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Safety citizenship behavior (SCB) in the workplace: A stable construct? Analysis of psychometric invariance across four European countries

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ABSTRACT

Safety citizenship behaviors (SCBs) are important participative organizational behaviors that emerge in workgroups. SCBs create a work environment that supports individual and team safety, encourages a proactive management of workplace safety, and ultimately, prevents accidents. In spite of the importance of SCBs, little consensus exists on research issues like the dimensionality of safety citizenship, and if any superordinate factor level of safety citizenship should be conceptualized, and thus measured. The present study addressed this issue by examining the dimensionality of SCBs, as they relate to behaviors of helping, stewardship, civic virtue, whistleblowing, voice, and initiating change in current practices. Data on SCBs were collected from four industrial plants (N = 1065) in four European countries (Italy, Russia, Switzerland, United Kingdom). The results show that SCBs structure around two superordinate second-order factors that reflect affiliation and challenge. Multi-group analyses supported the structure and metric invariance of the two-factor model across the four national subsamples.

1. Introduction

Safety citizenship behaviors (SCBs) reflect discretionary and prosocial employee activities that are essential for managing risk in 'safety-critical' industries. Example behaviors include suggesting improvements for change to safety practices, reporting those who violate safety, and helping others with safety issues (Hofmann et al., 2003). SCBs are equivalent to citizenship behaviors observed in organizations more generally, but they are directed towards safety issues specifically (Didla et al., 2009). As noted by Zohar (2008), employees develop attitudes and related behaviors that are specific to domains of organizational functioning. Within safety-critical industries, specific attitudes and behaviors typically develop towards safety.

The conceptualization of SCB varies across studies. SCB has been presented as a single higher-order construct, comprising second-order constructs related to helping co-workers with safety, promoting safety programs, demonstrating initiative, suggesting changes for improving safety, whistleblowing on those who violate safety and protecting co-workers from the consequences associated with accidents and unsafe situations at work (Christian et al., 2009; Hofmann et al., 2003; Reader et al., 2017). Alternatively, it has been conceptualized as a two-factor structure, comprising factors that divide along the dimension of *target* (people vs. organization) (Griffin and Curcuruto, 2016; Organ et al., 2006), or along the dimension of *degree of change* in the organizational system (some change vs. maintaining the status quo) (Conchie, 2013; Curcuruto et al., 2016). Underlying these two-factor models is the suggestion that SCBs are *affiliative-oriented* or *challenging-oriented*. Affiliative-orientated behaviors are prosocial, interpersonal and cooperative, and result in the strengthening of social relations and functional working balances within groups and organizations. Challenging-orientated behaviors focus on enacting organizational change and improvement through the generation of ideas, problem solving, and innovation.

In the next sections of the article we will firstly review the most recent conceptual and empirical research developments in the safety citizenship literature. Secondly, we will present our research aims and a specific research hypothesis on the superordinate factor structure of SCB according to the state of the art. Thirdly, we will report an empirical cross-national study which tests our research hypothesis and its validity across four different national samples. Finally, a general dis-

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cussion of the contributions for research and practice will be presented.

2. Conceptual foundations of safety citizenship behavior

The central role that SCBs play in reducing work accidents, injuries to people, property damage and potential risks and hazards in the workplace makes them an important construct to understand which behaviors are central in this reduction (Curcuruto et al., 2015). Single construct presentations of SCB imply that all behaviors are equally important, and thus, initiatives should be directed at the full class of actions. However, emerging research suggests that this view may be too simplistic, showing rather that SCBs operate differently in terms of the factors they are influenced by and in turn come to influence. Conchie (2013) found that challenge SCBs were driven by intrinsic motivation, yet affiliative SCBs were not. Curcuruto et al. (2015) found that challenging-oriented SCBs predicted near-miss events and lost-time injuries, while affiliative-oriented SCBs predicted micro-accidents and property damage. This latter research suggests that focusing on SCBs as a single class of behaviors may miss important relationships as significant links become masked by less significant links. For instance, a recent study by Curcuruto and Griffin (2018) developed in a multinational chemical industry found that affiliative typologies of SCBs (i.e. stewardship) were associated with affective psychological mechanisms, like the affective commitment for the organization. On the other hand, change-oriented SCB typologies (i.e. safety voice) were found to be related to the psychological internalization of the existing safety programs (psychological ownership for safety promotion). This study also showed that affective commitment and psychological ownership played a distinct mediational role of the effect of team safety climate on the two distinct classes of SCBs.

2.1. Typologies of citizenship behavior: affiliative vs challenging

The *challenge* vs *affiliative* citizenship dichotomy has increasingly becoming a dominant conceptual orientation to understand organizational citizenship behavior (OCB). Deriving from the main organizational behavior literature (McAllister et al., 2007), an increasing number of safety research studies adopted it as conceptual framework to understand safety citizenship (see Conchie, 2013; Curcuruto et al., 2015; Curcuruto and Griffin, 2018; Qiang et al., 2018; Wang, 2018). The *challenge vs affiliative* dichotomy was initially used by Hofmann et al. (2003) when they conceptualized for the first time the construct of the safety specific form of safety citizenship, and then presented the constructs included in their seminal SCB model (2003), providing examples of affiliative oriented safety citizenship (helping; stewardship; civic virtue; wistleblowing), and introducing constructs like *safety voice* and *initiating a safety related change* as examples of challenging oriented safety citizenship. However, in their seminal paper, the authors did not provide statistical information to empirically support their conceptual assumption about an effective differentiation between challenging and affiliative citizenship at an empirical level. In spite of this, following research confirmed the assumption that the two typologies of citizenship behavior have distinct antecedents. For instance, challenging oriented citizenship was found being predicted by constructs like role breadth self-efficacy (McAllister et al., 2007) or openness and extroversion (Chiaburu et al., 2011), whereas affiliative oriented citizenship was predicted by employees' role definition (McAllister et al., 2007), conscientiousness and agreeableness (Chiaburu et al., 2011)

2.2. The target of citizenship behavior: people vs organizations

Besides the conceptual framework described by Hofmann et al. (2003) other conceptual frameworks have been used in literature to understand organizational citizenship. For instance, in accordance with a functionalistic approach, Organ et al. (2006) argued that different forms of organizational citizenship behavior might be characterized by different goals and targets in workplace settings. According to Organ and colleagues, a first category of OCB would aim to improve the quality of the performance and work experiences of other *people*, through actions like altruism (i.e. discretionary behaviors that have the effect of helping a specific work colleague with an organizationally relevant task or problem), and courtesy (discretionary behaviors that aim at preventing work-related conflicts with others). A second category of OCB would aim to support the organization itself through actions like civic virtue (i.e. a positive involvement in the concerns of the organization, like attending meetings and keeping up with what is going on with the organization) and sportsmanship (i.e. the employee's tolerance of less-than-ideal organizational circumstances without complaining and blowing problems out of proportion). According with this perspective, in the field of occupational safety research, citizenship behaviors like civic virtue and initiating a safety related change would be considered as SCBs primarily targeting the care or the improvement the *organization* itself, whereas other safety behaviors like stewardship and voice could be considered as SCBs targeting the care of *people* well-being, and/or the improvement of their work conduct.

2.3. The self-regulatory focus framework: prevention vs promotion

Another conceptual framework which has been recently applied in safety behavior research is the self-regulatory focus framework (Higgins, 2005), according to which safety behaviors would be differently motivated by approach vs avoidance motivational patterns (Curcuruto et al., 2019; Griffin and Talati, 2014). On the one hand, there would be behaviors like initiative, voice and helping that would be driven by a *promotion* focus, which would allow organizations to achieve positive outcomes, like refining safety systems and group practices (Conchie, 2013; Qiang et al., 2018). On the other hand, safety behaviors like reporting risks and/or violations with safety standards would be characterized by a *protection* focus, which would aim to reduce potential lost associated with negative risk and safety events for the workforce. In this perspective, examples of protection oriented safety citizenship would be stewardship (Curcuruto & Griffin, 2016) and wistleblowing (Conchie, 2013).

