the maximum possible distance, equaling $(g-1) \times (g-2)$, where g is the number of actors in a network. Centralization can vary from 0, when all actors have the same centrality index (the same in-degree), to a maximum of 1 if one actor completely dominates the others (Wasserman & Faust, 1994). We used Ucinet for Windows to compute this parameter (Borgatti et al., 2002).

Safety climate was measured with a six-item scale relating to procedural safety implementation across situations, taken from a larger questionnaire for soldiers (Zohar & Luria, 2004). The latter covers a range of safety practices and events appropriate for veteran soldiers as well as a distinction between group- and organization-level climate perceptions. Both aspects relate to issues that are not yet relevant for soldiers in boot camps. The present scale was selected based on interviews with soldiers and officers as well as on formal policies and informal practices indicating the prime importance of procedural action in military boot camps as well as its predictive validity with injury-rate criteria. Furthermore, this variable and the leadership variable that follows had to be measured with brief scales due to the time-consuming nature of the social network questionnaires and the need to limit this time under the field conditions in which the questionnaire was completed. Example items include "My commander will not allow soldiers to leave base without a full safety briefing even if it delays going home; thoroughly communicates safety-related guarding procedures even after more than two months of training; strictly follows regular safety procedures even during a difficult week out in the field." The items were accompanied by a 5-point rating scale ranging from 5 (*completely agree*) to 1 (*completely disagree*). Cronbach's alpha coefficient was .73 in this sample.

Transformational leadership was measured with a 10-item scale taken from the Multifactor Leadership Questionnaire (MLQ-5X-Revised; Bass & Avolio, 1997). The scale items constitute the highest-loading items across the four transformational dimensions (Bass & Avolio, 1997), representing transformational leadership as a single higher-order factor. The brief scale follows recent meta-analytic results indicating that lower-order dimensions are highly correlated (corrected $r = .93$; Judge & Piccolo, 2004), which has led many researchers to combine them into a single score (e.g., Carless, 1998; Howell & Hall-Merenda, 1999; Judge & Bono, 2000). Similar short scales were used in earlier research (e.g., Barling et al., 2002). Example items include "My commander talks enthusiastically about what needs to be accomplished; acts in ways that build soldiers' respect; suggests new ways of looking at how to complete assignments; emphasizes the importance of having a collective sense of mission; talks about our most important values and beliefs."[1] A 5-point rating scale accompanied the items, ranging from 0 (*never*) to 4 (*always*). Cronbach's alpha coefficient was .90.

Results

Before starting data analysis, we tested the factorial structure of transformational leadership, using confirmatory factor analysis (CFA) at the individual level. Expecting a single-factor structure to offer a better fit than can a four-factor structure, we compared the fits of both models. The single-factor CFA offered an acceptable fit, $\chi^2(N = 186) = 432.4$, $p < .01$ (non-normed fit index [NNFI] = 0.93; comparative fit index [CFI] = 0.95; root-mean-square error of approximation [RMSEA] = 0.03). The four-factor CFA fit was unacceptable, supporting our single-score measurement of transformational leadership, $\chi^2(N = 180) = 2{,}367.1$, $p < .01$ (NNFI = 0.43; CFI = 0.50; RMSEA = 0.13). We also tested the discriminant validity of the leadership and climate scales by comparing a two-factor CFA structure that separates items from both scales with a one-factor structure that combines the two. The two-factor CFA offered an acceptable fit, $\chi^2(N = 184) = 411.2$, $p < .01$ (NNFI = 0.95; CFI = 0.96; RMSEA = 0.02). The one-factor structure fit was unacceptable, $\chi^2(N = 187) = 1{,}840.1$, $p < .01$ (NNFI = 0.56; CFI = 0.68; RMSEA = 0.18).

Climate strength, representing the within-group dispersion of climate perceptions, was operationalized as the *SD* of soldiers' perceptions of safety climate. According to Schneider et al. (2002), *SD* has several advantages over the R_{wg} homogeneity statistic

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(Bliese, 2000). R_{wg} can exceed 1.00 on occasion and has no natural reference values. Furthermore, most people think about dispersion in terms of the *SD* statistic (Lindell & Brandt, 2000; Schmidt & Hunter, 1989). In the present sample, the average climate *SD* value was 0.53 across units ($SD = 0.10$), and the median R_{wg} value was 0.84 ($SD = 0.08$). Correlation between the two statistics was –.98 ($p < .001$). These results suggest sufficiently high within-group homogeneity to justify aggregation.

