Journal of Occupational and Organizational Psychology (2012), 85, 454–471
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Perceptual equivalence of psychological climates within groups: When agreement indices do not agree

Jeremy M. Beus*, Steven M. Jarrett, Mindy E. Bergman and Stephanie C. Payne
Texas A&M University, USA

Individual climate perceptions (i.e., psychological climates) are often aggregated to form group-level climates without considering the equivalence of the meaning of climate within groups. Confirming perceptual equivalence across faultlines – within-group dividing lines that can create subgroups based on the alignment of group member attributes (Lau & Murnighan, 1998) – is a particularly important concern given that sense-making processes and subsequent psychological climates are likely to differ across faultlines. Using safety climate as an exemplar, we demonstrate the importance of assessing qualitative perceptual equivalence (i.e., perceptions of what a climate is) within groups instead of solely relying on traditional agreement indices (e.g., r_{wg}, intraclass correlation [ICC]) to make aggregation decisions. Specifically, we tested for perceptual equivalence across context-specific faultlines (hierarchical level and organizational heritage) in a large, multinational organization using multi-group hierarchical confirmatory factor analyses and found that although traditional agreement indices universally supported aggregation decisions, tests of perceptual equivalence in 8 of 12 separate subgroup analyses failed to support aggregation. These findings confirm the importance of testing for perceptual equivalence within groups before aggregating psychological climates to the group level.

Practitioner points

- Our findings underscore the value for organizations to consider the potential existence of faultlines and to examine their possible influence on employee climate perceptions.
- These findings also point to the need for organizations to promote qualitative equivalence of climate perceptions among employees independent of the potential existence of faultlines.

*Correspondence should be addressed to Jeremy Beus, 4235 TAMU, College Station, TX, USA (e-mail: jeremybeus@gmail.com).

DOI:10.1111/j.2044-8325.2011.02049.x

Organizational climate – employee perceptions of organizational policies, procedures, and practices and the behaviours reinforced thereby (Reichers & Schneider, 1990; Schneider & Reichers, 1983) – has important implications for subsequent employee behaviour (e.g., Ostroff, Kinicki, & Tamkins, 2003; Schneider, Ehrhart, & Macey, 2011). Because organizational climate lacks meaning without a specific referent (Schneider & Reichers, 1983), researchers have investigated a variety of climates (e.g., safety, service, justice) to explain both organizational phenomena and individual behaviour. Whereas organizational climate is considered a group-level phenomenon,[1] psychological climate is an *individual's* perception of workplace policies, procedures, and practices (James & Jones, 1974).

However, even though organizational climate is a group-level phenomenon, it is generally measured at the individual level – the locus of perceptions (James, 1982; Joyce & Slocum, 1979) – and then aggregated across people to the group level (Chan, 1998). James (1982) defended this common practice by noting, '[I]f the objective of climate measurement is to assess the psychological meaning imputed to environments through cognitive processes ... then it is axiomatic that the unit of theory be the individual' (p. 220). We likewise contend that aggregating psychological climates is the most theoretically appropriate means of assessing group-level climates. It is our position, however, that psychological climates are frequently aggregated to represent organizational climates without confirming that the phenomenon of interest is understood in the same way across group members. Specifically, psychological climates are often aggregated to the workgroup or organizational level without confirming that perceptual equivalence exists within those groups across potentially relevant within-group boundaries, such as faultlines. Faultlines are dividing lines based on the alignment of one or more group member attributes (e.g., sex; Lau & Murnighan, 1998) that could create perceptual differences in psychological climates. This is problematic because if the meaning of a construct is not equivalent across faultlines within a group, it is not appropriate to aggregate psychological climates across such faultlines to the group level. The common practice of using within-group agreement indices (e.g., r_{wg}, intraclass correlation [ICC]) to determine the appropriateness of aggregating psychological climates to the group level (Bliese, 2000; Chan, 1998) does not solve this problem because such indices do not necessarily indicate a shared understanding of the construct's meaning. That is, within-group agreement metrics focus on quantitative agreement (i.e., the extent to which group members chose the same number on a scale) with little regard for qualitative agreement (i.e., the extent to which group members perceive the construct as the same basic phenomenon; Bergman, 2011).

Consequently, the purpose of this study is to describe how systematic perceptual differences might arise within groups due to faultlines and how such differences can be evaluated in organizational climate research. Our contention is that the sole reliance on quantitative agreement indices for making aggregation decisions can overlook meaningful qualitative differences within groups and that testing for such differences across potential faultlines is an important additional step that should precede aggregation to the group level. We illustrate the importance of this consideration by testing the qualitative equivalence of psychological safety climates across relevant faultlines in an

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[1] *Group-level climates are sometimes generically referred to as 'organizational climate' but can exist at lower level groupings within an organization as well (e.g., site level, workgroup level; Ostroff, Kinicki, & Tamkins, 2003).*

international chemical processing and manufacturing organization. However, before doing so, we first introduce and distinguish the related concepts of qualitative and quantitative perceptual similarity and then discuss the relevance of faultlines to these concepts.