3. Research aim and hypothesis

Our research aims to fill some conceptual gaps in safety citizenship literature by adopting and testing the validity of the original theoretical dichotomy proposed by Hofmann and colleagues *(affiliative vs challenging)*. Therefore, the current study primarily sought to contribute to a better understanding of the SCB factor structure. Based on the broader organizational literature (e.g. McAllister et al., 2007) and studies that show different processes and outcomes for different SCBs (e.g. Curcuruto et al., 2015, 2016), we hypothesize that:

Hypothesis 1. SCB is a higher-order category of organizational behavior that is identified by two superordinate factors: affiliative-oriented SCB (helping; stewardship; civic virtue; whistleblowing), and challenging-oriented SCB (voice; initiating change safety-related).

In testing the SCB factor structure, we offer a psychometric validation of the questionnaire tool proposed by Hofmann et al. (2003), which was developed to assess the frequency of employees' engagement in acts of safety citizenship, and is routinely used by researchers (Chmiel et al., 2017; Conchie, 2013; Conchie and Donald, 2009; Conchie et al., 2012; Curcuruto and Griffin, 2018; Curcuruto et al., 2015; Laurent et al., 2018; Turner et al., 2005). In their original article, the authors provided a useful taxonomy of multiple SCBs including helping, stewardship, whistleblowing, civic virtue, voice and initiating safety-related change. Unfortunately, this seminal work on SCB did not include specific information on the psychometric properties of the assessment tool. Therefore, our study aims to fill this existing gap in literature by analyzing the psychometric properties of this

multidimensional safety citizenship model. We also intend to compare this conceptual approach to safety citizenship with other alternative approaches, like the functionalistic and self-regulatory frameworks proposed by Organ et al. (2006) and Higgins (2005). Finally, an important step in testing the SCB factor structure is verifying its invariance across samples; in the present article we include samples from different countries. We achieved this by testing five typologies of psychometric invariance: a) configural invariance of the baseline model; b) metric invariance of the first order factors; c) metric invariance of second order factors; d) scalar invariance; e) invariance of the covariances.

4. Method

4.1. Participants

We eventually tested and compared the SCB factor structure on 1011 industrial workers taken from four samples from different plants based in the United Kingdom, Italy, Russia and Switzerland. The four samples were contacted with the support of four multinationals which owned the plants which hosted the present study. The demographic composition and representativeness of the workforce was checked by the researchers at the beginning of the study with the support of the HR staff of each plant. Each sample was characterized by a local workforce representative of the national context, with a percentage of immigrant workers which was quite marginal for the aims of the present research (less than 5%). Specific differences associated with aspects like the maturity and the complexity of the national safety regulatory systems - as provided by the International Labour Organization (ILO) - and accident records provided by mandatory insurance reporting systems at the national level, are reported in Appendix 1.

This cluster of national samples was collected in order to capture variation across the cultural dimensions proposed by Hofstede (2001). Hofstede's cultural dimensions theory takes into account the effects of a society's culture on the values and behaviors of its members, using a structure derived from factor analysis. Hofstede's model includes four cultural clusters: Anglo-Saxon, Latin European, Eastern Europe and Germanic. The Anglo-Saxon cluster is mainly characterized by an individualistic performance orientation, with emphasis placed on personal achievements (Ashkanasy et al., 2002). In our research this cluster is represented by a sample of workers from the United Kingdom. The Latin-European cluster presents high values in power distance and minor propensity to be consultative (Jesuino, 2002). In our research this cluster is represented by a sample of workers from Italy. The Eastern-Europe cluster is characterized by high values in group and family collectivism, and in subjective feelings of in-group membership and loyalty (Bakacsi et al., 2002). In our research this cluster is represented by a sample of workers from Russia. Finally, the Germanic cluster is characterized by orientations of uncertainty reduction and low tolerance for ambiguity (Szabo et al., 2002). In our research this cluster is represented by a German-speaking worker sample from Switzerland.

4.2. Procedure

In each plant the target of participants corresponded with the entire workforce population. Every employee was therefore able to be involved in the survey administration and participate in our research. Participation was entirely voluntary and no kind of incentive was used to motivate the employees to fill out the questionnaire. The cover page of every questionnaire copy included information which pointed out the purely academic research purpose of the survey. It was made clear to participants that the information provided would have been used as the foundation of scientific research advancements, and/or to provide specific insights for the improvements of the safety culture in every plant, with a general presentation report inclusive of the main descriptive statistical results, made available both to the top management and the entire workforce.

4.2.1. United Kingdom sample

Participants were employees at a construction company based in Northern England specialized in the building of new infrastructures. Questionnaires were collected from 233 frontline employees. Response rate was 80%. Most participants were male (99.0%). The average age of employees was 36.5 years (SD = 7; Range: 18–66). The average length of service was 15.9 years (SD = 12. Range: 9 months – 51 years). Most participants were employed in production (54.2%) or logistic sectors (17.6%).

4.2.2. Italian sample

Participants were employees at a chemical plant based in Northern Italy and specialized in plastic production for the agriculture sector. Questionnaires were collected from 258 employees. Response rate was 73.7%. Most participants were male (68.2%). The average age of employees was 35 years (SD = 8; Range: 18–62). The average length of service was 9.73 years (SD = 7.15. Range: 1 year – 34 years). Most participants were employed in production (54.2%), logistic sectors (17.6%), packaging (13.1%), or research and development (6.3%).

4.2.3. Russian sample

Participants were employees at a manufacturing plant specialized in tobacco production, based in Saint Petersburg which, from a cultural perspective, is considered the most European city of the Russian Federation. Questionnaires were collected from 349 employees. Response rate was 77.1%. Most participants were male (90.4%). The average age of employees was 31 years (SD = 6; Range. 22–58). The average length of service was 7.5 years (SD = 5.48; Range: six months – 32 years). Most participants were employed in production (49.2%), chemical treatment (24.5%), packaging (22.1%) or maintenance (4.3%).

4.2.4. Swiss sample

Participants were employees at a pharmaceutical plant specialized in the production of biotechnologies. The plant is based in the northern part of the German-speaking region of Switzerland. Questionnaires were collected from 225 employees. Response rate was 90.3%. Most participants were male (88.4%). The average age of employees was 38.3 years (SD = 5; Range: 21–53). The average length of service was 9.37 years (SD = 6.52. Range: 19–42). Most participants were employed in the sectors of production (37%), warehouse (36.7%), chemical laboratories (11.7%), and general administration (7%).

4.3. Materials

The *Safety Citizenship Behavior* questionnaire tool (Hofmann et al., 2003) comprises 27 items that measure six types of behaviors. Using a five point scale of Never (1) to Frequently (5), participants are asked to self-report how often they engage in: helping (e.g. *"helping others with safety related responsibilities"*, 6 items); stewardship (e.g. *"taking action to protect other members of the group in risky situations"*, 5 items); whistleblowing (e.g. *"reporting crew members who violate safety procedure"*, 5 items); civic virtue (e.g. *"keeping informed of changes in safety policies and procedures"*, 3 items); voice (e.g. *"raising safety concerns during planning sessions"*, 4 items); and initiating safety-related change (e.g. *"trying to change the way the job is done to make it safer"*, 4 items).

