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# Discourse-Based Intervention for Modifying Supervisory Communication as Leverage for Safety Climate and Performance Improvement: A Randomized Field Study

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The article presents a randomized field study designed to improve safety climate and resultant safety performance by modifying daily messages in supervisor–member communications. Supervisors in the experimental group received 2 individualized feedback sessions regarding the extent to which they integrated safety and productivity-related issues in daily verbal exchanges with their members; those in the control group received no feedback. Feedback data originated from 7–9 workers for each supervisor, reporting about received supervisory messages during the most recent verbal exchange. Questionnaire data collected 8 weeks before and after the 12-week intervention phase revealed significant changes for safety climate, safety behavior, subjective workload, teamwork, and (independently measured) safety audit scores for the experimental group. Data for the control group (except for safety behavior) remained unchanged. These results are explained by corresponding changes (or lack thereof in the control group) in perceived discourse messages during the 6-week period between the 1st and 2nd feedback sessions. Theoretical and practical implications for climate improvement and organizational discourse research are discussed.

*Keywords:* organizational climate intervention, safety climate improvement, randomized field research, organizational discourse



Organizational climate research has largely focused on investigating the nature of relationships between climate and its antecedents or consequences. Such investigation has largely used correlation-analytic techniques for testing hypothesized relationships between variables in the nomological network of the climate construct. Recent literature reviews support a robust relationship between studied variables, indicative of the efficacy of organizational climate as a predictor of organizational performance outcomes (Kuenzi & Schminke, 2009; Ostroff, Kinicki, & Muhammad, 2012; Schneider, Ehrhart & Macey, 2011; Zohar & Hofmann, 2012). Considering safety climate as a pertinent example, recent meta-analytic studies indicated that its effect size on safety performance and objective injury data equals or surpasses all other known safety risk indicators, including unguarded physical hazards at the workplace (Beus, Payne, Bergman, & Arthur, 2010; Christian, Bradley, Wallace, & Burke, 2009; Clarke, 2010; Nahrgang, Morgeson, & Hofmann, 2011).

Given such evidence regarding climate's predictive validity, it follows that climate improvement is expected to result in subsequent improvement in terms of relevant consequences. However, a computer-based search of the primary databases covering organizational climate research (i.e., PsycINFO, PubMed, and ISI Web of Science), using a number of search terms (e.g., *organizational climate* (or *culture*) *intervention, modification, improvement,* or *change*; *safety climate intervention, modification, improvement,* or *change*), failed to identify any peer-reviewed intervention studies. Given the popularity of organizational climate and culture and the fact that the practitioner literature abounds with claims for successful interventions (e.g., Krause, 2005; Schabracq, 2009), our purpose in the present study was to present and test an intervention strategy aimed at organizational climate improvement, using safety climate as exemplar.

## Leverages for Climate Change

Organizational climate is commonly defined as socially shared perceptions of the work environment focusing on key organizational attributes informing employees of the kinds of behavior likely to be supported or rewarded (Ostroff et al., 2012; Schneider, 1975; Schneider et al., 2011). The current paradigm for climate research discriminates between two attribute types (i.e., generic and facet-specific ones), resulting in emergence of foundation and

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facet-specific climates (Schneider, 1975; Schneider et al., 2011). Given that most climate research focuses on the latter (Kuenzi & Schminke, 2009), we will refer to specific climates for the remainder of this paper as our default definition when talking about organizational climate. As noted by Zohar and colleagues, one logical implication of this definition is that climate perceptions are aimed at uncovering the (often implicit) order in the work environment or its underlying logics of action, offering guidance for the better-rewarded role behavior (Zohar, 2010, 2011; Zohar & Hofmann, 2012). A relevant cue in this regard concerns the relative priority among competing job facets or operational task demands, such as speed versus accuracy (Wickelgren, 1977) or individual versus team achievement (Denison, Hooijberg, & Quinn, 1995). Considering organizational climate as a facet-specific construct referring to a specific job dimension or task demand, its perceived priority by comparison with other relevant demands constitutes a proximal indicator informing employees of the kinds of role behavior likely to be rewarded. By default, therefore, identification of relative priorities associated with different operational task demands constitutes a primary target of climate perceptions (Zohar, 2010; Zohar & Hofmann, 2012).

Taking safety climate as exemplar, one expression of competing demands arises in manufacturing organizations where production speed or costs tend to compete with nonproductive investments in workers' health and safety. Facing such competing demands, organizational leaders are likely to (formally or informally) assign relative priorities to each facet (Humphrey, Moon, Conlon, & Hofmann, 2004). Using relevant personal experiences, employees collect information regarding trade-offs between safety and productivity issues, attending mostly to situations presenting a conflict between the two. Practically speaking, if productivity is favored across a variety of situations, implying a higher priority, it will promote a poor safety climate, leading employees to align their behaviors accordingly. These arguments were tested by Zohar and Luria (2004), using a modified safety climate scale in which safety considerations were contextualized by the presence of different competing demands. Supervisory decisions in situations where supervisors had to choose between safety and accomplishing the mission were predictive of employee perceptions of safety climate.

Given this line of reasoning, it follows that modification of managerial practices indicative of relative priorities and/or trade-offs among competing task demands can serve as leverage for climate-improvement interventions. Although in the present case we apply this intervention for safety climate improvement, the same strategy can be used for improvement of other organizational climates. Service climate, for example, has been shown to compete with productivity and/or efficiency demands (Schneider & Bowen, 1995), and the climate for innovation competes with organizational demands for stability and control (Anderson & West, 1998). We argue that, irrespective of the particular climate, intervention-induced modification of managerial priorities during daily activities ought to improve the relevant climate level by modifying employee perceptions of the kinds of behavior likely to be supported or rewarded at the workplace.

## Guiding Principles for a Climate-Change Strategy

Our intervention strategy is based on a number of guiding principles congruent with the above discussion. First, given that climate perceptions concern the kinds of behaviors likely to be supported and rewarded, climate change must be preceded by a change in (perceived) role-behavior contingencies at the workplace. According to role theory (Katz & Kahn, 1978; Merton, 1957), role behavior is shaped and recurrently adjusted by sent role expectations from members of one's role set. Considering that managerial roles entail reward and coercive power over members (French & Raven, 1959), coupled with discretionary decision-making capacity (Thompson, 1967), it follows that modification of supervisory sent role expectations can be leveraged for promoting a change in members' climate perceptions.