Qualitative versus quantitative perceptual similarity

According to James, James, and Ashe (1990), the meaning employees attach to latent organizational constructs can differ both qualitatively and quantitatively. Qualitative differences in meaning suggest that individuals differ in the cognitive schemas used to interpret the same organizational phenomenon, whereas quantitative differences correspond to dissimilarities in the evaluations individuals make of the same phenomenon (James *et al.*, 1990). Stated differently, qualitative differences denote that individuals do not perceive a given construct as the same phenomenon, whereas quantitative differences reflect variation in the extent to which individuals perceive a phenomenon as good or bad, favourable or unfavourable, or existing to a greater or lesser degree. Importantly, in order to determine whether quantitative differences are truly meaningful, qualitative similarity must first be established (Bliese, Chan, & Ployhart, 2007). Absent qualitative similarity, it is not possible to determine whether quantitative differences are due to actual differences in perceptions or whether they are due to underlying differences in the meaning of the construct.

As noted, the most common practice in organizational climate research is to aggregate psychological climates to the group level only if group members demonstrate a high degree of perceptual agreement (e.g., Chan, 1998; James, 1982; Klein, Conn, Smith, & Sorra, 2001). This typifies the direct consensus composition approach, which assumes that the emergence of a higher-level construct is dependent upon agreement, or consensus, at the lower level (Chan, 1998). Although organizational climates have been argued to exist and to provide meaningful contextual information regardless of the degree of consensus (i.e., climate strength) at the group level (Beus, Bergman, & Payne, 2010; Glick, 1985; Lindell & Brandt, 2000; Schneider, Salvaggio, & Subarits, 2002), the more problematic issue in direct consensus models is that group member agreement is typically determined by comparing *quantitative* climate perceptions (e.g., within-group variance of individual scores on a climate measure) whereas qualitative similarity is an implicit assumption that usually goes untested. However, because it is possible to have what appears to be quantitative perceptual agreement without qualitative agreement and *vice versa* (Bergman, 2011), both qualitative and quantitative congruence should be considered explicitly and separately (Drasgow & Hulin, 1987; Hulin, Drasgow, & Komocar, 1982).

For example, two workers could both rate the prevailing justice climate in their organization favourably, but person A does so because he receives full details regarding organizational decisions whereas person B does so because such decisions are communicated to her with kindness and respect; in this case, the construct of 'justice climate' is defined differently by the two employees. Conversely, individuals might agree on what constitutes a good justice climate but disagree on its level of favourability. Thus, the mere appearance of quantitative equivalence does not guarantee the existence of qualitative equivalence and *vice versa*. Given the importance of assessing qualitative perceptual equivalence within groups before aggregating to higher levels or making quantitative comparisons, it follows that researchers should identify *where* perceptual differences might theoretically be expected to exist within groups in order to conduct targeted assessments of qualitative equivalence. Faultlines theory provides a framework for understanding how potentially meaningful groupings, across which employee perceptions and subsequent sensemaking (Weick, 1995) would be expected to differ, might arise.

Faultlines and qualitative equivalence

Individual differences in group member attributes can result in the creation of faultlines within groups (Lau & Murnighan, 1998). Past research has considered the formation of faultlines based on the alignment of demographic (e.g., sex, race, tenure, functional work background) and nondemographic attributes (e.g., values, experiences, personality) among group members (Lau & Murnighan, 1998; Meriac, Poling, & Woehr, 2009; Woehr, Arciniega, & Lim, 2007). When faultlines are made salient, larger groups can split into subgroups along the faultline (e.g., men vs. women; supervisors vs. subordinates) because employees categorize each other into in-groups and out-groups based on their particular set of attributes (Lau & Murnighan, 1998; Thatcher & Patel, 2011). Different faultlines can create different groupings, depending on the attributes that are made salient. For example, in a group consisting of one White male, one White female, one Asian male, and one Asian female there are two potential subgroups depending on whether sex or race was salient to the group. Further, the more attributes align within groups and differ across groups, the stronger the faultline will be. For example, a group consisting of two White males and two Asian females would be more likely to recognize subgrouping and form a faultline than would the former example.

Faultlines affect individual sensemaking across and within subgroup boundaries because individuals within subgroups are more apt to share information and discuss organizational events with each other than they are with members of other subgroups, probably due to reduced social integration and communication across subgroup boundaries (Lau & Murnighan, 1998; Lau & Murnighan, 2005; O'Reilly, Caldwell, & Barnett, 1989). This is noteworthy because sensemaking (Weick, 1995) is an important part of the development of psychological climate (Ostroff *et al.*, 2003), as it is a mechanism to reduce uncertainty related to organizational or group-level norms (Louis, 1980; Weick, 1995). Individuals use the sensemaking process to infer organizational priorities and the corresponding behaviours that are expected to be rewarded or punished based on those priorities. Sensemaking is posited to be the primary means by which organizational events and social information are transformed into psychological climate (Ostroff *et al.*, 2003). If sensemaking systematically differs across faultlines, it is likely that psychological climates would also differ across subgroup boundaries. Thus, the aggregation of psychological climates across faultlines can lead to improperly defined group-level climates, because the 'group' is in reality a set of subgroups. Consequently, before aggregating psychological climates, climate researchers should consider potentially relevant faultlines within groups and confirm a shared qualitative understanding of the construct of interest across such faultlines. To illustrate the merit of this proposition, we next consider climate perceptions within a large organization and describe relevant potential faultlines that could preclude the aggregation of psychological climates across their boundaries.