Because climate measurement also requires between-group variance, a one-way analysis of variance was performed and indicated significant variance between groups, $F(44, 1105) = 2.93$, $p < .01$. The calculation of the intraclass correlations of ICC(1) and ICC(2) integrates within- and between-group sources of variance (Bliese, 2000). The value of ICC(1) was 0.15 and that of ICC(2) was 0.82, indicating relatively small values, which may be the result of either high within-group variance or low between-group variance (James, 1982). However, the *SD* and/or R_{wg} data indicating sufficiently low within-group variation, coupled with the analysis of variance results indicating sufficiently high between-group variation, warranted aggregation of climate scores. This conclusion follows previous climate research in which similar results were considered as justifying aggregation (e.g., Hofmann & Stetzer, 1996; Zohar & Luria, 2004).

Intraclass correlation coefficients were also calculated for the transformational leadership variable. ICC(1) was 0.34, and ICC(2) was 0.92. Considered jointly with a median R_{wg} value of 0.83 ($SD = 0.12$), the results indicate sufficiently low within-group variation and high between-group variation to warrant aggregation of transformational leadership scores.

Correlations between variables on platoon-level data are shown in Table 1. Platoon size correlated with network variables (for communication density, $r = –.70$; and for friendship density, $r = –.66$; $p < .01$). Hence, platoon size should serve as a control variable in regression models where network density is the dependent variable. The platoon commander's tenure was not significantly correlated with climate strength ($r = –.30$; $p < .09$), yet the correlation coefficient's size suggested it should be included as a control variable in regression models with climate strength as the dependent variable.

Table 1 also presents the correlations between the four network variables, ranging from 0.46 to 0.76 ($p < .01$). Whereas such zero-order correlations might indicate covariation of the communication and friendship networks, it should be noted that the coefficients are based on global network scores. A better method of testing network similarity is a matrix similarity analysis that takes into account the data structure of social networks. We used the quadratic assignment procedure (QAP; Hubert & Schulz, 1976), designed to test whether two $N \times N$ matrices are similar by comparing each dyadic cell in matrix A with the corresponding cell in matrix B. These cell-level comparisons are contrasted with a reference similarity distribution generated by randomly permuting the rows and columns of one of the matrices. The similarity is computed by comparing the network data with the reference distribution and deriving the mean matrix correlation (Meyer, 1994). In the present sample, QAP analysis resulted in a mean correlation coefficient of 0.31 ($SD = 0.07$) across corresponding matrix cells, which is small enough so that we could consider the communication and friendship networks as distinct interaction structures.

To test our hypotheses we used a linear regression model, with company and battalion identities as the control variables (instead of using the hierarchical GENMOD model with the same nesting variables; see SAS Institute, 1997). There are two reasons for this choice: (a) the statistical models have only 45 platoons, which is quite limited for hierarchical modeling; (b) comparing the *SE* (standard error) estimates of regression models and generalized estimating equations estimates of hierarchical models, there are no significant differences between the nesting variables (company or battalion). This means that regression and hierarchical models give very similar results in our case, while the former is less affected by limited sample size. Furthermore, because variables in this sample are similarly correlated within each company or battalion, only one such nesting variable should be included in the statistical models.

Results presented in Table 2 (Step 2) support Hypothesis 1 due to the positive relationship between transformational group leadership and climate strength ($\beta = -0.57$; $p < .01$). Because climate strength was calculated by *SD*, which measures disagreement, a minus sign means less *SD*, better agreement, and higher strength. The R^2 of this model accounted for 30.2% of the variance in climate strength.

According to Hypotheses 2a and 2b, density of the communication network partially mediates the effect of transformational group leadership on climate strength. In order to identify a mediating effect, three conditions must be met (Baron & Kenny, 1986): (a) The independent variable (transformational leadership) should predict the presumed mediator (communication density). Results presented in Table 3 (Step 2) support this condition ($\beta = 0.32$; $p <$

Table 1
Intercorrelations and Descriptive Statistics of Variables in Statistical Models in the Aggregated Data

Variable	*M*	*SD*	1	2	3	4	5	6	7	8
1. Platoon size	29.51	7.86	—							
2. Commander tenure	5.58	1.08	0.05	—						
3. Climate strength (*SD*)	0.53	0.10	0.22	−0.30	—					
4. TL score	3.10	0.46	−0.10	0.37*	−0.61**	—				
5. Communication density	0.55	0.13	−0.70**	0.34	−0.38*	0.40**	—			
6. Communication centralization	0.30	0.08	0.64**	0.03	0.17	−0.10	−0.65**	—		
7. Friendship density	0.20	0.07	−0.66**	0.06	−0.32*	0.24	0.76**	−0.55**	—	
8. Friendship centralization	0.27	0.08	−0.28	0.05	−0.18	0.01	0.46**	−0.10	0.45**	—

Note. $N = 45$. TL = transformational leadership.
* $p < .05$. ** $p < .01$.

