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Thirty years of safety climate research: Reflections and future directions

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ABSTRACT

Looking back over 30 years of my own and other safety-climate scholars' research, my primary reflection is that we have achieved an enormous task of validating safety climate as a robust leading indicator or predictor of safety outcomes across industries and countries. The time has therefore come for moving to the next phase of scientific inquiry in which constructs are being augmented by testing its relationships with antecedents, moderators and mediators, as well as relationships with other established constructs. Whereas there has been some significant progress in this direction over the last 30 years (e.g. leadership as a climate antecedent), much more work is required for augmenting safety climate theory. I hope this article will stimulate further work along these lines.

Ever since the publication of the original study that defined, measured and tested safety climate some 30 years ago (Zohar, 1980), much of the work in this field has focused on methodological rather than theoretical or conceptual issues. Most studies seem to have focused on climate measurement issues, including factorial structure of measurement scales and its predictive validity with regard to a variety of safety outcomes. As a result, a number of review papers identified more than 20 empirically tested safety climate scales for manufacturing industries alone (Flin et al., 2000), covering more than 50 different variables or conceptual themes (Guldenmund, 2000). This situation resembles the study of the more generic organizational climate in which 32 different definitions were identified (Verbeke et al., 1998). Such a situation implies conceptual ambiguity and the need for greater effort directed at theoretical issues.

Fortunately, despite such variation, the various definitions and measurement scales reveal some commonality, allowing identification of core conceptual themes and shared measurement subscales (Flin et al., 2000; Guldenmund, 2000; Verbeke et al., 1998). It is apparently due to such convergence that recent meta-analytic studies revealed that safety climate offers robust prediction of objective and subjective safety criteria across industries and countries (Nahrgang et al., 2008; Christian et al., 2009). These studies attest to the strength of relationship between safety climate and safety criteria (e.g. mean corrected correlation of −0.38 between safety climate and injury rate, or −0.42 between safety climate and OSHA medical records). As noted by Nahrgang et al. (2008), the demonstrated stability of such relationships across industries and countries attests also to their robustness. The latter meta-analysis, based on a sample of 202 published studies that have passed the authors' scientific inclusion criteria, encompassing 236 independent samples (N=127,266), attests also that time has come to re-focus our attention on theoretical and conceptual issues, having demonstrated the predictive validity of safety climate as a leading safety indicator. The purpose of the present paper is to highlight a number of conceptual issues associated with safety climate, hoping this would not only reduce conceptual ambiguity but stimulate a shift from practical to more theoretical issues, leading to the emergence of better developed safety-climate theory.

1. Conceptual attributes of the construct of safety climate

Organizational climate is made up of shared perceptions among employees concerning the procedures, practices and kinds of behaviors that get rewarded and supported with regard to a specific strategic focus (Schneider, 1990). When the strategic focus involves performance of high-risk operations, the resultant shared perceptions define safety climate (Zohar, 2000).

A key attribute of organizational climate is that it involves employee perceptions regarding selected characteristics or features of their organizational environment. Given the availability and variety of perception-based constructs in safety management research (e.g. risk perception, management style, organizational flexibility), climate perceptions must be distinguished from other types of organizational perceptions (Huang et al., 2006, 2007). The foregoing discussion highlights a number of distinctions qualifying organizational perceptions as safety climate perceptions.

2. Relative priorities

As noted above, climate perceptions are aimed to uncover the kinds of behaviors that get rewarded and supported. The assess-

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ment of such behaviors is often cognitively challenging due to the complexity of the organizational environment. Assuming that the building blocks of the organizational environment consist largely of policies, procedures, and practices; climate perceptions ought to relate to the nature of *relationships between or the relative priorities among* these elements rather than to the consideration of individual elements in isolation. This process is equivalent to pattern recognition whereby raw data are classified into recognizable patterns whose characteristics transcend those of the individual elements making up the pattern. The main practical advantage of this higher level of analysis stems from the fact that once patterns are recognized and the relationships between and relative priorities among these elements are perceived, individuals will have a more informed and comprehensive perspective on the kinds of behaviors likely to be supported and rewarded.

Safety climate perceptions should thus focus on the nature of relationships between safety policies, procedures, and practices, taking into account that oftentimes rules and procedures associated with safety compete with those associated with other domains (e.g. safety vs. productivity or efficiency). From an employee standpoint, it is the overall pattern and signals sent by this complex web of rules and policies across competing domains that ultimately must be sorted out in order to discern what role behavior is expected, rewarded and supported. This argument suggests that safety climate perceptions should move beyond a focus on safety in isolation toward a more comprehensive evaluation that captures at least some of these competing domains. Obviously, how organizational leaders trade-off production-related policies and procedures when situations arise where some policies are in direct conflict with safety will provide the clearest message to employees regarding which is most important. Practically speaking, if productivity is favored over safety across a variety of situations, it implies a higher priority and employees will align their behaviors accordingly to the detriment of safety.