Safety climate and faultlines in a specific organizational context

Safety climate represents employee perceptions of the relative priority of safety within an organization (Zohar, 2000) and is arguably the most widely examined type of climate in the organizational sciences. Meta-analytic evidence has demonstrated meaningful relationships between safety climate and important safety-related outcomes (Beus, Payne, Bergman, & Arthur, 2010; Christian, Bradley, Wallace, & Burke, 2009). In the international chemical processing and manufacturing organization used as exemplar in this study (Company A), safety climate is of particular importance given workers' interactions with and proximity to dangerous chemicals and materials. Correspondingly, a safety climate survey was administered across Company A's 82 sites. It is noteworthy that a series of mergers and acquisitions preceded the survey such that employees could be categorized as being hired into Company A through one of four distinct avenues as follows: (1) by being an employee of Company X, which was acquired by Company A ($n = 4{,}547$); (2) by being an employee of Company Y which later merged with Company A ($n = 1{,}434$); (3) through direct hire into Company A – hereafter referred to as 'direct hires' ($n = 1{,}560$); and (4) by being an employee of a company contracting with Company A – hereafter referred to as 'contractors' ($n = 922$).

The integration of employees from four distinct backgrounds into one organizational context creates a scenario where faultlines based on organizational heritage could emerge. Although employees joining the organization through merger, acquisition, or contract were likely familiar with their prescribed tasks before joining Company A, each group is likely to have experienced distinct sensemaking and socialization processes; different organizations, even in the same industry, would be expected to have distinct climates such that individuals from each group might have a unique conceptualization of 'the way we do things around here' (Fisher, 1986; Van Maanen & Schein, 1979).

Although organizational heritage alone is likely sufficient to activate a faultline, the combination of this variable with workers' hierarchical level would be expected to accentuate any perceptual differences that might exist (Lau & Murnighan, 1998). Specifically, the alignment of organizational heritage and a worker's position within the organizational hierarchy should be particularly dividing such that (for example) a front-line worker acquired from Company X would be expected to have a different climate perspective than a manager who arrived through a merger with Company Y. The power differential that exists between lower-level employees and supervisory or managerial employees (French & Raven, 1955), in combination with operating in distinct working environments (front-line employees generally work in more hazardous conditions than managerial employees), make an employee's hierarchical position a meaningful additional contributor to the potential formation of faultlines (Cheyne, Tomas, Cox, & Oliver, 2003; Cole & Bruch, 2006).

Thus, in the following sections, we examine whether there is qualitative perceptual equivalence at the psychological climate level across the faultlines of organizational heritage and position in the organizational hierarchy. We compare the results of these analyses to those from traditional aggregation analyses (i.e., estimates of quantitative agreement, such as $r_{wg} \geq .70$) to test the merit of considering qualitative equivalence in addition to quantitative equivalence. There are three possible outcomes to this comparison. First, both approaches could support aggregation. Second, neither approach could support aggregation. Finally, one approach could support aggregation and one could not support it. We use the results of these analyses to draw conclusions about the

Table 1. Sample breakdown by examined faultlines

Organizational heritage	Employee	Supervisor	Total
Full sample			
Company X	3,443	1,099	4,542
Company Y	1,123	311	1,434
Direct hires	1,265	289	1,554
Contractors	738	184	922
Total[a]	6,569	1,883	8,452

Note. The full sample (N = 8,658) does not match the total sample used for this study (N = 8,452) because there was a small number of employees acquired from another company who were dropped from our analyses because nearly all of these employees were located in only two work sites. Workers from the other organizational heritages were more widely distributed throughout Company A's several worksites.

[a]Analyses within the five large individual sites were considered by organizational heritage alone and not by employee position because of limited sample sizes for individual positions within these sites. Subsample sizes within these sites were as follows: Site A (Company X, n = 553; Company Y, n = 75; contractors, n = 112), Site B (Company X, n = 256, direct hires, n = 89), Site C (Company X, n = 192, direct hires, n = 87), Site D (Company Y, n = 112, direct hires, n = 61), Site E (Company X, n = 253, direct hires, n = 54).

utility of testing qualitative equivalence and to demonstrate within this context how the sole use of quantitative agreement indices could falsely support aggregation decisions.