Considering that organizational climate is a higher order concept operationalized by facet-specific climates, climate change requires modification of supervisory role expectations focusing on the particular role facet serving as the target of intervention. For example, by communicating a priority for continued compliance with safety rules even in situations in which it might reduce production speed or increase its costs, supervisors can improve safety climate perceptions among group members. Such a change is expected to result in a higher safety climate level for as long as supervisory role expectations retain such priorities.

Second, given role theory distinctions between sent and received (i.e., interpreted) role expectations and the fact that the two might be misaligned due to the idiosyncrasies of interpersonal communication (Katz & Kahn, 1978; Merton, 1957), it follows that climate intervention must be based on the latter (i.e., received expectations). In other words, it is the perceived change in supervisory role expectations that can modify current climate perceptions, rather than its objective discursive attributes. Consequently, a climate intervention project must employ perceived supervisory role expectations as the leverage for change. That is, climate perceptions are expected to change as a result of perceived change in communicated supervisory priorities associated with the focal climate facet.

The distinction between sent and received role expectations is especially important when such expectations relate to the priorities associated with competing role facets, constituting the target or referent of climate perceptions. Assessment of priorities requires an interpretive sense-making process on behalf of employees stemming largely from the difficulty of untangling or discriminating between espoused and enacted priorities (Simoms, 2002; Zohar & Hofmann, 2012). For example, given that protecting employee health and safety is a universally endorsed ethical principle or core value (Schwartz, 1999; Schwartz & Boehnke, 2004), management in most (if not all) companies adopts a formal policy and espouses corporate values prioritizing employee safety over other (competing) strategic goals, including profitability. Yet, given that organizational sustainability depends on profitability, such formal policies may be accompanied by lagging implementation in organizational units, resulting in small or no effect on daily safety practices (i.e., decoupling between formal policies and daily practices; see Meyer & Rowan, 1977; Scott, 2008; Weaver, Trevino, & Cochran, 1999). Given the prevalence of decoupling (Aravind & Christmann, 2011; Behnam & MacLean, 2011; Bromley & Powell, 2012; Weaver et al., 1999), employee climate perceptions must depend on received (i.e., interpreted, contextualized) rather than sent role expectations that may be largely related to espoused priorities.

Third, the fact that language serves as the primary medium for interpersonal processes implies that role sending and role receiving must also be largely mediated or embedded in verbal leader–member exchanges. This idea is based on the supposition that (almost) every organizational process is discourse driven (Deetz, 2003). Namely, people talk with each other in order to clarify role expectations and identify role-behavior contingencies, turning language into an inherent dimension of organizational behavior (Phillips & Oswick, 2012). An intervention designed to modify supervisory sent role expectations ought to be based, therefore, on the modification of supervisory discourse or verbal exchanges with group members.

Fourth, changes in the content of (received) supervisory messages or role expectations must remain stable and consistent, offering sufficient opportunities for group members to experience and validate it as a real (rather than espoused) change in supervisory role expectations. In other words, changed role expectations must be experienced in routine or daily leader–member exchanges rather than reserved to formal occasions. This requirement stems from two reasons. Firstly, daily exchanges offer employees multiple opportunities for testing managerial enactment of espoused priorities. A change of safety climate would thus require provision of repetitive evidence indicative of sustained supervisory prioritization of safe performance in the context of daily events or work situations presenting competing operational demands. Such stability implicates genuine commitment to employee safety and health, which has been considered the primary target of safety climate perceptions ever since the publication of Zohar's (1980) original paper (see reviews in Flin, Mearns, O'Connor, & Bryden, 2000; Guldenmund, 2000; Zohar, 2011).

Second, given that organizational climate implies socially shared cognitions or perceptions, supervisory verbal exchanges with group members must be sufficiently frequent to promote a climate change. Practically speaking, this means that a climate intervention project ought to try and modify supervisory daily exchanges with group members such that individual members would have had similar experiences required for inducing a socially shared change in climate perceptions.

## Feedback Intervention for Climate Change

The present study was designed as a randomized field study in which work-unit supervisors were randomly assigned to an experimental or control groups. Considering that performance feedback constitutes one of the best studied intervention strategies (Kluger & DeNisi, 1996), supervisors in the experimental group received individualized feedback, using data collected from their group members. Feedback data indicated the perceived priority or significance of three role facets (i.e., safety, productivity, and teamwork) they have communicated during routine verbal exchanges. Supervisors in the control group received no feedback (although their group members were equally contacted to collect received supervisory role expectations). Intervention incorporated a number of contextual variables that have been shown to increase performance improvement (i.e., when feedback is considered accurate or nonthreatening; when it suggests a need for change, makes recipients believe change is feasible, or is being provided by a neutral facilitator; Smither, London, & Reilly, 2005; see also Seifert, Yukl, & McDonald, 2003). A full description of study design is provided in the Method section.

Assuming a performance facilitation effect for the feedback intervention on supervisory practices, it is expected that an increase in perceived priority or importance of safety vis-à-vis other role facets as communicated in daily supervisory exchanges will lead workers to modify their safety climate perceptions. Given the well-documented effect of safety climate on safety behavior reported in a number of recent meta-analytic studies (Beus et al., 2010; Christian et al., 2009; Clarke, 2010; Nahrgang et al., 2011), these ideas lead to the following hypotheses:

> *Hypothesis 1:* The feedback intervention will result in a higher safety climate level in the experimental but not the control group.

> *Hypothesis 2:* The feedback intervention will result in a higher safety behavior level in the experimental but not the control group.

Given that the safety facet often competes with the productivity facet of work roles, presenting competing operational demands known as safety versus speed, safety-climate intervention programs must include feedback regarding supervisory messages associated with the latter. Such inclusion can be best understood when examined from the perspective of the decoupling phenomenon. A primary qualifying attribute of decoupling concerns partial implementation of formally espoused policies, resulting in policy–practice gaps in organizational subunits (Behnam & MacLean, 2011; Bromley & Powell, 2012). Given that decoupling largely takes place with regard to morally or socially sanctioned goals, designed to gain legitimacy on behalf of key organizational stakeholders, they often compromise the pursuit of business goals related to profitability, productivity, or efficiency (Brunsson, 1989; Oliver, 1991). Consequently, decoupling allows organizations to acquire legitimacy by conforming to external expectations while shielding day-to-day operations from its harmful impact on profitability and related strategic goals. Considering that safety often competes with productivity considerations, decoupling is likely to result in supervisory communications in which production messages are being perceived as having greater priority than safety messages. An intervention designed for safety climate improvement must therefore modify supervisory role expectations in such a way that the perceived priority of productivity-related issues is mitigated whenever it compromises employee safety.