4.3.1. Back translation and linguistic adaptation

The questionnaire was administrated in native language in each sample after a translation of the original SCB proposed by Hofmann et al. (2003). In order to obtain an appropriate version of the SCB questionnaire for each national linguistic sample, we proceeded with a back-translation procedure. More specifically, the English version in the original questionnaire proposed by Hofmann et al. (2003) was

translated in German, Italian and Russian by a pool of two bilingual experts for each national sample, and then refined by a member of the HSE managerial board from each company, following three steps. *i)* A mother-tongue expert translated the original English version of the questionnaire in the native language of her/his specific national sample, obtaining a first translated version of the questionnaire (forward translation). ii) Then a second bilingual expert was asked to re-translate the forward translation obtained by the first linguistic expert in English, and to report potential incongruences between the 'back translation' and the original English version of the questionnaire. iii) Finally, a senior HSE manager from every industry was later asked to double check the comprehensibility and the quality of the translation in his/her industrial sample through a 'cognitive interview' procedure which was administrated by one of the members of the pool of the academic researchers. This was in order to verify the effective comprehensibility of the questionnaire in the eyes of the participants, and to correct and/or rectify any potential inconsistency identified by the second bilingual expert. This process was repeated for each translation of the original questionnaire in German, Italian, and Russian.

4.4. Procedure

The questionnaire was administrated in native language in each sample after a translation of the original SCB questionnaire (Hofmann et al., 2003), as described in the previous section. Questionnaires were distributed to employees in a sealed envelope together with instructions for completion. For the United Kingdom sample, questionnaires were distributed to work teams by the lead researcher and were returned directly to the researcher after their completion. For the Italian sample, questionnaires were distributed by a pool of research associates during an annual safety day. The questionnaires were returned to the research associates by the end of the safety day. For the Swiss sample, questionnaires were administrated by a pool of research associates at the beginning of regular planning meetings of the working groups. The questionnaires were returned at the end of the meetings. For the Russian sample, questionnaires were administrated by the Health and Safety staff of the company who were previously instructed by the researchers. As above, the questionnaires were distributed at the beginning of regular planning meetings and returned at the end of the sessions. In all samples, participants were guaranteed anonymity and confidentiality, and informed that their responses would be used mainly for academic purposes, with a short summary of the overall findings being submitted to their company for the purposes of organizational learning and improvement.

4.5. Data analysis

Given the pre-existent research already published in the literature on Hofmann et al.'s questionnaire tool, we adopted a confirmatory approach with the statistical analyses described in the following sections of the article. A confirmatory approach is usually advised in literature: the researcher uses his/her knowledge of the theory or pre-existent empirical research (or both), and he/she intends to postulate a relationship pattern a priori - and then to test his/her hypothesis statistically (Child, 1990). In these cases, CFA analyses do not need to be preceded by EFA (Kline, 2015), which is usually advised as a preliminary step when the researcher still does not have a clear understanding of the relationship between the items and the constructs to be measured (Curcuruto et al., 2018). However, the scope of the present research was to investigate the internal structure of a well-established multidimensional model of safety citizenship (Chmiel et al., 2017; Conchie, 2013; Curcuruto and Griffin, 2018; Turner et al., 2005), by embracing a specific conceptual position from the general organizational behavior literature. Overall, these considerations led us to assume a confirmatory approach to test our research hypothesis.

In the light of these methodological assumptions, analyses were carried out as follows: 1.) calculation of descriptive statistics for the 27 items; 2.) item parceling; 3.) test of normality (e.g. kurtosis and skewness) and examination of common method effects; 4.) the use of the structural equation model (SEM) to test nine concurrent models in the different samples using confirmatory factor analyses (CFA); and 5.) multi-group invariance testing.

Parceling. Comrey and Lee (1992) provided the following scale of sample size adequacy: 50 – very poor, 100 – poor, 200 – fair, 300 – good, 500 – very good. Furthermore, the authors reported an ideal ratio of ten cases per research variable when using confirmative factor analysis (Nunnally, 1978). This meant that our samples from Italy, Switzerland and the United Kingdom were too low to ensure a reliable factor structure based on the 27 items. To address this issue, we used the item parceling technique. Parceling refers to a procedure for computing sums or average scores across multiple items (Bandalos, 2008). The sum or average scores (called parcel scores) instead of the individual item scores are then used as indicators of latent factors in a confirmatory factor analysis (CFA). The use of parcels of items to examine the invariance of a measuring instrument is not new in the organizational literature (e.g. Williams and O' Boyle, 2008). Parceling items can produce more reliable estimates of the relationship between manifest variables and latent factors and allows a more effective approximation of the assumptions of normality (Marsh et al., 1998). This is especially useful, as suggested by Little et al. (2002), in a study like ours, which is interested in the analysis of a latent superordinate factor hierarchy to explain the associations among the different first order SCB factor constructs, rather than among the single items – parceling is strongly warranted.

Following the indications provided by Marsh et al. (1998), we averaged items to form eighteen parcels in order to reduce the number of the observed variables: three parcels for each dimension. In the present case, the item parceling process was developed according to the "Item to Construct Balance" technique (Little et al., 2002). For each original SCB scale, the item with the highest factor loading in the underlying latent factor was coupled with the item with the lowest factor loading value in the same latent factor. In this way, the resulting parcel was obtained as the average of the two original items. The set of parcels which were eventually created allowed a better expression of the statistical communality shared by the units, offering a clearer reading of the relationships among the constructs (Little et al., 2013). For further details about the parceling process, coupling criteria and the final parceling configuration for each one of the six SCB scales, see Appendix 2. It is evident that, given the recommendations about sample size and case/variable ratio our choice of proceeding with the parceling technique allowed us to obtain a better case/variable ratio – in the light of the 18-parcel structure that we obtained (all the four national samples presented at least 180 participants). This is especially true when compared with the original 27-item structure (only the Russian sample presented more than 270 participants).

Univariate and multivariate normality. These were tested for the 27 variables and outliers were excluded based on the Mahalanobis distance (Aguinis et al., 2013). This analysis was performed separately for each national sample. Participants with a multivariate outlier significance value below 0.001 were excluded from the following CFA analyses. For each national sample the number of removed cases was always less than 10% of the questionnaires originally collected (respectively: eleven from the UK sample; fourteen from the Italian sample; twenty-two from the Russian sample; and seven from the Swiss sample). The following analyses were then conducted on a overall sample of 1011 workers: 222 workers from the UK construction industry; 244 workers from the Italian industry; 327 from the Russian manufacturing industry; 218 workers from the Swiss pharmaceutical industry.

Because self-reports were used to measure variables, we considered the degree to which common-method variance could be a threat to our analyses. Harman's single-factor test by Confirmative Factor Analysis was performed to test whether a single factor could account for all the

variance in our data rather than the proposed dimensions (Podsakoff et al., 2003).

4.5.1. Model comparisons

We used AMOS 22 to test different SCB factor models. Estimation for each analysis was performed using maximum likelihood and based on a covariance matrix. Since there were some missing data (less than 1%) means and intercepts were estimated. Following the recent methodological recommendations by Hoyle (2014) and Kline (2015), we used a combination of complimentary fit indices when assessing CFA models, including: incremental fit indices (CFI), absolute fit indices (RMSEA), and parsimony fit indices (Chi2 Ratio; AIC). Model fit was assessed by using the chi-square test, comparative fit index (CFI) and the Residual Mean Square Error of Approximation (RMSEA) (Byrne, 2001). A non-significant chi-square is indicative of acceptable model fit (Brown, 2006). However, as this statistic is biased by factors such as sample size (Barrett, 2007), we used this fit index in combination with approximate indices. We considered CFI values of 0.90 as acceptable and values of 0.95 or higher as indicative of excellent fit (Awang, 2015; Hu and Bentler, 1999). For the RMSEA, values below 0.05 are considered good, while values up to 0.08 represent reasonable errors of approximation (Awang, 2015; Browne and Cudeck, 1992). In terms of parsimony fit index, values of Chi2 ratio are considered good, with values between 3 and 5 considered satisfactory (Awang, 2015; Hoyle, 2014).