Method

Participants and procedure

In November 2007, a health and safety survey was administered to Company A, an international chemical processing and manufacturing organization. The organization's global director of health and safety informed employees about the survey via e-mail, which included a link to an online survey. Messages were sent to site leadership to encourage employee participation, and an invitation to participate was posted on the employee portal for 1 month. Surveys were administered in nine languages and respondents could select which language they preferred to use; translations were undertaken by an external vendor who used translation-back-translation procedures (Brislin, 1970, 1986). The questionnaire was sent to 20,260 employees and contractors, of which 8,658 individuals (77% male) gave useable responses, providing a response rate of 43%. Respondents were from 82 work sites (ranging from 3 to 1063 possible employees at each site, M = 219, SD = 248) in 19 countries. For a sample breakdown by the faultlines considered here, see Table 1.

Safety climate measure

Consistent with extant theory (i.e., Zohar, 2003), our safety climate measure was designed to assess both general safety policies (five items) as well as specific safety practices (i.e., safety reporting, three items; and hazard assessment, four items; see Table 2). These particular safety practices were selected not only because of their importance to the organization surveyed but also because they represent the means by

Table 2. Confirmatory factor analysis results for safety climate perceptions

Safety climate items	Factor loading
Site management focuses on process safety in audits, self-assessment, and inspections	.64
Site management considers health and safety when setting production rates and schedules	.61
Site management provides all necessary safety equipment for workers	.61
In my work area, we always take time to stop and assess the safety hazards before doing a job	.63
Site management focuses on safety in audits, self-assessments, and inspections	.74
Every health and safety-related incident at this site is taken seriously and investigated	.68
We do a good job of routine housekeeping at this site	.50
Site management is strict about working safely at all times even when work falls behind schedule	.66
Workers routinely report actions, conditions, or events that raise a health and safety concerns including near miss and learning events	.57
Health and safety issues or problems are promptly corrected in my work area	.70
I believe a culture exists at this site encourages raising health and safety concerns	.70
Workers sometimes work around safety concerns rather than report them[a]	.26

Note. Factor loadings were derived from a one-factor model using the full sample ($N = 8{,}658$) and the common metric completely standardized solution.
[a]Reverse-coded item.

which an organization identifies (i.e., safety reporting) and subsequently responds to (i.e., hazard assessment) safety-related issues. The safety policy items were based on Zohar and Luria (2005), whereas the safety-reporting items and one of the hazard-assessment items were derived from the British Petroleum (BP) Baker Report (Baker, 2007). Items were revised where necessary to apply to the chemical processing industry. The remaining hazard assessment items were developed for this survey with input from leadership of the participating organization and following procedures outlined by Hinkin (1998). The three proposed factors had Cronbach coefficient alphas of .79 for safety policies, .51 for safety reporting, and .74 for hazard assessment; the overall 12-item scale had a coefficient alpha of .87.

Results

Testing quantitative equivalence across groups

Before testing to determine if psychological safety climates were qualitatively equivalent across faultlines, we calculated a set of typical aggregation indices (i.e., r_{wg}, ICC[1], ICC[2]) to determine if traditional assessments of quantitative agreement show that aggregating psychological climates across the proposed faultlines to a higher level is appropriate. Because the general question in this study is whether psychological climates can be aggregated within a *single* organization, the most appropriate quantitative index of agreement is r_{wg} (James, Demaree, & Wolf, 1984). As a common rule-of-thumb, r_{wg} values greater than or equal to .70 are generally considered necessary to justify aggregation (e.g., Dickson, Resick, & Hanges, 2006; James *et al.*, 2008) and suggest high levels of within-group agreement (James *et al.*, 1984). Although r_{wg} values are often given the most weight in aggregation decisions (e.g., Lindell & Brandt, 2000; Schneider, White, & Paul, 1998; Schneider *et al.*, 2002; Zohar & Tenne-Gazit, 2008), ICC(1) and ICC(2) values are often reported as well. Consequently, we also computed ICC(1) and ICC(2) values in our analyses.

ICC(1) can be interpreted as the proportion of variance in a particular variable – in this case psychological safety climate – that can be explained by group membership (Bliese, 2000). ICC(1) values that signify lower-level agreement (i.e., higher ICC values) are used to justify aggregating lower-level units to a higher level to allow group-level analyses to be conducted; a pre-requisite of doing so is sufficient between-group variability as well. However, because the focus of the current study is to consider qualitative perceptual equivalence within one organization, a high ICC(1) value would actually support the presence of distinct subgroups and would preclude aggregation across their boundaries. Conversely, a low ICC(1) value would suggest that perceptions do not cluster within meaningful subgroups and that it may be appropriate to aggregate perceptions across subgroup boundaries. We note, however, that this is an imperfect estimate as a low ICC(1) may not only suggest low between-group variance, but could also be the result of high within-group variance that would not support aggregating to a higher level (James, 1982). We also computed ICC(2) in the present study which is used to estimate the reliability of group means (James, 1982). Generally, the larger the group, the more reliable the group means are considered to be (James, 1982).