The operationalization of safety climate, therefore, should involve employees evaluating the relative priority of safety such that the overall level of safety climate represents the shared perceptions of the priority of safety compared to other competing priorities (Zohar, 2003). Using a modified safety climate scale in which safety considerations were contextualized by the presence of different competing demands, Zohar and Luria (2004) demonstrated that supervisory decisions in situations where they had to choose between safety and accomplishing the mission were predictive of employee perceptions of safety climate. I, therefore, believe that safety climate perceptions should be viewed from the perspective of "procedures-as-pattern" rather than to individual safety practices or procedures viewed in isolation. In other words, safety climate should be operationalized in the context of other competing task domains.

3. Alignment between espousals and enactments

A second pattern-level attribute of safety climate is the alignment between espoused and enacted priorities. This attribute refers to the extent of convergence or divergence (i.e. alignment or misalignment) between words and deeds on behalf of managers at different levels of the organizational hierarchy (Argyris and Schon, 1996; Simons, 2002). Thus, despite the espousal of employee safety as a high-priority issue, safety procedures are often compromised under competing operational demands such as production pressures or costs, resulting in a gap between enacted and espoused priorities (Eakin, 1992; Pate-Cornell, 1990; Wright, 1986).

The alignment between enacted and espoused priorities is an important attribute of climate perceptions because it is only the *enacted* policies that provide reliable information regarding the kinds of behavior likely to be rewarded and supported (Zohar, 2003). In other words, the distinction between espoused and enacted priorities is of key adaptive significance because only the latter informs employees of behavior-outcome expectancies (Zohar, 2000, 2003).

Alignment between enacted and espoused priorities is not always an easy thing for employees to evaluate or assess. As noted by Simons (2002), the assessment of alignment requires multiple observations, across multiple situations. Over time and across situations, a pattern will emerge that will inform employees how large the gap is between enacted and espoused priorities. As this gap becomes clearer, climate perceptions will be adjusted accordingly.

The evaluation of espoused versus enacted priorities will also include supplementary assessments involving the situational demands contributing to alignment (or the lack thereof). For example, if managers act inconsistently with their espoused safety priorities when circumstances change, this signifies a lower safety priority. If inconsistency or gaps occur under ordinary conditions, this is likely to signify a lesser priority for safety. Espoused priorities regarding safety, for example, might be compromised for certain customer types (e.g. high-volume customers who emphasize on-time delivery), certain product categories, or when safety changes cost more than a certain amount of money. The justifying logic in these cases is that the organization must focus its limited resources on key customers or products. Such compromises and situational characteristics that trigger them create for employees a discrepancy between enacted and espoused priorities which, in turn, help to inform their overall climate perceptions.

4. Internal consistency

A third pattern level attribute of safety climate perceptions is the internal consistency among relevant policies, procedures and practices. Whereas the previous attribute referred to discrepancies between leaders' words and actions, this attribute refers to potential inconsistencies nested among organizational policies, procedures and practices. Although the bureaucratic, or rational, view of organizations suggests an internal consistency and stability among policies, procedures and practices (Blau and Scott, 1962; Weber, 1968), other views characterize organizations as 'organized anarchies' (Cohen et al., 1972) and 'loosely coupled systems' (Weick, 1979). These various views of organizations suggest that internal consistency among organizational elements and processes may vary considerably. In other words, as most every reader has probably experienced, organizations can create rules and policies that seem logically inconsistent and/or mutually exclusive.

Adopting a level-of-analysis perspective, it is also possible to identify inconsistencies across the organizational hierarchy. A recent multilevel model of safety climate (Zohar, 2000, 2003; Zohar and Luria, 2005), suggested that organizational policies define strategic goals and the means of their attainment, whereas procedures provide tactical guidelines for actions related to these goals and means. Practices, on the other hand, relate to the implementation of policies and procedures in each sub-unit. In other words, top managers are concerned with policy-making and the establishment of procedures to facilitate policy implementation, while at lower organizational levels supervisors execute these procedures by turning them into predictable, situation-specific action directives (identified as supervisory practice).