Table 2
Climate Strength (SD) Regressed on Control Variables and Transformational Leadership

Variable	*B*	*SE B*	β
Step 1			
Constant	0.703	0.117	
Company	−9.02E-04	0.003	−0.050
Commander tenure	−3.26E-02	0.020	−0.297
Step 2			
Constant	1.045	0.140	
Company	−5.09E-04	0.003	−0.028
Commander tenure	−9.44E-03	0.018	−0.086
TL	−0.151	0.044	−0.570**

Note. Adjusted R^2 = .029 for Step 1. Adjusted R^2 = .302 for Step 2. $F(1, 27) = 11.973$, $p < .01$. TL = transformational leadership.
** $p < .01$.

.01); (b) the mediator should predict the dependent variable (climate strength). Table 4 indicates that communication density is positively related to climate strength (β = –0.54; $p < .01$); and (c) the effect of the independent variable on the dependent variable should be reduced in the presence of the mediator. Tables 2 and 4 present such a reduction, that is, the effect of leadership on climate strength is significantly reduced in the presence of communication density (from β = –0.57, $p < .002$, in Table 2; to –0.35, $p < .05$, in Table 4). This pattern supports the mediation effect of communication density on the leadership–climate relationship, offering a significant increase in explained variation over the model with transformational leadership alone ($F_{\text{change}} = 13.02$; $p < .01$).

Results presented in Table 5 support Hypothesis 3a but not 3b, in that although density of the friendship network was positively related to climate strength (β = –0.42; $p < .01$), it was not predicted by the unit's leadership, thereby failing the first criterion of mediation. Instead of mediating the effect of leadership on climate strength, friendship density offered an incremental prediction, increasing the explained variance from 30.2% with transformational leadership alone to 46.8% for both predictors ($F_{\text{change}} = 9.43$; $p < .01$).

Hypothesis 4 suggests that the centralization of communication and friendship networks exerts independent effects on climate strength with regard to transformational leadership, resulting in incremental prediction. Results presented in Table 6 show a significant increase in the explained variance, that is, 48.3% for communication centrality ($F_{\text{change}} = 10.47$, $p < .01$) and 37.8% for friendship centrality ($F_{\text{change}} = 4.29$, $p < .05$).

Hypotheses 4a and 4b relate to the relationship between network centrality and climate strength, suggesting opposing directed effects. According to Hypothesis 4a, centralization of the communication network is *negatively* related to climate strength. Results presented in Table 6 (Part 1) support this hypothesis (β = 0.428; $p < .01$). According to Hypothesis 4b, centralization of the friendship network is *positively* related to climate strength. Results presented in Table 6 (Part 2) support this hypothesis (β = –0.309; $p < .05$).

Table 3
Communication Density Regressed on Control Variables and Transformational Leadership

Variable	*B*	*SE B*	β
Step 1			
Constant	0.863	0.061	
Company	2.68E-03	0.002	0.135
Platoon size	−1.17E-02	0.002	−0.704**
Step 2			
Constant	0.585	0.105	
Company	1.39E-03	0.002	0.070
Platoon size	−1.11E-02	0.002	−0.669**
TL	8.97E-02	0.029	0.318**

Note. Adjusted R^2 = .48 for Step 1. Adjusted R^2 = .57 for Step 2. $F(1, 41) = 9.86$, $p < .01$. TL = transformational leadership.
** $p < .01$.

Table 4
Climate Strength (SD) Regressed on Control Variables, Transformational Leadership, and Communication Density

Variable	*B*	*SE B*	β
Constant	1.064	0.117	
Company	−1.10E-03	0.002	−0.061
Commander tenure	−5.02E-04	0.015	−0.005
TL	−9.15E-02	0.040	−0.346**
Communication density	−0.502	0.139	−0.543**

Note. Adjusted R^2 = .517. $F(1, 26) = 13.02$, $p < .01$. TL = transformational leadership.
** $p < .01$.