Considering hierarchical position (i.e., front-line employee, supervisor/manager) and organizational heritage (i.e., Company X, Company Y, direct hire, contractor) as relevant potential faultlines both alone and in conjunction, we conducted five sets of analyses using the pre-specified agreement indices to test for quantitative equivalence. First, we formed subgroups based on the alignment of both position and organizational heritage (eight groups); second, by heritage alone (four groups); third, by position alone (two groups); fourth, by position within each of the heritage subgroups (four analyses with two groups in each); and fifth, within five large individual sites by heritage (five analyses; three groups in Site A and two groups each in Sites B–E). These analyses are presented in Table 3. As can be seen, these indices (i.e., r_{wg}, ICC(1), and ICC(2)) universally support the decision to aggregate climate perceptions to higher levels in this sample. The estimated r_{wg} values uniformly exceeded the rule-of-thumb .70 cutoff and all ICC(1) values were relatively low, suggesting no meaningful perceptual clustering within the specified subgroups. Although the computed ICC(2) values were generally high, suggesting reliable mean differences between groups, we note that these estimates are driven by large sample sizes (Bliese, 2000) and that the true differences in means across groups was fairly minimal (means ranged from 3.89 to 4.34 in the eight-group analysis), which further supports the decision to aggregate psychological climates to the group level.

Table 3. Results for the analysis of typical aggregation indices

Subgrouping	*N*	r_{wg}	ICC(1)	ICC(2)
Heritage by position status[a]	8,452	.95	.08	.99
Heritage alone[a]	8,452	.95	.01	.95
Position alone[a]	8,452	.95	.10	.99
Position within heritage				
Company X	4,542	.94	.17	.99
Company Y	1,434	.95	.13	.99
Direct hire	1,554	.96	.03	.94
Contractor	922	.95	.02	.86
Heritage alone within large individual sites				
Site A	740	.96	.00	−7.86[b]
Site B	345	.94	.00	−12.96[b]
Site C	279	.94	.10	.93
Site D	173	.93	.00	.23
Site E	307	.97	.00	−2.38[b]

Note. r_{wg} corresponds to $r_{wg(j)}$ (James *et al.*, 1984); ICC(1) estimates were computed using the corrected formula reported by Bliese and Halverson (1998) that accounts for unequal group sizes.

[a]These three analyses were all conducted using the full sample; thus, the r_{wg} estimate is the same in each case.

[b]A negative ICC value is possible when there is greater within-group variance than between-group variance (Bliese, 2000); in these cases there was little to no between-group variance – the means were nearly identical.

Testing qualitative equivalence across groups

We tested for qualitative invariance by using a multi-group hierarchical confirmatory factor-analysis approach. This approach is appropriate because it can test how well the specific indicators of a construct (i.e., items) represent the underlying construct (i.e., factor) for a set of subgroups. To test for qualitative invariance across subgroups, two steps were undertaken (Byrne, Shavelson, & Muthén, 1989), which we describe below.

Step 1: Configural invariance

Configural invariance is the extent to which the configuration of items loading on factors is the same across groups; in other words, configural invariance is achieved if the same items load on the same factors for all groups. If items load onto different factors for different groups or if there is a different number of factors for different groups, then configural invariance is not achieved.

In this step, *a priori* models are evaluated in each group independently to determine which best fits the observed data. We examined a single-factor model and a three-factor model (safety policies, safety reporting, and hazard assessment). We conducted separate confirmatory factor analyses (CFAs) on each employee group (i.e., Company X, Company Y, direct hires, and contractors). Results of these model comparisons are provided in Table 4. As can be seen, both models adequately fit the data for each employee group. Although the three-factor model technically fit each group better than the one-factor model, models that freely estimate a greater number of parameters mathematically must exhibit better fit to the observed data. Further, entries in the phi matrix (i.e., the covariances among the latent factors) were very high (ranging from .90 to .97), indicating

Table 4. Comparison of three-factor and one-factor models for groups based on organizational heritage

Model	χ^2	*df*	RMSEA	CFI	SRMR
Company X					
1-factor model	697.71	54	0.051	0.959	0.030
3-factor model	611.02	51	0.049	0.965	0.028
Company Y					
1-factor model	413.03	54	0.068	0.930	0.041
3-factor model	359.87	51	0.065	0.940	0.038
Direct hires					
1-factor model	308.98	54	0.055	0.943	0.037
3-factor model	295.93	51	0.056	0.945	0.036
Contractors					
1-factor model	185.39	54	0.051	0.936	0.040
3-factor model	175.59	51	0.051	0.939	0.039

Note. Company X, $n = 4{,}542$; Company Y, $n = 1{,}434$; direct hires, $n = 1{,}554$; contractors, $n = 922$; CFI, comparative fit index; RMSEA, root mean square error of approximation; SRMR, standardized root mean square residual.

that the supposedly separate factors in the three-factor model were essentially the same. Given the strong relationships among the factors in the three-factor model as well as the very small differences in model fit across the one- and three-factor models, we selected the more parsimonious, single-factor model as best fitting for each group[2] and subsequently used this model for the remainder of our analyses.