Finally, model comparisons were conducted by using the Akaike's information criterion (AIC) (Vrieze, 2012). AIC compares non-nested competing models, and it estimates the relative quality of statistical models for a given set of data. AIC is founded on information theory. When a statistical model is used to represent the process that generated the data, the model will almost never be exact; some information will be lost by using the model to represent the process. AIC estimates the relative information lost by a given model: the less information a model loses, the higher the quality of that model. In making an estimate of the information lost, AIC deals with the trade-off between the goodness of fit of the model and the simplicity of the model. This is because the AIC index is computed by penalizing the inclusion of more free parameters in a given statistical model. Given a collection of models for the data, AIC estimates the quality of each model, relative to each of the other competing models. AIC rewards goodness of fit (as assessed by the likelihood function), but it also includes a penalty that is an increasing function of the number of estimated parameters. In these cases, the model with the smallest AIC is preferred. In addition, we based our interpretation on AIC following Burnham and Anderson's guidelines (2003), which provide threshold indications about how to understand and compare the differences of the AIC index (ΔAIC) associated with different concurrent models: *a)* ΔAIC less than 2: lack of evidence to conclude for a substantial difference between two concurrent models *b)* ΔAIC from 2 to 7: sufficient evidence to consider a substantial difference in terms of plausibility and accuracy of statistical information *c)* ΔAIC equal or higher to 7: substantial loss of plausibility and presence of substantial equivocalness.

4.5.2. Multi-group invariance

The different factor models were tested separately in each of the four samples to assess fit. Consistency in fit across samples allows for a test of invariance. Vandenberg and Lance (2000) proposed that configural, metric and scalar invariance should be established to assess the model consistency validity across groups. Hair et al. (2006) followed these recommendations and advised researchers to establish configural invariance when conducting studies involving two or more different cultures, to examine whether the rating scales are used similarly in different cultures (metric invariance) and to verify if the quantifiable meanings of the scale are the same across cultures (scalar invariance). Finally, factor variances should be examined to establish the equality of the relationship between latent factors (invariance of covariances).

Configural invariance was analyzed by testing if the basic model structure (i.e. the pattern of fixed and non-fixed parameters) was invariant across groups. This initial baseline model considers that different parameter values may exist across groups and provides the basis for comparison with all subsequent models in the invariance hierarchy. The configural invariance model is of critical importance: if identical patterns of fixed and non-fixed parameters across the groups (configural invariance) are not supported by the data then neither will the data support more restrictive models (Bollen, 1989).

Metric invariance analysis was conducted to test if different groups respond to the items in the same way. If this assumption is satisfied, ratings obtained from different groups can be compared in a meaningful way (Hair et al., 2006). Practically, metric invariance considers factor pattern coefficients (loadings) to be equal across groups because the pattern coefficients carry the information about the relationship between latent scores and observed scores. A model with metric invariance is more restrictive than the baseline model.

Scalar invariance considers the association of observed scores and latent constructs across groups (Meredith, 1993). Scalar invariance entails that individuals who have the same score on the latent construct would obtain the same score on the observed variable regardless of their group membership. When the intercept terms for each measured variable are invariant between groups then scalar invariance exists.

Tests for the measurement (configural, metric, and scalar) and structural invariance were performed separately. The measurement invariance tests were performed using the following hierarchical ordering of nested models: configural invariance, metric invariance, and scalar invariance. For these analyses, we generally follow recommendations provided by Chen et al. (2005), and by Dimitrov (2010) with specific application to second-order factor models.

To compare the nested models we use the χ^2 and the CFI difference tests. The χ^2 difference test works by identifying significant cross-group differences. A non-significant result suggests no cross-group differences between the constrained parameter. A significant χ^2 difference suggests cross-group inequality exists (Bollen, 1989). However, some authors (e.g. Brannick, 1995; Kelloway, 1995) have criticized the use of the χ^2 difference test because of its sensitivity to sample size. Consequently, as suggested by Cheung and Rensvold (2002), when testing cross-group differences the CFI difference test is recommended, which was shown not to be associated to sample size issues. Extensive simulations have shown that a CFI difference higher than 0.01 is indicative of a significant drop in fit, meaning an effective difference of fit quality between the models being compared (Cheung and Rensvold, 2002).

5. Results

5.1. Preliminary analysis

Mean, standard deviation and correlations between the 27 SCB variables are shown in Table 1. Before analyzing the hypothesized models, the degree to which common-method variance could be a threat to our analyses was analyzed. Harman's single-factor test by CFA was performed to test whether a single factor could account for the covariances within the data (Podsakoff et al., 2003). The results showed a poor fit to the full sample data with a single factor model (CFI = .753; RMSEA = .159). This analysis was repeated for every national sample. The results show that common method variance did not explain a substantial amount of covariance among variables (Tables 2–5).

Table 1
Mean, standard deviation and correlations between SCB dimensions in each sample.

	NItem	M	Sd	1	2	3	4	5	6	7	8	9	10	11
UK sample *(N = 222)*														
1 Age	–	36.5	7	–										
2 Job tenure	–	15.9	12	.50	–									
3 Overall SCB	27	3.24	.83	.08	.12	*(.93)*								
4 *Affiliative SCB*	19	3.37	.86	.09	.13	.98*	*(.90)*							
5 *Challenging SCB*	8	2.92	.90	.08	.12	.90*	.79*	*(.89)*						
6 Civic virtue	3	3.71	.98	.10	.11	.63*	.67*	.47*	*(.79)*					
7 Helping	6	3.22	.96	.12	.10	.82*	.71*	.94*	.51*	*(.82)*				
8 Initiate a change	4	2.94	.91	.07	.08	.92*	.92*	.78*	.42*	.69*	*(.84)*			
9 Stewardship	5	3.56	.97	.08	.07	.88*	.90*	.71*	.49*	.78*	.64*	*(.85)*		
10 Voice	4	2.90	1.00	.09	.08	.87*	.78*	.95*	.46*	.77*	.79*	.70*	*(.83)*	
11 Whistleblowing	5	3.18	1.06	.11	.06	.86*	.89*	.67*	.48*	.74*	.61*	.72*	.66*	*(81)*
Italian sample *(N = 244)*														
1 Age	–	35	8	–										
2 Job tenure	–	9.7	7.2	.52	–									
3 Overall SCB	27	3.16	.81	.09	.07	*(.97)*								
4 *Affiliative SCB*	19	3.13	.87	.10	.08	.97*	*(.96)*							
5 *Challenging SCB*	8	3.22	.88	.09	.07	.82*	.65*	*(.93)*						
6 Civic virtue	3	3.16	.71	.12	.10	.72*	.75*	.47*	*(.74)*					
7 Helping	6	3.29	1.04	.11	.08	.88*	.90*	.63*	.59*	*(.94)*				
8 Initiate a change	4	3.14	.94	.09	.08	.74*	.57*	.94*	.40*	.56*	*(.90)*			
9 Stewardship	5	3.12	1.12	.09	.07	.90*	.93*	.60*	.66*	.75*	.52*	*(.96)*		
10 Voice	4	3.30	.93	.09	.05	.80*	.66*	.94*	.48*	.62*	.76*	.61*	*(.89)*	
11 Whistleblowing	5	2.93	.92	.10	.06	.86*	.90*	.55*	.64*	.68*	.47*	.81*	.56*	*(.94)*
Russian sample *(N = 327)*														
1 Age	–	31	6	–										
2 Job tenure	–	7.5	5.5	.53	–									
3 Overall SCB	27	3.24	.83	.11	.12	*(.96)*								
4 *Affiliative SCB*	19	3.34	.85	.12	.10	.98*	*(.95)*							
5 *Challenging SCB*	8	2.92	.89	.11	.09	.89*	.78*	*(.92)*						
6 Civic virtue	3	3.72	.98	.13	.11	.63*	.66*	.46*	*(.77)*					
7 Helping	6	3.22	.96	.14	.13	.92*	.92*	.78*	.51*	*(.89)*				
8 Initiate a change	4	2.94	.90	.08	.07	.81*	.70*	.94*	.41*	.69*	*(.83)*			
9 Stewardship	5	3.56	.96	.12	.10	.88*	.90*	.71*	.50*	.79*	.63*	*(.91)*		
10 Voice	4	2.90	.98	.10	.11	.87*	.78*	.95*	.45*	.78*	.79*	.70*	*(.90)*	
11 Whistleblowing	5	3.17	1.05	.13	.12	.86*	.89*	.67*	.48*	.73*	.60*	.73*	.66*	*(.91)*
Swiss sample *(N = 218)*														
1 Age	–	38.3	5	–										
2 Job tenure	–	9.4	6.5	.51	–									
3 Overall SCB	27	3.36	.70	.09	.11	*(.96)*								
4 *Affiliative SCB*	19	3.41	.72	.10	.06	.98*	*(.94)*							
5 *Challenging SCB*	8	3.23	.77	.07	.13	.87*	.74*	*(.91)*						
6 Civic virtue	3	3.41	.94	.01	.03	.68*	.69*	.54*	*(.82)*					
7 Helping	6	3.57	.79	.03	.05	.91*	.91*	.74*	.55*	*(.89)*				
8 Initiate a change	4	3.24	.83	.01	.14	.79*	.66*	.94*	.47*	.77*	*(.88)*			
9 Stewardship	5	3.76	.87	.11	.11	.86*	.89*	.65*	.50*	.73*	.59*	*(.92)*		
10 Voice	4	3.22	.82	.01	.12	.84*	.73*	.94*	.54*	.64*	.76*	.63*	*(.83)*	
11 Whistleblowing	5	3.09	.89	.14	.09	.77*	.83*	.52*	.43*	.77*	.46*	.62*	.51*	*(.86)*