Inconsistencies across the organizational hierarchy are likely to arise from supervisory discretion in policy implementation. Supervisory discretion stems from a number of sources such as the presence of competing operational demands, and the fact that procedures rarely cover all situations (Zohar and Luria, 2005). As members of both individual units and the organization as a whole, employees will perceive signals both from senior management regarding policies and their local supervisor regarding how these

practices are operationalized in their immediate job context. The result is perceptions regarding both an overall organizational climate as well as a local group-level climate where these two climates may be well aligned and consistent or quite inconsistent and discrepant. As these discrepancies arise, employees perceive a lack of internal consistency among policies, procedures, and local practices. This inconsistency will further inform climate perceptions.

As an example, consider a supervisor who directs workers to disregard certain safety procedures whenever production falls behind schedule thus creating a gap between company procedures and sub-unit practices. This local practice which departs from organizational policy helps to inform employee perceptions regarding the level of safety climate within the subunit. If the procedurally inconsistent supervisory practices are accompanied by aligned supervisory words and deeds, this will further strengthen the discrepancy between group- and organization-level safety climates. Using a sample of more than 40 manufacturing companies, Zohar and Luria (2005) found significant within-company variation between departments, accompanied by an overall alignment between the average departmental climate and the company's global safety climate.

5. Shared cognitions or social consensus

An additional attribute of organizational climate stems from its definition as *shared* employee perceptions regarding psychologically meaningful attributes of the organizational environment. From a levels-of-analysis perspective, organizational climate originates with individual members' experiences and perceptions which gradually become socially shared through a variety of mechanisms, thus, emerging as a group-level property (Kozlowski and Klein, 2000).

One key theoretical question relates to the process through which these perceptions become shared and, therefore, climate emerges. How do individual perceptions become shared? Why do groups engage in activities resulting in this emergence? These questions – focused on the antecedents of climate – have not received much attention in the literature yet this is another key attribute distinguishing climate perceptions from other more general employee perceptions.

Previous reviews identified two primary antecedents likely to promote the emergence of shared climate perceptions, i.e. symbolic social interaction and supervisory leadership (Ostroff et al., 2003; Schneider and Reichers, 1983). Because of its relevance to the development of climate models it will be briefly discussed.

5.1. Symbolic social interaction

Symbolic interactionism is the philosophical view that meaning and reality is socially construed, arising from cognitive exchanges among people seeking to comprehend their environment or the world they live in (Blumer, 1969; Stryker, 2008). In other words, the meaning of things and the interpretation of events arise from the interplay between one's own perceptions and those of others in the same situation. During such a process, one's perceptions are being checked and modified in light of others' observations and assessments. Symbolic interaction involves comparing bits of information and cues, discussing possible interpretations, and attempting to reach consensual interpretation of the meaning of events, procedures and practices at the workplace. As a result of such a process, over time, group members' perceptions are expected to converge, resembling processes of newcomer socialization (Schneider and Reichers, 1983). Such convergence promotes the emergence of climate because group members come to share the meanings of their organizational environment. Because group members interact more often with each other than with employees from other groups, they are likely to develop shared perceptions of the local, subunit climate as well as more global organizational climate perceptions.

More recently, symbolic interactionism has been labeled as social sense-making, referring to ongoing interpretative processes in which individuals who are facing complex and ambiguous work situations engage in social exchanges, attempting to make sense of these situations (Weick, 1995, 2005; Weick et al., 1999, 2005). Sensemaking is, therefore, an ongoing, socially based interpretative process directed at the construction of plausible interpretations or accounts of ambiguous situations requiring action on behalf of the participating actors (Brown, 2000).

The role of sensemaking or symbolic interactions as antecedents to climate has not been well studied despite the long-standing proposition regarding its key role in climate emergence (Schneider and Reichers, 1983). The few available studies on this subject used social-interaction rating scales (Gonzalez-Roma et al., 2002; Klein et al., 2001), or social-network techniques (Rentsch, 1990; Zohar and Tenne-Gazit, 2008) as proxies for sensemaking processes. Using a variety of organizational climates (including safety climate), these studies reported positive relationships between the frequency of social exchanges and density of group communication networks and climate strength (i.e. the degree of within-unit agreement among unit members' climate perceptions; see Zohar and Tenne-Gazit, 2008, for a safety climate study).

5.2. Leadership

Throughout much of the history of climate research, there has been a long-held proposition that "leaders create climate" (Lewin et al., 1939). The notion of leadership as a climate antecedent has hardly changed ever since, although this has resulted in limited empirical work (Dragoni, 2005; Kozlowski and Doherty, 1989; Ostroff et al., 2003). Much of the available work focuses on safety climate, consistently supporting the climate-leadership relationship (Barling et al., 2002; Gonzalez-Roma et al., 2002; Hofmann and Morgeson, 1999; Hofmann et al., 2003; Zohar, 2002; Zohar and Luria, 2004; Zohar and Tenne-Gazit, 2008).