To prepare for the next step of the analysis, we re-estimated the one-factor model simultaneously in each group, without any constraints on the parameters across groups (i.e., a 'stacked analysis') to provide a baseline fit against which more constrained models could be compared. The χ^2 and degrees of freedom from this analysis are equal to the sum of the χ^2 and degrees of freedom of each of the individual analyses because there are no constraints on the factor loadings across groups; this analysis is done merely to provide additional baseline fit statistics against which the next step can be compared. These analyses are reported in Table 5.

[2] *Because our data were gathered in a single survey administration, it is possible that the one-factor structure revealed for each employee group was a consequence of common method bias and not actual conceptualizations of the safety climate construct. To address this alternative explanation, we conducted CFAs for each employee group with an additional safety-related construct included in the models (Podsakoff & Organ, 1986). Specifically, we incorporated six quantitative workload items (Spector & Jex, 1998) that were assessed in the same survey administration as safety climate to test whether another safety-related construct would load onto the same factor as our proposed safety climate construct; such findings would suggest the presence of common method bias. Although both constructs have implications for safety, safety climate and quantitative workload are theoretically distinct and should thus load onto separate factors, given the absence of common method bias. Consequently, we tested a single-factor model and a two-factor model (safety climate, quantitative workload) to determine the potential influence of common method bias in our results. Consistent with our expectations, although the latent constructs were moderately correlated (.28 and .17), the two first-order factor models revealed the best fit (for specific information regarding the relative fit indices please contact the first author), suggesting that safety climate and quantitative workload represent distinct, but related, factors. Given these findings, our original one-factor solution for the safety climate items does not appear to be the result of common method bias.*

Table 5. Goodness-of-fit statistics for multi-group invariance tests

Model	χ^2	*df*	$\Delta\chi^2$	Δdf	RMSEA	CFI	SRMR
Heritage by position status (χ^2_{Crit} (77)* = 98.48, $p < .05$)							
Configural invariance	3,019.68	516			.068	.904	.134
Metric invariance	3,204.00	593	184.32*	77	.056	.900	.135
Heritage alone (χ^2_{Crit} (33)* = 47.40, $p < .05$)							
Configural invariance	1,962.06	252			.057	.937	.044
Metric invariance	2,044.56	285	82.50*	33	.054	.936	.054
Position alone (χ^2_{Crit} (11)* = 19.68, $p < .05$)							
Configural invariance	1,923.00	120			.059	.932	.109
Metric invariance	1,973.93	131	50.93*	11	.057	.930	.101
Company X by position (χ^2_{Crit} (11)* = 19.68, $p < .05$)							
Configural invariance	1,263.54	120			.065	.922	.156
Metric invariance	1,293.43	131	29.89*	11	.063	.920	.149
Company Y by position (χ^2_{Crit} (11)* = 19.68, $p < .05$)							
Configural invariance	680.79	120			.081	.888	.134
Metric invariance	706.77	131	25.98*	11	.078	.885	.140
Direct hire by position[a] (χ^2_{Crit} (11)* = 19.68, $p < .05$)							
Configural invariance	440.24	120			.059	.928	.067
Metric invariance	449.05	131	8.81	11	.056	.929	.069
Contractor by position[a] (χ^2_{Crit} (11)* = 19.68, $p < .05$)							
Configural invariance	323.09	120			.061	.904	.061
Metric invariance	337.83	131	14.74	11	.059	.902	.072
Heritage within Site A (χ^2_{Crit} (22)* = 33.92, $p < .05$)							
Configural invariance	392.49	186			.067	.879	.073
Metric invariance	433.56	208	41.07*	22	.066	.868	.103
Heritage within Site B (χ^2_{Crit} (11)* = 19.68, $p < .05$)							
Configural invariance	368.65	120			.110	.855	.075
Metric invariance	400.46	131	31.81*	11	.109	.843	.121
Heritage within Site C (χ^2_{Crit} (11)* = 19.68, $p < .05$)							
Configural invariance	282.68	120			.099	.875	.109
Metric invariance	311.45	131	28.77*	11	.099	.861	.178
Heritage within Site D[a] (χ^2_{Crit} (11)* = 19.68, $p < .05$)							
Configural invariance	186.71	120			.080	.923	.065
Metric invariance	197.74	131	11.03	11	.077	.923	.096
Heritage within Site E[a] (χ^2_{Crit} (11)* = 19.68, $p < .05$)							
Configural invariance	222.20	120			.074	.893	.080
Metric invariance	231.38	131	9.18	11	.071	.895	.087

Note. *$p < .05$, $\Delta\chi^2$, the difference in χ^2 to the next restricted model (e.g., configural tested against metric invariance, then metric tested against error invariance); Δdf = change in *df*; CFI, comparative fit index; *df* = degrees of freedom; RMSEA, root mean square error approximation; SRMR, standardized root mean square residual.

[a]Analyses that meet the accepted standard for perceptual equivalence (Byrne *et al.*, 1989).