Practically speaking, such a change is going to be expressed in modified supervisory exchanges in which productivity and safety messages are better intertwined or integrated. For example, rather than having an exchange focused largely on production and/or cost-cutting issues, accompanied by a nonspecific reminder that one has to keep working safely (i.e., separation), modified supervisory exchanges would be signified by discussing both goal categories in the context of the other (e.g., referring to a particular safety rule most relevant to the particular production issues under discussion). Such integration is expected not only to increase the perceived priority of safety messages (i.e., Hypothesis 1) but also to reduce the perceived priority of productivity messages in situations where it compromises employee safety. Because productivity enhancement entails higher (mental, physical, temporal, and performance) job demands on shop-floor workers (i.e., greater workload), a reduction in the perceived priority of productivity is expected to result in an experienced decline of workload level by the end of intervention. These ideas lead to the following hypothesis:

> *Hypothesis 3:* The feedback intervention will result in lower perceived workload level for the experimental but not the control group.

A recent meta-analysis indicated that work-group or team processes are among the strongest contextual factors affecting safety climate, safety behavior, and injury outcomes (Clarke, 2010). Such processes include coordination, cooperation, and communication as key elements (Kozlowski & Bell, 2003; Kozlowski & Ilgen, 2006; Stewart, 2006). Similar findings have been reported in the literature on high-performance work systems, identifying group cohesion, members' sense of belongingness, and information sharing as factors affecting safety performance (see review in Zacharatos, Barling, & Iverson, 2005). Such results indicate that, in addition to safety-specific communication among team members (Hofmann & Morgeson, 1999; Hofmann & Stetzer, 1996), sharing any kind of task-related information among team members, resulting in improved coordination or cooperation, is likely to improve the team's safety performance.

Given the relevance of teamwork to safety climate and performance, an intervention aimed at safety climate improvement ought to include supervisory-team-related messages, turning it into an additional source of feedback data. Assuming a performance enhancing effect of such feedback, by increasing the frequency and prioritization of supervisory-team-related messages we can expect an increase in workers' safety climate and team-related behaviors. In addition to safety climate improvement, we can expect greater coordination and communication among group members after the end of intervention. Furthermore, considering that, unlike the productivity facet, teamwork augments rather than competes with safety, an increase in one is expected to be accompanied by an increase in the other. This line of thinking leads to the following hypothesis:

> *Hypothesis 4:* The feedback intervention will result in a higher level of perceived teamwork in the experimental but not the control group.

Finally, given the empirically supported relationship among safety climate, safety behavior, and objective safety outcomes such as near misses and injuries (see meta-analytic results in Beus et al., 2010; Christian et al., 2009; Clarke, 2010; Nahrgang et al., 2011), it follows that changes in safety climate and behavior as well as team communication resulting from our feedback intervention will affect objective safety outcomes.

Safety audits, conducted by safety experts using industry-specific checklists, offer a valid methodology for measuring such outcomes (Glendon, Clarke, & McKenna, 2006). Furthermore, safety audits incorporate company-specific sections for testing implementation of formal policies in individual organizational units (e.g., British Safety Council, 2010). Consequently, such audits can measure both unprotected hazards in individual subunits and, by default, the extent of safety decoupling in each organizational subunit. Based on these methodological attributes, the following hypothesis specifies an expected improvement in safety audit scores as a result of the feedback intervention.

> *Hypothesis 5:* The feedback intervention will result in higher safety audit scores for the experimental but not the control group.

# Method

## Subjects and Procedure

The study was conducted in a midsize heavy manufacturing company responsible for constructing and assembling steel- and aluminum-based sections for large metal structures. The company has a flexible production system, producing customer-tailored products or short batches of the same product. The plant's manufacturing division included 364 workers divided into 26 work teams, each including an average of 14 members (range = 8–16). Average worker age was 42.7 (*SD* = 8.9) with an average tenure of 9.3 (*SD* = 4.1) years in the company. Supervisors, serving as team leaders, were slightly older and had longer tenure at the company (mean age = 47.1; *SD* = 7.7 and mean tenure 14.5; *SD* = 6.9). Supervisors reported directly to the manufacturing division manager, who reported in turn to the company's general manager. As such, the manufacturing manager belonged to the company's senior management team.

The project started with a meeting called by the manufacturing manager and attended by all supervisors. In that meeting, the intervention project was announced; it was described as a safety leadership development project that uses individual feedback to help supervisors increase the importance of their safety messages during daily communication with workers. The project was described as a management-supported project aimed at reducing the gap between the company's formal safety policy and shop-floor practices. It was noted that individual feedback information would remain private and be processed exclusively by the research team, and that the content of feedback sessions conducted with members of the research team would remain confidential. Following this introduction, the first author described the project's rationale, design, and timeline.

The project was designed as a randomized field study in which half the supervisors were randomly assigned to the experimental group, receiving two individual feedback sessions 6 weeks apart. The other half received no feedback, although their workers were equally contacted to elicit the same information regarding perceived supervisory messages during daily exchanges. Supervisors in both groups were asked to inform workers of the intervention project and request their participation in data collection by members of the research team. Such participation was described as having to answer a short list of questions on their cell phone regarding recent exchanges with the direct supervisor, lasting some 3–5 minutes. At the same time, no formal information was made available to supervisors or workers regarding their selection for the experimental or control groups. By the project's conclusion, supervisors in the control group received printed individualized feedback based on the two cycles of their worker ratings, accompanied by a standard explanation regarding the interpretation of these data. Furthermore, supervisors in both groups received at that time a brief summary of intervention results, which they were asked to share with their workers.

Group assignment was determined by a random number generator, with supervisory ID numbers used as input data. This process resulted in the selection of 13 supervisors to the experimental group and 13 supervisors to the control group. Given that one supervisor originally selected for the experimental group refused to take part in the project due to imminent retirement, his group was switched to the control group and was replaced by another, randomly chosen group originally assigned for the control group.