This relationship can be explained as a social learning process in which group members repeatedly observe and exchange information with their leader as a means for interpreting the organizational environment (Dragoni, 2005). Supervisory practices are relatively easy to observe due to their proximity and availability, and they routinely inform group members as to relative priorities as well as behavior that is valued and supported by both the leader and the organization at large (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 domain-specific climate.

The relationship between leadership and safety climate has been largely explained as an extension of the leader's concern for group members' welfare. Effective leaders who have established high quality relationships with their unit members care about their psychological welfare. Such caring extends to physical welfare in situations involving heightened risk. The resultant supervisory practices have been shown to affect the very targets of safety-climate perceptions (i.e. perceived priority of safety vs. competing operational demands), resulting in the abovementioned relationship (Hofmann et al., 2003; Zohar, 2002; Zohar and Luria, 2004; Zohar and Tenne-Gazit, 2008). Further research is required for identifying the specific mechanisms with which leaders promote better safety climate in high-risk operations.

Both antecedents imply that shared climate perceptions evolve as a result of ongoing member–leader and member–member interactions (see also Kozlowski and Doherty, 1989). Although there is much evidence suggesting that these interactions do result in

shared climate perceptions, less consideration has been given as to *why* individuals engage in this collective investment of cognitive effort. In other words, a less asked question is where does the motivation for engaging in such social information processing – as opposed to individually searching for the requisite answers – come from?

6. The motivation for climate perceptions: social verification

Given that organizational climate qualifies as *shared* perceptions of the organizational environment, it is important to explicate possible reasons for the shared quality of climate perceptions. Namely, why do group members strive for shared perceptions? I believe that a key reason for the creation of shared perceptions lies in the complexity and equivocality of the organizational environment. The management literature specifies a number of sources for such complexity, including the presence of competing values (Quinn and Rohrbaugh, 1983), competing operational demands (Lawrence and Lorsch, 1967), discrepancies between espousals and enactments (Simons, 2002), and cross-level variations in policy implementations (Zohar and Luria, 2005). Other sources relate to the multiplicity of organizational policies and procedures, accompanied by the fact that they are often little known or understood by relevant employees (Hargie and Dickson, 2007; Stevens et al., 2005). Given the lack of a simple and rational structure, employees need to engage in interpretative and sense-making activities which involve a social-, interpersonal-based process (Weick, 1995).

This is consistent with other theoretical perspectives suggesting that when contextual cues are ambiguous, individuals turn to others for social verification (Festinger, 1954). One such perspective – the shared-reality model (Hardin and Higgins, 1996) – postulates that subjective experiences survive as reliable and valid interpretations by virtue of being reproduced in others and accepted by them as the veridical interpretation of the group's external world.

In the context of organizational safety climate, these theories suggest that the formation of shared climate perceptions is motivated by the need to interpret the complex pattern of signals existing within the organizational context regarding what issues are of high priority and what behaviors are likely to be rewarded and supported. Given the complexity of the organizational environment, individuals will be motivated to test their understanding with others in order to determine if it is a reliable and valid understanding of the organizational context. It is apparently this social verification process that motivates the formation or emergence of organizational safety climate.

7. Safety climate and the safety pyramid

The above discussion can be summarized with a conceptual model linking the occupational safety and organizational climate literatures (see Fig. 1). This model integrates a modified version of the Safety Pyramid model (Reason, 1997) and our discussion of safety climate attributes. The upper part of Fig. 1 represents the long-held premise that the likelihood of occupational injuries is a joint outcome of unsafe conditions at the workplace (i.e. social/technical hazards), unsafe acts, and chance variations (Heinrich, 1959). Whereas this premise refers to immediate or proximal causes of injury, the (modified) safety pyramid represents three layers of increasingly distal injury causes. The bottom or deep layer represents organization-level policies, focusing on the distinction between espoused and enacted policies. The middle layer represents departmental or group-level priorities for competing operational demands, focusing on safety versus speed/productivity. The upper or surface layer refers to workers' practices while