Discussion

The intention of this study was to examine the long assumed effects of leadership and group interaction on climate strength. The results indicated that the effect of transformational leadership on safety-climate strength is mediated by the density of the communication network. Such mediation supports the propositions regarding leadership and symbolic social interaction as primary climate antecedents. At the same time, leadership did not predict the density of the friendship network, resulting in independent rather than mediated effects for both antecedents on climate strength. Leadership and the centrality of the communication and friendship networks offered positive and negative effects on climate strength, respectively. These results suggest that transformational group leadership predicts the emergence and subsequent

Table 5
Climate Strength (SD) Regressed on Control Variables, Transformational Leadership, and Friendship Density

Variable	*B*	*SE B*	β
Constant	1.106	0.124	
Company	−1.41E-04	0.002	−0.008
Commander tenure	−1.11E-02	0.016	−0.101
TL	−0.124	0.039	−0.468**
Friendship density	−0.694	0.226	−0.422**

Note. Adjusted R^2 = .468. $F(1, 26) = 9.43$, $p < .01$. TL = transformational leadership.
** $p < .01$.

Table 6
Climate Strength (SD) Regressed on Control Variables, Transformational Leadership, and Networks Centralization

Variable	*B*	*SE B*	β
Part 1 – Communication centralization			
Constant	0.817	0.140	
Company	−2.05E-05	0.002	−0.001
Commander tenure	−1.33E-02	0.016	−0.121
TL	−0.138	0.038	−0.521**
Communication centralization	0.657	0.203	0.428**
Part 2 – Friendship centralization			
Constant	1.141	0.140	
Company	8.07E-04	0.003	0.045
Commander tenure	−9.80E-03	0.017	−0.089
TL	−0.142	0.041	−0.537**
Friendship centralization	−0.484	0.233	−0.309**

Note. Adjusted R^2 = .483 for Part 1. $F(1, 26) = 10.47$, $p < .01$. Adjusted R^2 = .378 for Part 2. $F(1, 26) = 4.29$, $p < .05$. TL = transformational leadership.
** $p < .01$.

strength of (safety) climate both directly and through mediated and additive effects of the networking among group members.

The social network mechanisms by which leaders influence climate elaborate the leadership–climate relationship and provide needed empirical evidence concerning the role of both leadership and social interaction as climate antecedents (Gonzalez-Roma et al., 2002; Klein et al., 2001). In the context of safety-climate research, where most relevant studies have been conducted, it has generally been assumed that transformational leaders directly influence climate emergence due to their concern for members' welfare under demanding conditions (see reviews in Hofmann & Morgeson, 2003; Zohar, 2003). The present study tested additional hypotheses stemming from known group-level effects of transformational leadership, such as the promotion of shared values, collective goals, and teamwork. These types of effects have been assumed to jointly influence (instrumental and social) group cohesion, impacting, in turn, on the group's social networks. Results indicated that leadership predicted the communication density, promoting higher consensus of personal safety-climate perceptions. At the same time, the weaker effects of leadership on the density of friendship ties, resulting in independent additive effects on climate strength, call for future research to examine possible explanations for these results.

In addition to the communication and friendship networks' density, we also tested the role of network centralization. This metric was not expected to be affected by leadership, calling for a test of additive rather than mediated effects. Centralization of the communication network was negatively associated with climate strength, whereas friendship network centralization was positively associated with it. These results support Erickson (1988), who suggested that the influence of significant others on group members depends on the nature of their relationship. When social influence stems from a social identity process, the affectively visible other's views and interpretations offer a common frame of reference in a centralized friendship network. The opposite is true in a communication network where social influence is based on direct (symbolic) communications between adjacent actors, searching for social verification of their subjective views. This pattern supports the original symbolic interaction proposition in regard to the communication network while offering a social identity extension regarding the friendship network among group members.

The results of this study offer several implications. Theoretically, knowing how climate is created and maintained is important for better understanding this construct. The emergence of consensus or agreement of individual climate perceptions is central to making climate a unit-level construct. As stated earlier, organizational climate involves both the perception of complex and abstract organizational properties and the sharedness of such perceptions among group members. Without sufficient agreement, there would only be divergent individual perceptions of organizational reality (known as psychological climate), promoting equally diverse role behaviors. Our theoretical contribution thus concerns the testing of mediating and independent influence models of transformational leadership and social interaction in climate consensus. Such tests have been repeatedly recommended but little performed due to the difficulties of studying social interactions.