The study employed a before–after design. All workers were asked to fill out a questionnaire delivered 6–8 weeks before the intervention phase and a questionnaire delivered 6–8 weeks after the end of the intervention phase. Given that the intervention phase lasted 12 weeks, questionnaires had to be filled 28 weeks (i.e., 7 months) apart. The questionnaires included scales measuring safety climate, safety behavior, subjective workload, teamwork, and corrective leadership (the latter variable served as covariate in our statistical models). Questionnaires were filled out in the company's training facility with workers arriving at prearranged times during work hours without their supervisor. Questionnaires were completed anonymously and were collected immediately by members of the research team, who supervised this process and guaranteed absolute confidentiality before aggregating the data for group-level analyses. Workers could decline participation by avoiding the scheduled sessions or by returning unfilled questionnaires. We ensured that management had no way of knowing who participated, eliminating potential pressure in this regard. Overall response rate was 86%, resulting in a sample of 313 respondents filling out both questionnaires. Concurrent with survey deliveries before and after the intervention, two external safety consultants performed safety audits across all work units. Audits (and questionnaires) were done for study purposes alone, and their results have not been shared with study participants.

The feedback intervention included two individual feedback sessions with supervisors belonging to the experimental group, provided 6 weeks apart. Feedback data presented the perceived priority of supervisory messages during routine exchanges regarding three role facets (i.e., safety, productivity, and teamwork) as reported by randomly selected workers. These sessions lasted between 30 and 45 minutes and were conducted at each supervisor office. Given our goal of testing a cost-effective intervention approach, we used two graduate students as neutral facilitators. They were trained for about an hour, focusing on three issues: (a) helping participants to interpret their individual bar-code graphs; (b) highlighting differences between sent and received messages; and (c) setting informal goals for future communication exchanges (i.e., up to their next feedback session; see Latham & Locke, 1991). Facilitators offered participating supervisors no suggestions or tips regarding goal setting, except for indicating that they had to choose a value they wished to achieve by the next feedback session for each of the three bars on their graph.

Feedback information was collected with the following procedure. First, four hourly-paid undergraduate students used random-number tables for calling worker cell phones at random times during the workday following a random (between- and within-group) employee selection and calling order. This process was continued until phone interviews had been conducted with seven to nine workers in each work team. The same process was conducted for both the experimental and control groups to collect data for subsequent between-group comparisons.

Once a worker had answered the call and indicated that he or she had time for a short conversation, a brief structured interview followed, guided by a six-item checklist referring to the last exchange the worker had with direct supervisor (items are described in the Measures section below). Items asked about the perceived significance or importance of three message categories communicated during that exchange. Feedback data, presented as bar graphs, offered each supervisor his mean work-group ratings on each of the three message categories. Additionally, benchmark data allowed comparisons with one's own initial score (i.e., using the first feedback data as baseline) and with the average score of other supervisors in the experimental group. The 12-week intervention phase was composed of two consecutive sessions, each lasting 6 weeks. Interviews with employees, lasting the first 3 weeks, were done before the feedback sessions, which took another 3 weeks to complete. Overall, 22 workers refused to participate in this process, resulting in a sample of 175 individuals in the experimental group and 167 individuals in the control group.

## Measures

*Perceived supervisory messages* were measured during structured phone interviews in which interviewers used a 6-item checklist adapted from Zohar and Luria (2003). Checklist items referred to three message categories: safety and reliability (error prevention), speed and efficiency, and team communication and coordination. Interviewed workers had to respond to each item by choosing a number indicating the extent to which it seemed to be significant or important to the supervisor during their last verbal exchange. The checklist used an easy-to-remember 3-point scale: 1 (*low/none*), 2 (*medium*), and 3 (*high*). Example items include "Made me feel that he cares about my safety"; "Spoke about timetables, hard work, pushing forward or making progress"; and "Indicated that he expects us to share information and work as a team." Given two items for each category, internal consistency was tested by computing the correlation between item pairs across the entire sample (i.e., workers belonging to experimental and control groups), based on data collected for the first feedback session. Pairwise correlation coefficients were as follows: 0.74 (safety messages); 0.81 (speed messages); and 0.71 (team messages). Consequently, message scores were computed based on the average rating of both items per each respondent. Supervisory feedback was presented graphically as a three-bar diagram representing the mean ratings of seven to nine respondents in each team.

*Safety climate* was measured with a 16-item group-level scale developed and validated by Zohar and Luria (2005). Subsequent studies confirmed its predictive validity in heavy manufacturing companies, using objective safety behavior and injury data as criterion outcomes (Johnson, 2007). Items were accompanied by a 5-point rating scale ranging from 1 (*completely disagree*) to 5 (*completely agree*). Scale items cover a range of indicators workers use to assess or perceive the priority of safety displayed by their direct supervisor. Sample items include "My supervisor makes sure we receive all the equipment needed to do the job safety"; "Frequently checks to see if we are all obeying the safety rules"; and "Insists we wear our protective equipment even if it is uncomfortable." Given previous factorial analyses of this scale, indicating a single high-order factor expressing global commitment or priority for safety, the climate score was measured with the mean item ratings. Alpha reliability of this scale was 0.93, corresponding with previous studies.

*Safety behavior* was measured with a six-item scale developed by Griffin and Neal (2000). Items were accompanied by a 5-point rating scale ranging from 1 (*completely disagree*) to 5 (*completely agree*). Scale items refer to two dimensions of safety behavior, identified as compliance and participation. Given strong correlations between both dimensions in the original paper and in the current study ($r = .80$), they were combined to form a single safety behavior score. Sample items include "I carry out my work in a safe manner"; "I use the correct safety procedures for carrying out my job"; and "I put in extra effort to improve the safety of the workplace." Alpha reliability of this scale was 0.81.

*Workload* was measured with a modified six-item scale developed by Caplan, Cobb, French, Van Harrison, and Pinneau (1980). Scale items refer to different workload dimensions (i.e., mental, physical, temporal, and performance demands). Items were accompanied by a 5-point rating scale ranging from 1 (*rarely*) to 5 (*very often*). Sample items concern the frequency of having to work really fast on the job or the frequency of having down time between intense work periods. Alpha reliability of this scale was 0.88.