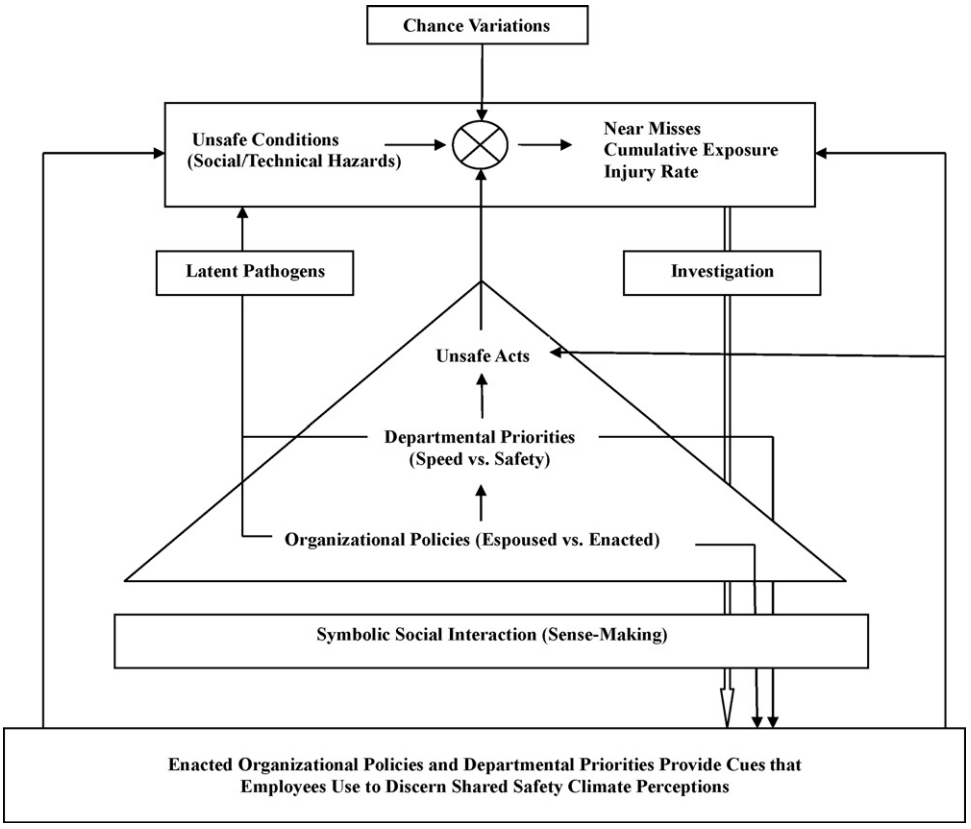

Fig. 1. Integration of safety climate and safety pyramid models.

performing high-risk operations, focusing on the prevalence or likelihood of unsafe acts among relevant employees.

In this sense, while the safety pyramid represents Reason's (1997) original model, progressing from individual- to group- to organization layers or levels of analysis, it does so by focusing on the targets of climate perceptions at each such level. As noted above, employees attend and try to make sense of the pattern of organizational policies by discriminating between espoused and enacted policies, using the latter as indicators of true organizational priorities. Likewise, they attend to the manner by which competing operational demands are being dealt with across a variety of situations and contexts, using it as complementary indicators of the manner by which policies are being implemented in their respective departments. Finally, employees make sense of their environment by attending to work practices exhibited by co-workers in a variety of situations, monitoring supervisory reactions and organizational payoffs associated with divergent practices (e.g. do workers who tend to act unsafely get rewarded for enhanced productivity or penalized for cutting corners?).

Following the original model, the safety pyramid in Fig. 1 is used to identify latent pathogens, i.e. latent factors that increase the likelihood of injury through the promotion of unsafe working conditions. However, the inclusion of a safety climate component at the lower part underlying the pyramid adds an important dimension, incorporating employee shared perceptions of their organization with the objective targets of such perceptions (i.e. objective attributes of the organizational environment). Given the meta-analytic data indicating that safety climate perceptions predict safety behaviors and subsequent safety outcomes (Christian et al., 2009; Nahrgang et al., 2008), the revised model includes an additional set of arrows suggesting the effect of safety climate on the proximal injury factors (i.e. unsafe acts, unsafe conditions, cumulative exposures).

The inclusion of safety climate in the Safety Pyramid model offers a number of advantages. Theoretically, the expanded model provides a contextual framework justifying the attributes of climate perceptions as listed above. Reframing *latent pathogens* as shared climate perceptions targeted on gaps between espoused and enacted safety policies, or on vacillating safety priorities due to other competing demands, offer a needed link between safety climate and the safety management literatures. Such reframing of objectively defined pathogens as targets of climate perceptions allows the inclusion of employee safety behaviors emanating from their shared climate perceptions (e.g. unsafe behavior as a result of poor safety climate). Consequently, the safety pyramid model can be expanded, integrating the effect of latent pathogens on both proximal and distal factors of injury and occupational disease.