Note: all correlations are significant at $p < .01$. SCB = Safety Citizenship Behavior. Figures in brackets on the diagonal and Cronbach alpha estimates of internal consistency.

5.2. Model comparisons

The hypothesized model (two superordinate factors of *affiliation* and *challenging* oriented SCB) was tested and compared against six 'alternative models'[1] . In total the eight models were as follows: i) *common method variance model* (see above); ii) *hypothesized model:* 2 superordinate dimensions of safety citizenship - *affiliation-oriented* SCB (civic virtue, helping, stewardship, whistleblowing) and *challenging-oriented* SCB (initiating change, voice); iii) *Alternative Model 1:* 6 first order SCB factors (each factor represented by a different behavior, such as helping or voice); iv) *Alternative Model 2*: 5 first order SCB factors (civic virtue, helping, stewardship, whistleblowing, *challenging-oriented* (voice + initiating change safety related). The decision to combine these two sets

[1] The hypothesized model and all the alternative models were defined based on one of three criteria: a) literature references *(hypothesised model* and *alternative model 1)* according with the seminal paper by Hofmann et al. (2003); b) statistical considerations *(alternative models 2* and *3;* common method model*)*; qualitative judgements of experts *(alternative models 4, 5,* and *6)*. In the case of *alternative models 4* and *5*, the original SCB scales (Hofmann et al., 2003) were divided as loading on one of two distinct superordinate factors by a pool of three organizational psychologists. The experts presented a deep scientific expertise and research experience on safety behavior and organizational citizenship. For each model, the experts evaluated the extent to which each one the original SCB scales could be positioned in one of the superordinate dichotomies of safety citizenship identified in the light of the literature review presented in

(*footnote continued*)
the first part of our article: *people vs organization* in alternative model 4 (please, see Organ et al., 2006); *promotion vs prevention* (please, see Higgins, 2013). Finally, in the case of alternative model 6, the scales were distributed across three superordinate typologies identified by the three scientific experts by combining alternative model 4 with our *hypothesised model: affiliative-oriented SCB focused on the organization*; *affiliative-oriented SCB focused on people*, and *challenging-oriented SCB* as a third separated typology.

Table 2
Comparison of a priori "safety citizenship" CFA models: British sample (N = 222).

Models	Psychological Factors	2nd order factors	Model Description	χ2	Df	CFI	RMSEA	AIC
Common-method variance	**Only method**	0	All items loading to only a single factor	604.801	135	.772	.132	712.801
Hypothesized model	**6 first order factors** *(CV, HE, IC, ST, VO, WI)*	2	Two superordinate dimensions of safety citizenship: affiliative oriented SCBs *(CV, HE, ST, WI)* and challenging oriented SCBs *(IC, VO)*	307.802	128	.912	.084	429.802
Alternative model 1	**6 first order factors** *(CV, HE, IC, ST, VO, WI)*	0	A multiple set of six safety citizenship behaviors	298.524	120	.913	.086	436.524
Alternative model 2	**5 first order factors** *(CV, HE, ST, WI + IC/VO)*	0	A multiple set of five safety citizenship behaviors	309.102	125	.911	.086	437.102
Alternative model 3	**6 first order factors** *(CV, HE, IC, ST, VO, WI)*	1	A general superordinate dimension of safety citizenship expressed by six kind of SCB	306.214	129	.888	.095	480.214
Alternative model 4	**6 first order factors** *(CV, HE, IC, ST, VO, WI)*	2	A first superordinate dimension of person-focused safety citizenship *(HE, ST)*, and a second one organization-focused *(CV, IC, WI, VO)*	344.119	128	.895	.092	466.119
Alternative model 5	**6 first order factors** *(CV, HE, IC, ST, VO, WI)*	2	A first superordinate dimension of promotion- focused safety citizenship *(HE, IC, VO)*, and a preventive-focused one *(CV, ST, WI)*	360.014	128	.887	.095	482.014
Alternative model 6	**6 first order factors** *(CV, HE, IC, ST, VO, WI)*	3	A combination of three superordinate dimensions from the hypothesized model and the alternative model 5: Affiliative SCB focused on the organization *(CV, WI);* Affiliative SCB focused on people *(HE, ST);* Challenging SCB *(IC, VO)*	324.260	126	.904	.089	450.260

Legend: CV = civic virtue; HE = helping; IC = initiating a change; ST = stewardship; VO = voice; WI = whistleblowing.

Table 3
Comparison of a priori "safety citizenship" CFA models: Italian sample (N = 244).

Models	Psychological factors	2nd order factors	Model Description	χ2	Df	CFI	RMSEA	AIC
Common-method variance	**Only method**	0	All items loading to only a single factor	1519.684	135	.679	.205	1627.684
Hypothesized model	**6 first order factors** *(CV, HE, IC, ST, VO, WI)*	2	Two superordinate dimensions of safety citizenship: affiliative oriented SCBs *(CV, HE, ST, WI)* and challenging oriented SCBs *(IC, VO*	413.786	128	.934	.084	532.786
Alternative model 1	**6 first order factors** *(CV, HE, IC, ST, VO, WI)*	0	A multiple set of six safety citizenship behaviors	401.937	120	.935	.086	539.937
Alternative model 2	**5 first order factors** *(CV, HE, ST, WI + IC/VO)*	0	A multiple set of five safety citizenship behaviors	452.982	125	.924	.092	580.982
Alternative model 3	**6 first order factors** *(CV, HE, IC, ST, VO, WI)*	1	A general superordinate dimension of safety citizenship expressed by six kind of SCB	535.390	129	.906	.102	655.39
Alternative model 4	**6 first order factors** *(CV, HE, IC, ST, VO, WI)*	2	A first superordinate dimension of person-focused safety citizenship *(HE, ST)*, and a second one organization-focused *(CV, IC, WI, VO)*	535.049	128	.906	.102	657.049
Alternative model 5	**6 first order factors** *(CV, HE, IC, ST, VO, WI)*	2	A first superordinate dimension of promotion- focused safety citizenship *(HE, IC, VO)*, and a preventive-focused one *(CV, ST, WI)*	489.315	128	.916	.096	611.315
Alternative model 6	**6 first order factors** *(CV, HE, IC, ST, VO, WI)*	3	A combination of three superordinate dimensions from the hypothesized model and the alternative model 5: Affiliative SCB focused on the organization *(CV, WI);* Affiliative SCB focused on people *(HE, ST);* Challenging SCB *(IC, VO)*	412.646	126	.934	.085	539.646

Legend: CV = civic virtue; HE = helping; IC = initiating a change; ST = stewardship; VO = voice; WI = whistleblowing.