Methodologically, this study demonstrates the utility of social network methodology for studying social influence and interaction. Group interactions measured as social networks provide a fuller description of interactions for each social unit. In the present work, we studied two different relationship types (communication and friendship), analyzing each with two network measures (density and centralization). These analyses produced different results and broadened the understanding of how social interaction affects the emergence of shared cognitions in a group. We have thus demonstrated that it is not the mere intensity of interactions that affects consensus, but also their structure. These results agree with research on corporate social capital, according to which the effect of the structure of social relationships on goal attainment depends on contextual factors (Gabbay & Leenders, 1999; Knoke, 1999). Any given structure might turn into social capital, enhancing goal attainment, yet it may also constrain attainment in a different network, turning into a social liability. Future research on social interaction and consensus should examine additional network structures and contexts.

Practically, better understanding of climate emergence and its subsequent maintenance or modification should contribute to its usefulness in the organizational setting. Research on organizational climate has focused largely on measurement issues and the prediction of performance criteria (e.g., fewer injuries with a safety climate or higher customer satisfaction with a service climate), leaving the study of climate antecedents to lag behind (Schneider et al., 2000). The present work highlights the distinction between individual- and group-level leadership effects, suggesting the latter as key antecedents of shared group cognitions, including climate perceptions. Unit leaders must, therefore, be aware of the distinction between their individual- and group-level effects on members and develop skills for exercising both. For example, inspirational motivation, a core dimension of transformational leadership, can be oriented at both the individual and group levels. Challenging task-related goals for individual members must be articulated in a manner that makes clear how they coalesce into the group's shared goals. This requires the leader to provide visions of what is possible, what needs to be done, and what is right and important for individual members and the group at large. The same can be said in regard to other leadership dimensions. For instance, intellectual stimulation ought to be applied by encouraging group members to question their own beliefs, assumptions, and practices regarding tasks and problems at the individual, dyadic, group, and organizational levels—highlighting cross-level relationships.

Our results further indicate that unit leaders must also be aware of the role of daily instrumental ties, symbolic exchanges, and friendship ties among unit members as antecedents of shared group cognitions. Considering the effect of climate on performance outcomes, activities that promote social ties and friendships ought to be considered highly instrumental, apart from their effect on the social needs of the group.

One limitation of this study is that it cannot identify the causal ordering of variables among leadership, social interaction, and climate strength. According to similarity-attraction theory (Heider, 1958) and social identity theory (Diederik & Hart, 2004; Wheeler & Suls, 2005), individuals tend to be attracted to those who are similar to them in terms of key attributes such as values, attitudes, or action modes. Thus, it is possible that platoon members chose to interact with individuals with whom they share similar climate perceptions. Future research should thus employ a longitudinal design, allowing the measurement of social interaction and climate consensus at several points in time, preferably at the beginning, middle, and toward the end of a group's existence. An additional possibility concerns the inclusion of group leaders in the social network, allowing the testing of social ties between leader and members as antecedents of climate emergence. For example, if the leader's centrality affects climate strength, this would help establish further mechanisms by which leaders create climate.

Another limitation is that the data were collected from platoon members undergoing military field training, which is quite different from civil organizations. For example, in contrast with civil organizations, the army constitutes a total organization, controlling every aspect of individual and collective lives, which may have affected the levels and correlations between our study's variables. One possibility in this regard concerns the extent of overlap between the communication and friendship networks. As noted in the Results section, our cell-level QAP analysis resulted in a mean correlation coefficient of 0.31 between the two networks. Given reported results about the correlation between the two networks, it is likely that such a relationship would have been weaker in more open organizations (Johanson, 2001). Furthermore, military organizations demand greater formalization and disciplinary behavior than most civil organizations, creating a strong situation affecting the emergence of shared cognitions (Mischel, 1976). However, previous studies with similar samples have indicated continuity rather than dissociation between military and civilian samples. For example, leadership research has found no noticeable differences between the two sample types (e.g., Bass et al., 2003; Shamir, Zakay, Breinin, & Popper, 1998). Furthermore, our study incorporates qualitative measurement differences with regard to leadership, climate strength, and social network variable scores. Such differences are likely to minimize the effect of situational strength due to differentiated calculation modes.

The current study focuses on face-to-face exchanges characteristic of traditional work teams. Given the increasing prevalence of virtual teams (Martins, Gilson, & Maynard, 2004), future research should also incorporate the study of social exchanges and contagion in the virtual environment, incorporating different samples (e.g., permanent vs. temporary teams) and interaction modes (e.g., synchronized vs. non-synchronized exchanges). Such tests would expand the conceptual framework, including the core question whether climate can emerge in virtual teams.

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