Methodologically, given the availability of well-developed procedures for safety climate measurement, its inclusion offers the advantage of quantitative analysis of (perceived) latent pathogens. Such an analysis allows comparison between departments in the same organization and between organizations in the same industry, using benchmarking as a means for meaningful comparisons. Contrary to the original model in which deeper level or lower pyramid layers are investigated following injury or near-misses, safety climate can be measured periodically, using it as a leading indicator of organizational safety. This allows development of a preventative safety strategy in which employee sense-making and climate perceptions are used as leverage for identifying latent or tacit factors *before* an accident has taken place.

8. Concluding comments

Our discussion of safety climate perceptions suggests a number of ways for reducing lingering conceptual ambiguity in this field of research. First, by postulating that the targets of safety climate perceptions relate to system-level attributes such as relative priorities of competing demands, espousal-enactment gaps or discrepancies, or internal consistencies among policies and procedures, it becomes possible to differentiate safety climate from other perception-based constructs. Because it is quite likely that safety climate perceptions have additional system-level targets, the above discussion should stimulate further exploration in this direction. Doing likewise should promote theoretical development of the safety climate construct by linking it with other constructs associated with organizational behavior at large and safety management in particular.

Secondly, our discussion of levels of analysis suggests an additional avenue for conceptual development. Given that the target of climate perceptions can relate to the organization or group levels of analysis (i.e. senior management commitments and policies vs. supervisory or co-worker practices), it follows that climate measurement should be based on level-adjusted subscales offering separate measures for climates associated with respective organizational levels. Given that it has been shown that there is substantial variation in departmental safety climates within organizations (Zohar and Luria, 2005), the practice of mixing items associated with divergent levels of analysis must be discontinued in order to avoid level discrepancy errors in safety climate measurement.

Thirdly, given evidence that employees develop level-specific climate perceptions (e.g. "My supervisor is less/more concerned about our safety than senior management"), development of level-specific subscales should be encouraged as it is likely to enhance measurement sensitivity and conceptual rigor. On a related note, development of industry-specific climate scales should also be encouraged as it is likely to identify new, context-dependent targets of climate perceptions in respective industries. An especially relevant example for the readership of this journal concerns the trucking industry and work-related driving. Several climate scales have been developed, pertaining to trucking (Arboleda et al., 2003), work-related driving (Wills et al., 2006, 2009), road construction (Glendon and Litherland, 2001), and road maintenance (Niskanen, 1994). A recent attempt to develop multi-level climate scales for the trucking industry along the lines described above includes divergent item sets such as: "Company will overlook log discrepancies if I deliver on time", or "My dispatcher insists that I do not use in-vehicle communication devices while driving". These items refer to a variety of observable indicators employees use as targets of their safety climate perceptions (Zohar et al., in preparation). Once a larger number of industry-specific scales are made available, offering a variety of concrete climate indicators, it would be possible to extrapolate underlying or tacit sense-making processes through which shared climate perceptions emerge. In other words, although it is possible to use generic safety climate scales across industries, focusing on the core themes of managerial commitment and safety management, the identification of concrete climate indicators in each industry should offer opportunities for eliciting and testing hypotheses regarding processes underlying climate emergence.

Looking back over 30 years of my own and other safety-climate scholars' research, my primary reflection is that we have achieved an enormous task of validating safety climate as a robust leading indicator or predictor of safety outcomes across industries and countries. The time has therefore come for moving to the next phase of scientific inquiry in which constructs are being augmented by testing its relationships with antecedents, moderators and mediators, as well as relationships with other established constructs. Whereas there has been some significant progress in this direction over the last 30 years (e.g. leadership as a climate antecedent), much more work is required for augmenting safety climate theory. I hope this article will stimulate further work along these lines.

References

Arboleda, A., Morrow, P.C., Crum, M.R., Shelley, M.C., 2003. Management practices as antecedents of safety culture within the trucking industry. Journal of Safety Research 34, 189–197.

Argyris, C., Schon, D.A., 1996. Organizational Learning: Theory, Method and Practice, 2nd ed. Addison-Wesley, Reading, MA.

Ashforth, B.E., 1985. Climate formation: Issues and extensions. Academy of Management Review 10, 837–847.

Barling, J., Loughlin, C., Kelloway, E.K., 2002. Development and test of a model linking safety-specific transformational leadership and occupational safety. Journal of Applied Psychology 87, 488–496.

Blau, P., Scott, W.R., 1962. Formal Organizations: A Comparative Approach. Chandler, San Francisco, CA.