*Teamwork* was measured with eight items taken from the team interaction frequency and openness subscales of the Team Climate Inventory (Anderson & West, 1998). Items were accompanied by a 5-point rating scale ranging from 1 (*not at all*) to 5 (*completely agree*). Sample items for team communication frequency include "We keep in touch with each other as a team" and "We interact frequently." Sample items for team communication openness include "We share information generally in the team rather than keeping it to ourselves" and "People keep each other informed about work-related issues in the team." Given strong correlation between the two item groups ($r = .84$), they were collapsed into a single scale. Alpha reliability of this scale was 0.79.

*Corrective leadership* was measured with six items of the management-by-exception (MBE-Active) subscale of the Multifactor Leadership Questionnaire (Bass & Avolio, 1997). Items were accompanied by a 5-point rating scale ranging from 1 (*not at all*) to 5 (*completely agree*). Sample items refer to concentrating on mistakes and departures from the norm or being on the lookout for rule violations. Alpha reliability of this scale was 0.92.

*Safety audits* were performed before and after intervention by two externally affiliated safety consultants who remained unaware of this study rationale or work-team allocation to experimental and control groups. Audits were performed independently by each auditor following the European Commission guide (European Commission, 1995), requiring auditors to judge risk protection based on three to five walk-around tours. Audits were done only for the purposes of this study, and the data were not provided to any company employee during the project. Prior to the start of the project, team supervisors were asked to go over the risk/hazard checklist in the audit guide and identify items that were under their team members' control. Risks affected by senior management action were removed from the list, resulting in a list of 13 items accompanied by a 10-point rating scale ranging from 1 (*poor risk protection*) to 10 (*excellent risk protection*). Items cover issues such as horizontal and vertical risks, handheld equipment risks, fire and electrical risks, hazardous material exposure, collective and personal protection, materials handling and personal transport. Exploratory factor analyses revealed a single global factor after removal of two items, with an internal consistency of 0.77. Such auditing allows comparison between work teams performing different kind of jobs. Scoring reliability was tested by comparing the audit scores for each work team between the two auditors, resulting in $r_s = 0.81$ ($p < .01$).

## Results

Table 1 presents the descriptive statistics for all variables in our statistical models, broken down by (experimental and control) group and time (pre- and postintervention). It is noteworthy that the pattern of correlations remains stable for both groups, indicating that our intervention had no effect on relationships among variables, just their means. Table 2 presents the descriptive statistics for the three supervisory message types as perceived and rated by exchange recipients, broken down by (experimental and control) group and time (first and second feedback sessions). These data indicate that, whereas at baseline (i.e., first feedback session)

Table 1
*Intercorrelations and Descriptive Statistics of Variables Used for Before- and After-Intervention Comparisons*

| | Experimental group | | | | | | Control group | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 | 4 | 5 | 6 |
| 1. Safety climate | — | −0.18 | 0.44 | 0.42 | 0.28 | 0.35 | — | −0.12 | 0.52 | 0.51 | 0.33 | 0.39 |
| 2. Workload | −0.14 | — | −0.36 | −0.28 | −0.30 | 0.22 | 0.04 | — | −0.18 | −0.22 | −0.27 | 0.11 |
| 3. Teamwork | 0.55 | −0.20 | — | 0.56 | 0.29 | 0.08 | 0.50 | −0.15 | — | 0.54 | 0.30 | 0.15 |
| 4. Safety behavior | 0.68 | −0.23 | 0.59 | — | 0.39 | 0.41 | 0.42 | −0.10 | 0.40 | — | 0.35 | 0.45 |
| 5. Safety audits | 0.34 | −0.33 | 0.21 | 0.44 | — | 0.39 | 0.36 | −0.31 | 0.25 | 0.39 | — | 0.41 |
| 6. MBE-Active | 0.37 | 0.27 | 0.11 | 0.43 | 0.44 | — | 0.43 | 0.19 | 0.08 | 0.40 | 0.42 | — |
| Mean T1 | 3.32 | 2.75 | 2.92 | 2.81 | 6.01 | 2.78 | 3.19 | 2.73 | 2.67 | 2.75 | 6.23 | 2.79 |
| Mean T2 | 3.93 | 2.37 | 3.44 | 3.20 | 7.79 | 2.81 | 3.29 | 2.64 | 2.71 | 2.93 | 6.09 | 2.77 |
| *SD* T1 | 0.70 | 0.78 | 0.74 | 0.70 | 1.14 | 0.69 | 0.74 | 0.69 | 0.84 | 0.78 | 1.22 | 0.72 |
| *SD* T2 | 0.69 | 0.69 | 0.78 | 0.73 | 1.19 | 0.72 | 0.80 | 0.70 | 0.74 | 0.72 | 1.08 | 0.76 |

*Note*. T1 (preintervention) data are above diagonal; T2 (postintervention) data are below diagonal. Experimental group $n = 175$; control group $n = 167$. If $r > 0.19$, $p < .05$; if $r > 0.29$, $p < .01$. MBE-Active = management-by-exception subscale of the Multifactor Leadership Questionnaire; T1/T2 = Time 1/Time 2; *SD* = standard deviation.

Table 2
*Descriptive Statistics of Supervisory Message Types as Perceived by Workers During Routine Exchanges*

| | Experimental group | | Control group | |
|---|---|---|---|---|
| Message type | Feedback 1 | Feedback 2 | Feedback 1 | Feedback 2 |
| Safety | 1.84 (0.40) | 2.78 (0.35) | 1.68 (0.42) | 1.89 (0.47) |
| Speed | 2.27 (0.56) | 1.41 (0.47) | 2.38 (0.89) | 2.32 (0.66) |
| Teamwork | 0.77 (0.15) | 2.17 (0.26) | 0.84 (0.19) | 0.78 (0.18) |

*Note*. Numbers refer to group means; numbers in parentheses refer to standard deviations. Numbers are derived from a 3-point rating scale used by exchange recipients.

there were no differences between the experimental and control groups, such differences emerged following the intervention (i.e., second feedback session). Given that this pattern of results can be observed across the three message types, it supports the effectiveness of our manipulation in terms of changes in perceived supervisory messages.

Table 3 presents the within-unit ICC(1) values measured before and after intervention for each of the dependent variables (Bliese, 2000; Kozlowski & Klein, 2000). The table also includes intraclass correlation (ICC) values for corrective leadership (MBE), serving as a unit-level control variable in the statistical models described below. As shown in this table, although ICC values remained significant before and after intervention, their level increased after intervention for the variables safety climate, perceived workload, and safety behavior, reflecting greater within-unit homogeneity apparently as a result of the feedback intervention.