Table 4
Comparison of a priori "safety citizenship" CFA models: Russian sample (N = 327).

Models	Psychological factors	2nd order factors	Model Description	χ2	Df	CFI	RMSEA	AIC
Common-method variance	**Only method**	0	All items loading to only a single factor	1627.954	135	.800	.145	1735.954
Hypothesized model	**6 first order factors** *(CV, HE, IC, ST, VO, WI)*	2	Two superordinate dimensions of safety citizenship: affiliative oriented SCBs *(CV, HE, ST, WI)* and challenging oriented SCBs *(IC, VO)*	522.419	128	.947	.077	644.119
Alternative model 1	**6 first order factors** *(CV, HE, IC, ST, VO, WI)*	0	A multiple set of six safety citizenship behaviors	511.813	120	.948	.079	650.813
Alternative model 2	**5 first order factors** *(CV, HE, ST, WI + IC/VO)*	0	A multiple set of five safety citizenship behaviors	549.985	125	.943	.080	677.985
Alternative model 3	**6 first order factors** *(CV, HE, IC, ST, VO, WI)*	1	A general superordinate dimension of safety citizenship expressed by six kind of SCBs	624.527	129	.934	.085	744.527
Alternative model 4	**6 first order factors** *(CV, HE, IC, ST, VO, WI)*	2	A first superordinate dimension of person-focused safety citizenship *(HE, ST)*, and a second one organization-focused *(CV, IC, WI, VO)*	606.874	128	.936	.084	728.874
Alternative model 5	**6 first order factors** *(CV, HE, IC, ST, VO, WI)*	2	A first superordinate dimension of promotion- focused safety citizenship *(HE, IC, VO)*, and a preventive-focused one *(CV, ST, WI)*	607.216	128	.936	.084	729.216
Alternative model 6	**6 first order factors** *(CV, HE, IC, ST, VO, WI)*	3	A combination of three superordinate dimensions from the hypothesized model and the alternative model 5: Affiliative SCB focused on the organization *(CV, WI);* Affiliative SCB focused on people *(HE, ST);* Challenging SCB *(IC, VO)*	520.870	126	.947	.077	646.870

Legend: CV = civic virtue; HE = helping; IC = initiating a change; ST = stewardship; VO = voice; WI = whistleblowing.

Table 5
Comparison of a priori "safety citizenship" CFA models: Swiss sample (N = 218).

Models	Psychological factors	2nd order factors	Model Description	χ2	Df	CFI	RMSEA	AIC
Common-method variance	**Only method**	0	All items loading to only a single factor	781.445	135	.763	.149	889.445
Hypothesized model	**6 first order factors** *(CV, HE, IC, ST, VO, WI)*	2	Two superordinate dimensions of safety citizenship: affiliative oriented SCBs *(CV, HE, ST, WI)* and challenging oriented SCBs *(IC, VO)*	252.476	128	.954	.067	374.476
Alternative model 1	**6 first order factors** *(CV, HE, IC, ST, VO, WI)*	0	A multiple set of six safety citizenship behaviors	243.556	120	.955	.069	381.556
Alternative model 2	**5 first order factors** *(CV, HE, ST, WI + IC/VO)*	0	A multiple set of five safety citizenship behaviors	276.267	125	.944	.075	404.267
Alternative model 3	**6 first order factors** *(CV, HE, IC, ST, VO, WI)*	1	A general superordinate dimension of safety citizenship expressed by six kind of SCBs	293.687	129	.940	.077	413.687
Alternative model 4	**6 first order factors** *(CV, HE, IC, ST, VO, WI)*	2	A first superordinate dimension of person-focused safety citizenship *(HE, ST)*, and a second one organization-focused *(CV, IC, WI, VO)*	280.339	128	.944	.074	402.339
Alternative model 5	**6 first order factors** *(CV, HE, IC, ST, VO, WI)*	2	A first superordinate dimension of promotion- focused safety citizenship *(HE, IC, VO)*, and a preventive-focused one *(CV, ST, WI)*	290.857	128	.940	.077	412.857
Alternative model 6	**6 first order factors***(CV, HE, IC, ST, VO, WI)*	3	A combination of three superordinate dimensions from the hypothesized model and the alternative model 5: Affiliative SCB focused on the organization *(CV, WI);* Affiliative SCB focused on people *(HE, ST);* Challenging SCB *(IC, VO)*	252.424	126	.954	.068	378.424

Legend: CV = civic virtue; HE = helping; IC = initiating a change; ST = stewardship; VO = voice; WI = whistleblowing.

of behaviors was based on the strong correlations between these measures; v) *Alternative Model 3:* 1 superordinate SCB factor comprising all the six first order factors (e.g. Conchie and Donald, 2009); vi) *Alternative Model 4:* 2 superordinate factors reflecting *person-focused* SCB (Helping, Stewardship), and *organization-focused* SCB (Civic Virtue, Initiating Change, Whistle-blowing, Voice) (e.g. William and Anderson, 1991); vii) *Alternative Model 5:* 2 superordinate factors reflecting *promotion-focused* SCB (Helping, Initiating change, Voice), and *preventive-focused* SCB (Civic Virtue, Stewardship, Whistle-blowing) (e.g. Higgins, 2005); ix) *Alternative Model 6:* 3 superordinate factors reflecting a combination of our hypothesized model and alternative model 4: *affiliative-oriented* SCB focused on the organization (Civic Virtue, Whistle-blowing), *affiliative-oriented* SCB focused on people (Helping, Stewardship), and *challenging-oriented* SCB (Initiating change, Voice).

The results of model comparisons (Tables 2–5) show the best fit for the hypothesized model (Range CFI = .912–.954; RMSEA = .067–.084) and the Alternative Model 1 (Range CFI = .913–.955; RMSEA = .069–.086) in all four samples. As reported before in the method section, according with recent recommendations (Awang, 2015), CFI values between .95 and .90 are considered satisfactory and good when above .95. As for the case of RMSEA, indices below 5 are considered good, while they are considered satisfactorys for RMSEA between .06 and .08.

Therefore, we focused our next analysis by checking the AIC values for these two models. As reported, AIC provides information about the balance between statistical parsimony and information richness of a given statistical model. As such, AIC allows the comparison between different concurrent models on how they address the balance instance of statistical parsimony-information richness. Given these statistical bases, the psychometric model presenting the lowest AIC should be preferred.

An inspection of the AIC estimates shows the lowest value for the hypothesized model across the four national samples. In addition, we checked the difference of the AIC values between our hypothesized model and Alternative model 1 across the fours national samples. The ΔAIC value was found very close or higher to the value of 7 in all the four national samples: UK (ΔAIC = 6.72), Italy (ΔAIC = 7.15), Switzerland (ΔAIC = 7.08), Russian Federation (ΔAIC = 6.69). In accordance with Burnham and Anderson's guidelines (2003), this ΔAIC value is considered the threshold criteria to conclude for a substantial loss of plausibility and presence of substantial equivocalness in Alternative model 1. when compared with the hypothesized model. Given this substantial and consistent trend in the statistical ΔAIC results, we take the hypothesized model as the best-fitting model and use this in the multi-group analysis to test for configural, metric and scalar invariance.