Blumer, H., 1969. Symbolic Interactionism: Perspective and Method. Prentice-Hall, Englewood Cliffs, NJ.

Brown, A., 2000. Making sense of inquiry sensemaking. Journal of Management Studies 37, 45–75.

Christian, M.S., Bradley, J.C., Wallace, J.C., Burke, M.J., 2009. Workplace safety: a meta-analysis of the roles of person and situation factors. Journal of Applied Psychology 94, 1103–1127.

Cohen, M., March, J., Olsen, J., 1972. A garbage can model of organizational choice. Administrative Science Quarterly 17, 1–25.

Dragoni, L., 2005. Understanding the emergence of state goal-orientation in organizational work groups: the role of leadership and multilevel climate perceptions. Journal of Applied Psychology 90, 1084–1095.

Eakin, J.M., 1992. Leaving it up to the workers: sociological perspective on the management of health and safety in small workplaces. International Journal of Health Services 22, 689–704.

Festinger, L., 1954. A theory of social comparison processes. Human Relations 7, 117–140.

Flin, R., Mearns, P., O'Connor, R., Bryden, R., 2000. Measuring safety climate: identifying the common features. Safety Science 34, 177–192.

Glendon, A.I., Litherland, D.K., 2001. Safety climate factors, group differences and safety behavior in road construction. Safety Science 39, 157–188.

Gonzalez-Roma, V., Peiro, J.M., Tordera, N., 2002. An examination of the antecedents and moderator influences of climate strength. Journal of Applied Psychology 87, 465–473.

Guldenmund, F.W., 2000. The nature of safety culture: a review of theory and research. Safety Science 34, 215–257.

Hardin, C., Higgins, E.T., 1996. Shared reality: how social verification makes the subjective objective. In: Sorrentino, R.M., Higgins, E.T. (Eds.), Handbook of Motivation and Cognition: Foundations of Social Behavior, 3rd ed. Guilford, New York, pp. 28–42.

Hargie, O., Dickson, D., 2007. Are important corporate policies understood by employees? Journal of Communication Management 11, 9–28.

Heinrich, H.W., 1959. Industrial Accident Prevention: A Scientific Approach. McGraw-Hill, New York.

Hofmann, D.A., Morgeson, F.P., 1999. Safety-related behavior as a social exchange: the role of perceived organizational support and leader-member exchange. Journal of Applied Psychology 84, 286–296.

Hofmann, D.A., Morgeson, F.P., Gerras, S.J., 2003. Climate as a moderator of the relationship between LMX and content-specific citizenship behavior: safety climate as an exemplar. Journal of Applied Psychology 88, 170–178.

Huang, Y.H., Ho, M., Smith, G.S., Chen, P.Y., 2006. Safety climate and self-reported injury: assessing the mediating role of employee safety control. Accident Analysis and Prevention 38, 425–433.

Huang, Y.H., Chen, J.C., DeArmond, S., Cigularov, K., Chen, P.Y., 2007. Roles of safety climate and shift work on perceived injury risk. Accident Analysis and Prevention 39, 1088–1096.

Klein, K.J., Conn, A.B., Smith, D.B., Sorra, J.S., 2001. Is everyone in agreement? An exploration of within-group agreement in employee perceptions of the work environment. Journal of Applied Psychology 86, 3–16.

Kozlowski, S.W., Doherty, M.L., 1989. Integration of climate and leadership: examination of a neglected issue. Journal of Applied Psychology 74, 546–553.

Kozlowski, S.W., Klein, K.J., 2000. A multilevel approach to theory and research in organizations. In: Klein, K.J., Kozlowski, S.W. (Eds.), Multilevel Theory, Research, and Methods in Organizations. Jossey-Bass, San Francisco, CA, pp. 4–90.

Lawrence, P.R., Lorsch, J.W., 1967. Organization and Environment. Harvard Business School, Boston, MA.

Lewin, K., Lippitt, R., White, R.K., 1939. Patterns of aggressive behavior in experimentally created social climates. Journal of Social Psychology 10, 271–299.

Nahrgang, J.D., Morgeson, F.P., Hofmann, D.A., 2008. Predicting safety performance: a meta-analysis of safety and organizational constructs. In: Presented at the Annual Meeting of the Society for Industrial and Organizational Psychology, San Francisco, April.

Niskanen, T., 1994. Assessing the safety environment in work organization of road maintenance jobs. Accident Analysis and Prevention 26, 27–39.