Given the hierarchical structure of our data (i.e., subjects nested in time due to repeated measurements and in organizational units) and demonstrated within-unit homogeneity, we employed a mixed-effects model for data analysis, using SAS Mixed Procedure software (SAS Version 9.3). Linear mixed models were applied for each of the dependent variables (i.e., safety climate, perceived workload, teamwork, and safety behavior). The independent variables were time (T = 0 before intervention; T = 1 after intervention); group (G = 1 for experimental group; G = 2 for control group); the interaction between time and group; and the control variable identified interchangeably as MBE or corrective leadership. The latter variable served as a group-level covariate, given that prioritization of safety compliance, likely to result from corrective leadership, has been shown to serve as a primary cue for safety climate perceptions (Griffin & Neal, 2000; Zohar, 2011). The repeated option was used to account for differences between times regarding the variances between organizational units and for correlations between times within units. Such a statistical model allows testing of all hypotheses with main and interaction effects between time and group for each of the dependent variables.

Table 4 presents the results of our mixed-effects model analysis, reporting the data by means of its respective variance terms, such that the major sources of nonindependence in the dependent variables can be determined. It should be noted that the interaction term in this table (i.e., Time × Group) represents the difference of change between time = 0 (before intervention) and time = 1 (after intervention) between treatment and control groups. Interaction-effect data in this table relate, therefore, to the extent (and statistical significance) of differences between the two study groups whose repeated measurements are nested in time (i.e., from time = 0 to time = 1). As shown in this table, Time × Group interaction terms were statistically significant with regard to all dependent variables. The shapes of these interactions are presented graphically in Figures 1a–1d. The effects of intervention on (independently measured) safety audits were as follows: Time ($F = 4.21$; $p < .05$), Group ($F = 5.87$; $p < .01$), Time × Group interaction ($F = 4.41$; $p < .05$), and MBE ($F = 8.14$; $p < .01$). Whereas at t = 0 there were no significant differences in audit scores between groups ($F = 0.16$; n.s.), at t = 1 there were significant differences between the two groups ($F = 2.89$; $p < .01$). These results are presented graphically in Figure 1e.

Considered jointly, our results support the five hypotheses described above, with the exception of Hypothesis 2, which was only partially supported due to a significant increase in safety behavior following the intervention (see group variable effects in Table 4). As noted below, such an increase may have resulted from control-group workers' exposure to the intervention project in general and their participation in data collection interviews in particular.

Table 5 presents information regarding effect-size estimates, using the $R^2_{\mathbf{LR}}$ statistic for each of the dependent variables. This statistic, recommended by Aguinis, Gottfredson, and Culpepper (2013), compares the $R^2$ values offered by a main-effect model with that offered by a model that includes the Time × Group interaction. $R^2_{\mathbf{LR}}$ is a likelihood-based $R$ square defined as follows:

$$R^2_{\mathbf{LR}} = 1 - \exp[-\frac{2}{n}(\log \mathrm{L}_{\mathbf{M}} - \log \mathrm{L}_{\mathbf{0}})]$$

$\log \mathrm{L}_{\mathbf{M}}$ is the maximum log likelihood of the model, and $\log \mathrm{L}_{\mathbf{0}}$ is the maximum log likelihood of the intercept-only model where $n$ is sample size (Cox & Snell, 1989; Magee, 1990). As shown in Table 5, all $R^2_{\mathbf{LR}}$ differences proved statistically significant, accounting for 15% increment in explained safety climate variance, 12% for perceived workload variance, 18% for teamwork variance, and 8% for safety behavior variance. Overall, therefore, the data indicate that in addition to resulting in statistically significant changes for all outcome variables, these changes were quite substantial in terms of their impact on worker assessment of their work environment.

Table 3
*Within-Unit ICC Values Measured Before and After Intervention for Safety Climate, Workload, Teamwork, Safety Behavior, and Corrective Leadership (MBE)*

| Variable | Before intervention (T = 0) | After intervention (T = 1) |
|---|---|---|
| Safety climate | 0.14** | 0.20** |
| Workload | 0.21** | 0.28** |
| Teamwork | 0.31** | 0.29** |
| Safety behavior | 0.14** | 0.23** |
| MBE-Active | 0.23** | 0.24** |

*Note*. Intraclass correlation (ICC) values refer to the ICC(1) statistic. T = time; MBE-Active = management-by-exception subscale of the Multifactor Leadership Questionnaire.
** $p < .001$.

Table 4
*Results of Mixed Effect Models Comparing the Effect of Intervention on Experimental and Control Groups*

| Variable | Safety climate | | | Workload | | | Teamwork | | | Safety behavior | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *B* | *F* | *df* | *B* | *F* | *df* | *B* | *F* | *df* | *B* | *F* | *df* |
| Intercept | 2.62 | 76.56** | 1, 21.4 | 4.59 | 107.1** | 1, 14.2 | 2.75 | 101.5** | 1, 20.5 | 2.67 | 105.8** | 1, 21.2 |
| Time (T) | 0.40 | 32.71** | 1, 17.7 | 0.13 | 2.10 | 1, 15.5 | −0.13 | 4.58* | 1, 17.1 | −0.02 | 0.14 | 1, 18.1 |
| Group (G) | 0.15 | 3.88* | 1, 14.1 | −0.05 | 0.28 | 1, 26.5 | 0.17 | 4.41* | 1, 27.5 | 0.24 | 7.95** | 1, 23.2 |
| T × G | 1.01 | 57.01** | 1, 40.1 | −1.79 | 85.4** | 1, 38.8 | 0.93 | 76.38** | 1, 41.8 | 0.50 | 20.34** | 1, 39.1 |
| MBE | 0.07 | 0.29 | 1, 21.1 | −0.70 | 17.30** | 1, 13.2 | −0.07 | 0.49 | 1, 18.2 | −0.01 | 0.02 | 1, 19.7 |

*Note*. Time concerns the main effect of intervention (T = 0 before intervention; T = 1 after intervention); group concerns the main effect of experimental design (G = 1 for experimental group; G = 2 for control group); T × G interaction concerns the differential effect of intervention on both groups. *df* = degrees of freedom.
* $p < .05$. ** $p < .001$.