Step 2: Metric invariance

The second and final step for determining qualitative equivalence is to test for *metric invariance* (Byrne *et al.*, 1989), or the extent to which factor loadings are the same across groups. Substantively, the test of metric invariance examines whether the specific indicator (i.e., the item) is equally representative of its latent factor (i.e., the climate construct) for each group. The previous step, in which configural invariance was established, determined that the configuration of factors and which items should load on them was the same across groups. This step further examines the relationships between factors and items across groups to demonstrate whether the factor loadings are the same across groups.

To test for metric invariance, a model is estimated in which each item is required to have the same factor loading for all groups. The fit of this model is then compared to the fit of the configural invariance model in which there are no equality constraints on the factor loadings across groups. This comparison is made by conducting a chi-square difference test ($\Delta\chi^2$), which compares the fit of the less-restricted group models with the more-restricted group models (Muthén & Muthén, 2010). Qualitative equivalence is supported when the difference in fit between the configural invariance and metric invariance models is not statistically significant; conversely, when the difference in fit between models is significant, qualitative equivalence is not supported (Muthén & Muthén, 2010) and suggests that the construct is perceived differently across groups. We tested for metric invariance using the same five subgroupings that were used to compute quantitative agreement indices previously; this resulted in a total of 12 separate metric invariance tests. The results of these analyses are reported in Table 5. Although the objective fit of the metric invariance models was generally acceptable across groups, the more important issue is the relative fit of the metric invariance models compared with the configural models. As can be seen in Table 5, 8 of the 12 analyses of metric invariance (67%) revealed significant drops in fit from the configural invariance model to the metric invariance model. This suggests that in the majority of cases, employee psychological safety climates were not qualitatively equivalent across faultlines. Thus, although quantitative agreement indices supported aggregation across faultlines in 100% of the examined cases, our analyses of qualitative perceptual equivalence suggest that aggregating psychological climates would only have been appropriate in a third of these cases.

Discussion

The purpose of this study was to demonstrate the value of testing for qualitative equivalence in climate research before aggregating psychological climates to the group level. Using faultline theory as our conceptual basis, we posited that the presence of meaningful faultlines within workgroups and organizations can lead to qualitative perceptual differences that can be masked by typical aggregation indices and that require different analyses to detect. Specifically, we used multi-group hierarchical confirmatory factor analysis to test for qualitative perceptual differences within groups based on relevant potential faultlines to more accurately gauge the appropriateness of aggregating psychological climates to higher levels. We tested this proposition in an international chemical processing and manufacturing organization by examining the qualitative equivalence of psychological safety climates across faultlines associated with both organizational heritage and position in the organizational hierarchy. Our analyses revealed that although quantitative agreement indices universally supported aggregation decisions across the faultlines (alone and in combination), there were qualitative perceptual differences identified across faultlines that would preclude aggregation in the majority of the examined cases. These findings underscore the importance of considering faultlines within groups as a means for identifying potential perceptual differences that could bias group-level estimates. We discuss the theoretical and practical implications of these findings in the sections that follow.

Theoretical implications

The theory and results of this study emphasize the importance of recognizing faultlines that could affect psychological climates. Because climate perceptions arise from a sensemaking process (Ostroff *et al.*, 2003) and because faultlines influence sensemaking (Lau & Murnighan, 1998), the possibility that people on different sides of faultlines will have different perceptions of the organization is obvious.

In the present context, meaningful faultlines were identified based on both the employees' hierarchical position and organizational heritage. These were important considerations within this organization given recent mergers and acquisitions and the existence of very clear hierarchical divisions. Although unique to this organization in some respects, similar faultlines could be considered in other contexts. For example, common educational background or similar previous organizational experiences might also perpetuate subgroups that evidence differential patterns of sensemaking. However, regardless of the generality of the specific faultlines considered in this study, the general point is the same. Specifically, that individuals' previous organizational experiences can affect sensemaking in their current context and when previous experiences are shared by multiple organizational members, faultlines can occur that may preclude the aggregation of psychological climates to higher levels.

Employee position in the organizational hierarchy is also an important potential faultline that is likely to be relevant to many organizations. The power differential and often distinct work context of front-line employees relative to supervisors' and managers' work contexts naturally create opportunities for faultlines to develop. Our study demonstrated that hierarchical position alone can lead to the formation of perceptual faultlines, though the alignment of this variable with others (e.g., demographic attributes) would certainly be expected to lead to stronger faultlines (Lau & Murnighan, 1998). Thus, we advise climate researchers to consider employees' hierarchical position when identifying potential faultlines.

Ultimately, though, the context of the groups under consideration and the constructs of interest are essential to identifying the most appropriate potential faultlines within an organization or workgroup. There is no simple way to determine *a priori* that some faultlines always matter and others never do, or even that some faultlines must matter in a particular situation and others have absolutely no effect. Instead, researchers must carefully consider the interactions between individuals and their associated characteristics, experiences, and viewpoints; and the way that these experiences and viewpoints would be expected to influence how organizational events are interpreted. Although it is possible that there are faultlines that are undiscovered or potentially very difficult to discover by researchers (e.g., faultlines created by political party affiliation or by attendance at a particular church), careful consideration of the constructs of interest and the context in which those constructs are interpreted should be able to guide the researcher to the more probable faultlines, if any are operating.