5.3. Multi-group analysis

Multi-group CFA was performed to investigate whether the measurement and structural portions of the hypothesized model were invariant across the four national samples. Five nested models were tested to examine the four types of invariance: *a) Configural invariance*. The pattern of free and fixed factor loadings were constrained to be the same across groups. This model also served as a baseline in the nested sequence (Model I). *b) Metric invariance*. Structural relationships were constrained to equality (first-order and second-order factor loadings). First, we tested first-order factors (Model II then second-order factor loadings (Model III). *c) Scalar invariance*. Constraints were added to the model to ensure equality among the items, and item and first-order factor intercepts for each national group. *d) Covariance invariance*. Equality of the covariance between the second-order factors for all the national groups were tested.

Table 6 displays a summary of the results from the analyses of national sample invariance. The hypothesized model had a reasonable fit in each sample when fitted separately. A well-fitting baseline model supported configural invariance. Measurement equivalence was first tested: each item-factor loading (lambda) was constrained to be equal across the four national samples. Model II had an RMSEA and CFI of 0.041 and 0.933 respectively. The ΔCFI between Model I and Model III was 0.007 so we accept model 2 with first-order factors invariant over the national samples. Model III shows an RMSEA of 0.042 and a CFI of 0.931. The ΔCFI between Model II and Model III is 0.001, indicating both first-order factor invariance over the four samples. Then we tested if the intercept for each measured variable was invariant. Model IV has an RMSEA and CFI of 0.058 and 0.851, respectively. The ΔCFI between Model III and Model IV is 0.080, indicating the intercepts were not invariant over the national samples. Finally, the invariance of second-order factor covariance was tested. Model V has an RMSEA of 0.042 and a CFI of 0.929. The ΔCFI between Model III and Model V is 0.002, so model V supported invariance.

Table 6
Invariance test.

Model	A	B	C	D	E	Chi2	Df	RMSEA	CFI
I	X					1510.085	512	.041	.940
II	X	X				1653.236	548	.041	.933
III	X	X	X			1703.670	560	.042	.931
IV	X	X	X	X		3066.412	614	.058	.851
V	X	X	X		X	1737.490	563	.042	.929

Legend: A. Configural invariance (baseline model); B. Metric invariance first order factor; C. Metric invariance second order factor; D. Scalar invariance; E. Invariance of covariances.

Our analyses show the validity and the stability of our hypothesized superordinate factor model, supporting two second order factors of safety citizenship: *affiliative-oriented* SCB (Civic virtue, Helping, Stewardship, Whistleblowing) and *challenging-oriented* SCB (Initiating change, Voice). Our statistical results showed that this model is stable across all the national samples. Furthermore, the model showed different aspects of invariance: configural invariance (baseline model); metric invariance (first order factor; second order factor); and covariance invariance.

6. General discussion

The active engagement by employees in safety citizenship behavior (SCB) is often measured as a single construct. However, emerging research suggests that differences exist within this construct between acts that are prosocial and reflect affiliation, and those that are proactive and seek to challenge the organizational status-quo (Conchie, 2013; Curcuruto et al., 2015). The current study sought to test this emerging suggestion by comparing several SCB models.

Consistent with our research hypothesis, we found support for a model with two-superordinate factors. The results fully supported configural equivalence (i.e. equivalence of the number of constructs and observed variables) of the model, thus attesting to the stability of its factorial structure irrespective of the national context. Our study also supported the equivalence in factor loadings, factor variances and covariances. In other words, the metric of the variables did not change across the UK, Italian, Swiss and Russian samples, which means that comparisons between the latent factor of affiliation and challenge (as defined in this analysis) are meaningful. However, and in contrast, we cannot directly compare scores on these factors across the samples as scalar invariance was not supported. At a practical level, this means that we cannot be certain that differences in responses to the SCB *scales* between the UK, Italian, Russian and Swiss samples reflect real differences in the underlying factors.

The failure to find scalar invariance across the samples may be due to several factors. First, our four research samples came from different industrial contexts (e.g. construction, manufacturing, pharmaceutical) where SCBs might be not interpreted in a conceptually similar manner.

These differences may be explained by substantial differences among the four industries in aspects such as work processes, teamwork, definitions of safety roles and responsibilities, and the maturation of safety cultures. These factors impact on the interpretation of SCB, such as whether these are expected behaviors within teams, their pertinence to work, and relevance to the organization. At a practical level, a certain change-oriented behavior (e.g. initiating a change safety related) might be perceived differently across our research samples, due to, for example, differences in the definition of the organizational safety roles and safety systems. In turn, these organizational differences can influence the workers' expectations of which changes related to safety can be effectively initiated, by whom, and to what extent.

Second, it is also possible that national legislation differences between the samples influenced the way in which safety citizenship was interpreted by our research participants (Griffin and Curcuruto, 2016). It is plausible that the four industries operate in national contexts characterized by different safety regulation systems, and that these differences may affect the extent with which certain behaviors (e.g. whistleblowing; stewardship) are effectively interpreted by the workers as discretional acts of safety citizenship. At a practical level, the failure to engage in some of the behaviors included in Hofmann's model as safety citizenship might result in negative sanctions under some national safety legislation systems, but not others. For example, reporting safety violations and incongruences (whistleblowing), or providing safety protection or support to colleagues during certain risky work operations (stewardship) may be a legal requirement in some samples, and thus will be performed with greater frequency.

Third, certain differences in the interpretation of safety citizenship might be due to cultural differences between our national research samples (Hofstede, 2001). Therefore, these cultural differences may determine the extent with which certain SCBs are assumed to be more or less desirable in the eyes of the workers. For example, in certain cultural contexts, a challenging behavior like raising safety concerns with supervisors (voice) might not be aligned with certain cultural social norms, whereas in other contexts showing the same degree of initiative may be more readily recognized and more positively received. In a speculative way, affiliative oriented behaviors like *helping* can be perceived and recognized in a different way across different national samples. For instance, in some of our samples, actions like offering and receiving support in work activities (helping) can be interpreted differently due to specific differences in social norms, social roles and social stereotypes (e.g. it may be seen as an insult to an individual's professional competence).

Research contributions, limitations and future research avenues. In testing the factor solution of SCB, our study was the first to offer an assessment of Hofmann et al.'s (2003) SCB measure in a large, and cross-national sample of industrial workers. Second, the current study contributed to the advancement of the substantive theory on organizational citizenship by differentiating two distinct superordinate factors in the safety-specific domain of organizational citizenship: *affiliative-oriented* and *challenging-oriented*. Third, we showed the invariance and stability of our hypothesized model across four different European samples.

The present research is not without its limitations. The use of convenience samples may affect the generalizability and representativeness of our findings. For instance, our analyses evidenced statistical fit indices worse for the UK sample compared to others. Given that this sample was composed of a workforce from the construction sector, which is usually characterized by a lower educational level, we interpreted this finding considering that different levels of socio-demographics variables (i.e. education) may affect the individual capability of discriminating between the contents of distinct elements of safety citizenship. We suggest that future studies should devote more attention on the individual and contextual variables which might affect the perception of safety citizenship behaviors. Therefore, even if the usage of the parceling technique allowed us to perform adequate statistical analyses given thesize of the available worker samples, the present research should be replicated in other contexts, not only with larger samples, but also investigating the validity our SCB superordinate structure model in other industries and business sectors, in order to provide further evidence on the generalizability of our research findings.