## Discussion

Results of this intervention study indicate that changes in supervisory messages indicative of modified priorities among role facets during routine communications with group members resulted in corresponding changes in safety climate, safety behavior, subjective workload, teamwork, and (externally measured) safety audit levels. The fact that such results were observed only in the experimental group reinforces the interpretation that observed changes in supervisory discourse resulting from the feedback intervention have been the underlying cause for subsequent changes in worker climate perceptions and role behaviors. At the same time, a comparison between pre- and postintervention data for the control group indicates significant improvement for its safety behavior level. It is likely that this change can be accounted for, however, by control group members' exposure to the intervention project in general and their participation in data-collection interviews during the intervention phase in particular. It should be noted, though that change was larger in the experimental group, offsetting implications of the control group's improvement.

These results have a number of theoretical and applied implications. First, our study offered a first experimental test of cause–effect relationships among some key variables in organizational climate theory. In particular, our intervention was based on the long-held proposition that managerial commitment to employee safety and health influences the resulting level of safety climate (Beus et al., 2010; Zohar, 1980). Our results indicate that modification of managerial commitment, operationalized as the perceived priority of safety during daily leader–member exchanges, resulted in subsequent modification of safety climate level. Considering organizational climate theory at large, these results imply that the perceived priority of any role facet constitutes the target of (facet-specific) climate perceptions such that modifying the former would result in subsequent modification of the latter.

Second, our study tested the utility (or usefulness) dimension of the organizational climate construct in general and climate–behavior relationship in particular (Bacharach, 1989). Whereas much of climate research has focused on its predictive validity, few studies, if any, have been designed to explain why employees engage (and invest cognitive and energetic resources) in symbolic social interaction leading to climate emergence (Schneider & Reichers, 1983). In other words, although climate scholars generally agree with the idea that climate perceptions concern the kinds of role behavior likely to be supported or rewarded (Schneider et al., 2011), offering an expected-utility explanation for climate emergence, this idea, to the best of our knowledge, has not been put to test. Our intervention data indicate that increased perceived priority or importance of safety messages in supervisory daily discourse, serving as a cue for the kinds of role behavior likely to be rewarded, results in improved safety climate and safety behavior. Such data offer needed empirical evidence regarding the utility aspect of organizational climate.

Third, this study demonstrates the value of discourse analysis in organizational research. Whereas climate theory presupposes social interaction as a contextual antecedent for climate emergence, available studies used other, nondiscursive conceptual frameworks for analyzing social interaction, such as social network analysis (Rentsch, 1990; Zohar & Tenne-Gazit, 2008) or quality of leader–member relationships (Hofmann & Morgeson, 2003; Zohar, 2003). Using a basic discourse analytic technique, our study indicates that linguistic information embedded in routine verbal exchanges can be used as leverage for changing the communicated messages, resulting in subsequent change in employee climate perceptions.

Finally and most important, reported results support the efficacy of our intervention strategy aimed at safety climate improvement. Although the practitioner literature abound with claims of successful interventions aimed at safety climate/culture and/or safety leadership improvement (e.g., Krause, 2005), our search of major databases for peer-reviewed literature found no intervention study relating to safety or any other organizational climate improvement. Given meta-analytic studies supporting safety climate as the most robust predictor of safety performance and subsequent injury records (Beus et al., 2010; Christian et al., 2009; Clarke, 2010; Nahrgang et al., 2011), such lack of intervention research highlights the practical significance of our discourse-based intervention. Because our intervention strategy is based on climate theoretical propositions and requires minimal training for feedback facilitators, there is no reason why our strategy cannot be applied for modification of other organizational climates, focusing, for example, on ethics- or innovation-related messages.

Although our intervention strategy offers a rather large span of application, it requires industry- or even organization-specific tailoring of interview items for collecting received supervisory messages. Development of such items must not only be based on identification of unique (and competing) role facets or operational demands but also be phrased according to common supervisory rhetorical practices at respective intervention sites. There is obvi-