This study also describes a more nuanced understanding of shared perceptions in organizational climate. Historically, the operationalization of shared perceptions has been low variance of psychological climates within a group, with stronger climates demonstrating less variance within groups (Schneider *et al.*, 2002). However, our work contends that the sharedness of perceptions can vary along both qualitative and quantitative dimensions, with qualitative sharedness being a prerequisite for examining quantitative sharedness. When qualitative perceptions do not align, conducting quantitative comparisons would be like comparing apples to oranges – it is not the same construct across faultlines. Subgroups must have consensus about the nature of the climate; otherwise, comparing their perceptions of the favourability of 'climate' is irrelevant, because they are in essence operating in different climates.

Practical implications

There are a number of practical implications associated with this study's findings as well. From an organization's perspective, it is desirable for employees to have a shared and accurate conceptualization of the prevailing climate. This is particularly true with regard to climates for safety, as the preponderance of organizations would want their employees to uniformly perceive that safety has the same (high) priority because of the inherent problems of having a poor safety climate and a bad safety record. The existence of perceptual differences across faultlines suggests that one prevailing climate is not pervasive enough to prevent sub-climates from forming across faultline boundaries. The perception of qualitatively different climates across employee subgroups could lead to different sets of behaviours across groups as perceptions of which behaviours are supported and reinforced by the prevailing climate may differ (Ostroff *et al.*, 2003; Zohar, 2003). In the domain of safety climate, such differences can have dramatic consequences (e.g., personal injury; Beus *et al.*, 2010; Christian *et al.*, 2009) and affirms the need for organizations to prevent the formation and activation of faultlines within groups. However, subgrouped climate perceptions would be problematic for any type of climate, even if the potential effects are not as dramatic as they are for safety climate.

Although the differential alignment of employee attributes in workgroups, particularly unobservable attributes (e.g., personality), may be unavoidable at times, it is possible for organizations to promote climates that are sufficiently strong as to supersede perceptual differences across activated faultlines. Potential means of strengthening existing climates could include targeted socialization activities (e.g., new employee orientations) and training that are specifically designed to cement employee perceptions of organizational priorities. The goal of such training and socialization activities is to create a 'faultline' that surrounds the entire group or organization and differentiates it from outsiders (e.g., other organizations) while also creating a strong, superseding identity for organizational members.

An additional practical implication of the qualitatively different climate perceptions between front-line employees and managerial employees is a potential lapse in communication across hierarchical levels (Lau & Murnighan, 2005). Given that managerial employees tend to be further removed from the day-to-day work for which safety is most salient and thus less aware of some safety-related information, this finding suggests a need for managerial employees to more actively seek safety-related information from front-line employees. This could be in the form of both seeking employee input on the organization's safety level, as well as facilitating the open reporting of accidents and near misses to give a clearer sense of organizational safety. Additionally, it suggests that there may be information that managers have that has not been transmitted clearly (or believably) to the front-line workers. Ultimately, the encouragement of more open communication (both bottom-up and top-down) should facilitate greater qualitative convergence in psychological climates across the organizational hierarchy.

Limitations and future directions

Our findings are not without limitations. We assessed employees' perceptual similarity with regard to only one type of organizational climate (i.e., safety climate) across a limited number of faultlines (i.e., organizational heritage and hierarchical position), thus resulting in only a first test of our general position about faultlines and climate. However, safety climate is arguably the most critical type of organizational climate that has been examined to date given its meaningful associations with both safety behaviour and other important safety outcomes (e.g., accidents, injuries; Beus *et al.*, 2010; Christian *et al.*, 2009). Safety climate's practical relevance and rapidly expanding research base made it a prime target for this study's propositions. Further, although the number and type of faultlines considered here was limited, we argued that faultlines should be identified within groups on a case-by-case basis as each organizational context will reveal its own idiosyncrasies. The examination of these particular faultlines in this study was meant primarily to demonstrate the general importance of considering such boundaries before making aggregation decisions. Nevertheless, we acknowledge this study's limitations with regard to generalizability and encourage future researchers to examine other types of psychological climates and to consider additional faultlines to test the generalizability of our findings.

Conclusion

In summary, this study questioned the sole use of standard agreement indices (i.e., r_{wg}, ICC[1], ICC[2]) to make aggregation decisions in organizational climate research and demonstrated the importance of identifying faultlines as specific instances where qualitative differences might exist within groups. We tested for qualitative similarity in psychological climates across context-specific faultline boundaries and found meaningful perceptual differences in the majority of instances where agreement indices supported aggregation. These findings suggest the need for climate researchers, where possible, to test for qualitative perceptual equivalence in addition to testing for quantitative equivalence to ensure that aggregation decisions are appropriate and to reduce biases in group-level climate estimates.

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Received 1 February 2011; revised version received 9 November 2011