Ostroff, C., Kinicki, A.J., Tamkins, M.M., 2003. Organizational culture and climate. In: Borman, W.C., Ilgen, D.R., Klimoski, R.J. (Eds.), Handbook of Psychology, vol. 12. Wiley, New York, NY, pp. 565–593.

Pate-Cornell, M.E., 1990. Organizational aspects of engineering system safety: the case of offshore platforms. Science 250, 1210–1217.

Quinn, R.E., Rohrbaugh, J., 1983. A spatial model of effectiveness criteria: towards a competing values approach to organizational analysis. Management Science 29, 363–377.

Reason, J.T., 1997. Managing the Risks of Organizational Accidents. Ashgate, Aldershot, UK.

Rentsch, J.R., 1990. Climate and culture: interaction and qualitative differences in organizational meanings. Journal of Applied Psychology 75, 668–681.

Schneider, B., 1990. The climate for service: an application of the climate construct. In: Schneider, B. (Ed.), Organizational Climate and Culture. Jossey-Bass, San Francisco, CA, pp. 383–412.

Schneider, B., Reichers, A.E., 1983. On the etiology of climates. Personnel Psychology 36, 19–39.

Simons, T., 2002. Behavioral integrity: the perceived alignment between managers' words and deeds as a research focus. Organization Science 13, 18–35.

Stevens, J.M., Steensma, H.K., Harrison, D.A., Cochran, P.L., 2005. Symbolic or substantive document? The influence of ethics codes on financial executives' decisions. Strategic Management Journal 26, 181–195.

Stryker, S., 2008. From Mead to structural symbolic interactionism and beyond. Annual Review of Sociology 34, 15–31.

Verbeke, W., Volgering, M., Hessels, M., 1998. Exploring the conceptual expansion within the field of organizational behavior: Organizational climate and organizational culture. Journal of Management Studies 35, 303–329.

Weber, M., 1968. Economy and Society. University of California Press, Berkeley, CA.

Weick, K.E., 1979. The Social Psychology of Organizing. Addison-Wesley, Reading, MA.

Weick, K.E., 1995. Sensemaking in Organizations. Sage, Thousand Oaks, CA.

Weick, K.E., 2005. Managing the unexpected: complexity as distributed sensemaking. In: McDaniel, R.R., Driebe, D.J. (Eds.), Uncertainty and Surprises in Complex Systems. Springer-Verlag, Berlin, pp. 51–65.

Weick, K.E., Sutcliffe, K.M., Obstfeld, D., 1999. Organizing for high reliability: processes of collective mindfulness. Research in Organizational Behavior 21, 81–123.

Weick, K.E., Sutcliffe, K.M., Obstfeld, D., 2005. Organizing and the process of sensemaking. Organization Science 16, 409–421.

Wills, A.R., Watson, B., Biggs, H.C., 2006. Comparing safety climate factors as predictors of work-related driving behavior. Journal of Safety Research 37, 375–383.

Wills, A.R., Watson, B., Biggs, H.C., 2009. An exploratory investigation into safety climate and work-related driving. Work 32, 81–94.

Wright, C., 1986. Routine deaths: fatal accidents in the oil industry. Sociological Review 4, 265–289.

Zohar, D., 1980. Safety climate in industrial organizations: theoretical and applied implications. Journal of Applied Psychology 65, 96–102.

Zohar, D., 2000. A group-level model of safety climate: testing the effect of group climate on micro-accidents in manufacturing jobs. Journal of Applied Psychology 85, 587–596.

Zohar, D., 2002. The effects of leadership dimensions, safety climate, and assigned priorities on minor injuries in work groups. Journal of Organizational Behavior 23, 75–92.

Zohar, D., 2003. The influence of leadership and climate on occupational health and safety. In: Hofmann, D.A., Tetrick, L.E. (Eds.), Health and Safety in Organizations: A Multilevel Perspective. Jossey-Bass, San Francisco, CA, pp. 201–230.

Zohar, D., Luria, G., 2004. Climate as a social-cognitive construction of supervisory safety practices: scripts as proxy of behavior patterns. Journal of Applied Psychology 89, 322–333.

Zohar, D., Luria, G., 2005. A multilevel model of safety climate: cross-level relationships between organization and group-level climates. Journal of Applied Psychology 90, 616–628.

Zohar, D., Tenne-Gazit, O., 2008. Transformational leadership and group interaction as climate antecedents: a social network analysis. Journal of Applied Psychology 93, 744–757.

Zohar, D., Huang, Y.H., Robertson, M., Gray, G. Developing Industry-specific Safety Climate Scales. Liberty Mutual Research Institute for Safety, in preparation.