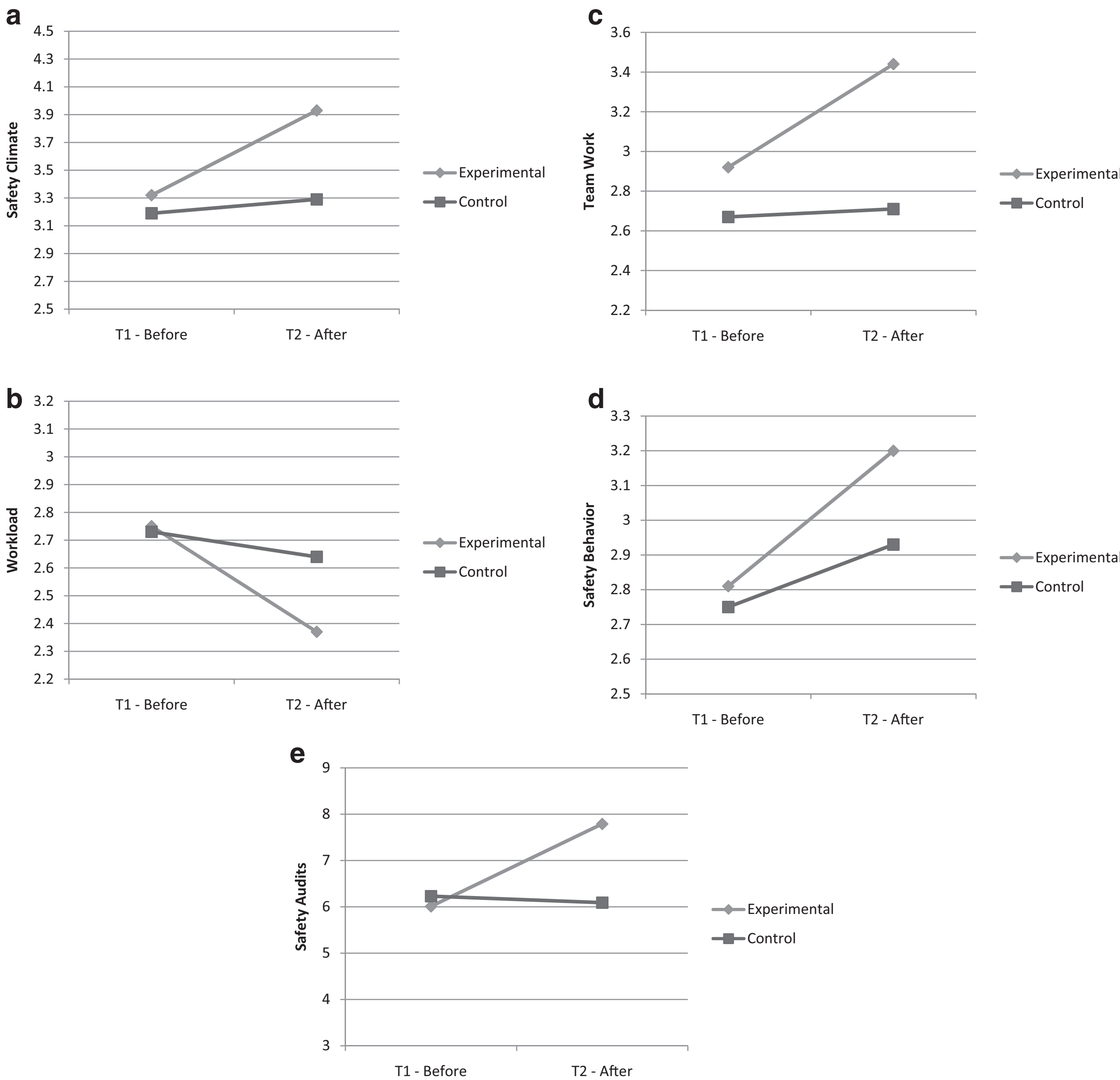


*Figure 1.* (a) Interaction between group and time for safety climate. (b) Interaction between group and time for workload. (c) Interaction between group and time for teamwork. (d) Interaction between group and time for safety behavior. (e) Interaction between group and time for safety audits. T1/T2 = Time 1/Time 2.



ously a need for further research examining the effectiveness of our intervention strategy with other climates, as well as expanding this line of research by testing additional intervention strategies. For example, supervisors in the experimental group can serve as (formal or informal) mentors for supervisors in the control group or for newly recruited ones, helping them modify daily messages on key (competing) role facets or task goals.

## Study Strengths and Weaknesses

A primary strength of this study concerns its design as a randomized field trial consisting of random assignment of work teams to the experimental and control groups, coupled with before–after measurements conducted 6–8 weeks before and 6–8 weeks after the end of the intervention phase. Given the dominance of correlational studies in applied psychology research, coupled with the scarcity of intervention research, the present study demonstrates the benefits of conducting such studies in terms of testing causality between model variables. An added strength concerns the use of multisource data. Whereas the before–after measurements were based on questionnaire data, the questionnaires were augmented by safety audits, conducted independently by two safety experts. Such an experimental design has increased the validity of reported study results.

Table 5
*Effect-Size Estimates Using $R^2_{LR}$ Statistics for Safety Climate, Workload, Teamwork, and Safety Behavior*

| Variable | $R^2_{LR}$ (no interaction) | $R^2_{LR}$ (with interaction) | $R^2_{LR}$ difference |
|---|---|---|---|
| Safety climate | 0.21 | 0.36 | $0.15^{**}$ |
| Workload | 0.13 | 0.25 | $0.12^{**}$ |
| Teamwork | 0.17 | 0.35 | $0.18^{**}$ |
| Safety behavior | 0.15 | 0.23 | $0.08^{**}$ |

*Note*. $R^2_{LR}$ is a likelihood-ratio-based $R^2$ (see explanations in text).
$^{**}$ $p < .001$.

Another methodological strength concerns the fact that our intervention has taken place in the presence of two uncontrolled contextual factors that could have impeded its effectiveness. One factor relates to the fact that supervisors and workers in the control group could observe or communicate with their counterparts in the experimental group by virtue of working in the same location. Furthermore, control-group supervisors participated in the opening session by announcing the start of this project, inasmuch as their workers were asked to respond to phone interviews by the research team during the intervention phase. Such exposure has offered a more stringent test concerning the (incremental) effect of our intervention.

Second, although we included corrective leadership in our statistical models due to its expected effect on prioritization of safety compliance in daily communications, we have not measured resistance to change or openness for experience with supervisors in the experimental group. Although this may be considered an oversight on our part, assuming that this personality trait would have moderated the intervention–outcome relationship, it has resulted in a more stringent test of our hypotheses. Given availability of brief measurement scales for these attributes (Gosling, Rentfrow, & Swann, 2003; Oreg, 2003), their incremental effect on intervention outcomes should be tested in future climate intervention studies.

Study weaknesses largely relate to two issues. First, our feedback intervention was confined to shop-floor supervisors. Given that supervisors belong to the lowest level of management, there is a need for expanding this intervention to include higher level managers in the organization. Assuming a top-down process in which organizational priorities are defined by senior management, it can be expected that discourse modification among senior managers resulting from our feedback intervention will filter down, promoting congruent changes at lower levels in the organization.

Second, being an intervention study, this study would have benefited from a lagged measurement that tested the stability of postintervention changes over a longer period of time. Although such lagged measurement was originally planned to take place 1 year after the project's end, it had to be canceled due to ownership change in this company. At the same time, based on casual conversations we have had with project participants, its impact seems to have been maintained (at least for some of the participants). Future climate intervention studies should incorporate lagged measurement to obtain objective evidence in this regard.

In conclusion, this study presents a new climate-intervention strategy, using theoretical premises as leverage for change. In particular, it induces a change in perceived cues regarding the kinds of role behavior likely to be rewarded by offering individualized feedback to supervisors in the context of routine leader–member communications. Given that this premise applies to any facet-specific climate, our intervention strategy can be used for modifying any climate type. Doing likewise, it offers a framework for conducting action research associated with organizational climate improvement.

Second, by using a discourse-based intervention, this study expands the small body of research focusing on language as a primary dimension of organizational behavior. Given the premise that people talk with each other in order to perform their job (Leclercq-Vandelannoitte, 2011; Phillips & Oswick, 2012) and the availability of quantitative discourse analytic methodologies (Alvesson & Karreman, 2000, 2011; Phillips & Oswick, 2012), inclusion of organizational discourse in organizational behavior research offers an important contribution.

We hope our study stimulates organizational climate scholars to design laboratory or field-based experimental studies, offsetting the current dominance of correlational study designs in this field of research.

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