Moreover, future replications of the present research would benefit by investigating the association of the Hofmann's SCB scales with other measures not included here, with the aim of controlling the influence of other psychosocial variables potentially related to the cultural national context (i.e. social distance in the organizational hierarchy; tolerance of ambiguities; values of cooperation vs individualism; sense of belongingness; personal loyalty), and how these relationships may change across different worker samples from distinct national clusters identified with the Hofsted's cross-cultural model. This in order to verify whether distinct samples surveyed in the study actually reflect the national cultural characteristics attributed to them. In the context of the present research, we were actually able to conduct a set of exploratory interviews to the senior health and safety directos from the four distinct industries. This set of interviews essentially confirmed our expectactions about the characteristics of the samples based on the Hofstede's cross-cultural model. However, given the complexity of managing the research within distinct multionationals based in different European countries, it was not possible at the present time to negotiate with the companies the inclusion of a further set of measures aimed to test whether the four samples surveyed in the study actually reflected the national cultural characteristics we attributed to them with the qualitative interviews we conducted with the site directors and health and safety managers from the distinct plants. Future studies on Hofmann's safety citizenship model will need investigate the association of the model with other psychological measures with the aim of controlling the influence of other psychological variables related to the cultural national context, and how these cultural influences may change across different worker samples from distinct national clusters identified with the Hofsted's cross-cultural model.

Despite these limitations we believe that the present study attests that these four national versions of Hofmann's SCB questionnaire are sound assessment tools for assessing and investigating safety citizenship behavior in organizational research conducted in the United Kingdom, Italy, Russia and Switzerland.

Practical implications for managerial programs and accident prevention in the workplace. Beyond the diagnostic value provided by the SCB survey tool described in our paper to assess distinct facets of safety participation behavior in the workplace, we believe that there are other practical implications of our research for safety researchers, organizational managers and safety consultants that deserve to be briefly outlined in this conclusive section of the article. In terms of practical implications, the stability of the SCB superordinate structure might suggest that supervision training and participative safety programs aimed at improving an organization's safety performance can be most effective if they are targeted at specific safety citizenship behaviors. Given that past research showed that both classes of behavior (affiliative and challenging-oriented SCBs) play an important and complimentary role in promoting a proactive safety culture in the workplace (Curcuruto et al., 2019), interventions or training initiatives that focus too heavily on the entire class of behaviors, or on those behaviors unrelated to the outcome, may observe minimal improvements. For instance, Curcuruto et al. (2015) found that challenging oriented SCBs are positively associated with near-miss reporting and negatively associated with LTI records, whereas affiliative SCBs were strongly – and negatively - associated with property damage records and micro-injury events (Zohar, 2002). From a managerial perspective, organizations may increase challenging-oriented SCBs by investing in communication strategies by team supervisors that focus on stimulating and reinforcing employees to go above and beyond mandatory safety behaviors when they offer meaningful safety related feedback (Conchie, 2013).

Similarly, public reward systems for raising suggestions about safety, for example, would provide employees with a visible demonstration of managerial support and recognition by top management of their commitment to safety communication (Curcuruto and Griffin, 2018; Saracino et al., 2015). In contrast, research on job design suggests that affiliative oriented SCBs may be more effectively promoted by focusing on the social aspects of teamwork (Parker, 2014). From a managerial perspective, organizations may increase affiliative-oriented SCBs by training team supervisors in managing psychosocial aspects of workgroups, reinforcing interdependence, cohesion, and peer-to-peer communication (Curcuruto et al., 2013). All this serves to enhance mutual trust and a positive psychological atmosphere in the workgroup (Frese and Fay, 2001). One outcome of this may be an increase in prosocial efforts like engaging in affiliative SCBs, such as looking out for the safety of others when carrying out job tasks.

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Appendix 1. National differences of OHS regulatory systems and accident records

By checking the information publicly available at the official website of the International Labour Organization (ILO) (http://www.ilo.org/safework/countries/europe/lang–en/index.htm), we found that at a descriptive level, these four countries can be ideally ranked in the following order, if we intend to look at the complexity and advancement of their national regulatory systems: a) UK b) Italy c) Switzerland, d) Russian Federation.

UK & Italian national OSH regulatory frameworks look both advanced and almost comparable, as currently they are both parts of the general European Union political context. However, the UK system embodies a more articulated and restrictive definition of workplace accident and injury events. For instance, accidents producing injuries during the travel from home to work are recorded as occupational **L**TIs in Italy but not in UK. For the rest, the Italian OHS regulatory framework is characterized by the same level of complexity in terms of norms, regulations and inspection systems.

According to the information provided by the ILO website, Switzerland presents an intermediate maturity of regulatory systems – probably less complex than UK and Italy - but any industrial company operating there is still required to implement company regulations, and the establishment of internal company regulations could be required for non-industrial companies when the nature of the business or the number of workers justifies it.

Finally, as far as the Russian Federation is concerned, ISO reports that over the last 10 years this country has seen a certain effort in the resumption of the functioning of a state-run system in the sphere of labor protection and OSH related issues under the new economic conditions. A regulatory and legal basis has been developed; state oversight and public control over the issues connected with labor laws has been put in place. However, the applicable system of state control over labor and OSH issues requires further improvement. Despite the reported tendency towards a smaller number of occupational accidents and diseases, a considerable amount of losses due to such cases can still be traced.

Interestingly, if we check the available Lost Time Injury data reported by ILO, collected by the national inspectorate records, we found a similar profile but in an opposite direction and different scale. For instance, when corrected and standardized for every 100,000 workers, we have: Russia: 29,880 LTIs. Switzerland: 96,056 LTIs; UK: 101,316 LTIs; Italy: 311,320. This data refers to 2014, which is the most recent year this information is available for each of the four national samples included in our study. These differences can entail further considerations – probably over and beyond the purposes of the present research - including a broad set of factors, including variables like: effective accuracy in data management; national employment security systems; risk of retaliation by the employer, with dismissal of injured workers; statistical incidence of illegal work; national specificity of accident records (different recording and treatment of accidents and injuries not strictly related to the fulfillment of the work-tasks included in the formal job descriptions).

Appendix 2. Original items and parcel structure

Scale items	Parcel structure
He1, He2, He3, He4, He5, He6	Parcel 1 (Mean He1, He4)
	Parcel 2 (Mean He2, He3)
	Parcel 3 (Mean He5, He6)
St1, St2, St3, St4, St5	Parcel 4 (Mean St1, St4)
	Parcel 5 (Mean St2, St3)
	Parcel 6 (St5)
Wh1, Wh2, Wh3, Wh4, Wh5	Parcel 7 (Mean Wh1, Wh3)
	Parcel 8 (Mean Wh2, Wh4)
	Parcel 9 (Wh 5)
Ic1, Ic2, Ic3, Ic4	Parcel 10 (Mean Ic2, Ic3)
	Parcel 11 (Ic1)
	Parcel 12 (Ic4)
Vo1, Vo2, Vo3, Vo4	Parcel 13 (Mean Vo2, Vo4)
	Parcel 14 (Vo1)
	Parcel 15 (Vo3)
Cv1, Cv2, Cv3	Parcel 16 (Cv1)
	Parcel 17 (Cv2)
	Parcel 18 (Cv3)

Note. The item parceling process was developed in accordance with the “Item to Construct Balance” technique (Little et al., 2002). For each

original SCB scale, the item with the highest factor loading in the underlying latent factor was coupled with the item with the lowest factor loading value in the same latent factor. In this way, the resulting parcel was obtained as average of the two original items. Then, for the longer SCB scales, the item with the second highest factor loading value was associated with the item presenting the second lowest factor loading in the same construct. This parceling process was repeated three times for the *helping* scale, two times for the *stewardship* and *whistleblowing* scales, and one time for the *voice* and *initiating a change safety related scales*. Given the low number of items, the structure of the civic virtue scale was not substantially modified by the parceling process.

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