Enabling Employees to Work Safely: The Influence of Motivation and Ability in the Design of Safety Instructions

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Abstract

Purpose: One of the major challenges for modern organizations is to create healthy and safe work environments, as evidenced by the number of occupational deaths (worldwide: four per minute), and an even higher number of injuries. This study explores different levels of motivation and ability, to identify which are most relevant for safety climate and safety performance. This study aims to pinpoint the areas information designers should focus on to most effectively contribute to healthy and safe work environments.

Method: We designed a questionnaire for employees of a Dutch high-tech and high-risk warehouse, a workplace where safety regulations are important. The employees scored their attitudes regarding motivation, ability, safety climate, and safety performance.

Results: The results confirmed the expected relationship between safety climate and safety performance. Of the explored sublevels of motivation and ability, personal motivation and external ability proved most relevant for creating a healthy safety climate and healthy safety performance.

Conclusion: In the design of safety instructions, focusing on personal motivation and external ability seems a promising strategy for contributing to healthy and safe work environments, especially in high-risk environments.

Keywords: motivation, ability, safety instructions, safety climate, safety performance

Practitioner's Takeaway

- This study shows that the sublevels personal motivation and external ability are most relevant for creating a healthy safety climate and optimal safety performance. Information designers should focus on these areas when designing safety instructions for high-risk workplaces.
- Personal motivation can be affected through safety instructions by personalizing general safety instructions—making them more realistic—and by making employees aware of the possible (negative) outcomes resulting from instruction non-compliance.
- External ability can be communicated in safety instructions by emphasizing that employees are and can be a role model for their colleagues.

Introduction

Worldwide, every minute, four workers die from a work-related accident or disease, and every minute, 640 workers have a work-related accident (International Labour Organisation [ILO], 2013). Extrapolating those numbers leaves us with 5,760 occupational deaths per day, and 2.1 million work-related deaths per year worldwide. According to the ILO, any deaths, diseases, or injuries resulting from an occupational accident are classified as an injury. Comparably, ILO (2014) defines an occupational disease as "a disease contracted as a result of an exposure over a period of time to risk factors arising from work activity," and an occupational accident as "an unexpected and unplanned occurrence, including acts of violence, arising out of or in connection with work which results in one or more workers incurring a personal injury, disease or death" (ILO, 2014).

Contrary to popular beliefs, occupational injuries are not merely an immense problem in developing countries, but also in the developed countries. In the Netherlands, for example, nearly 450 thousand workers (on a total working population of around 7 million) were injured on the job in 2013 (Statistics Netherlands, 2014). Around half of these injured workers missed out one day of work, and over a third of them missed over four workdays. These numbers have been relatively stable since 2005 (Statistics Netherlands, 2014), which indicates an ongoing need for a further increase in workplace safety. Apart from the emotional toll of work-related accidents on the injured workers, their families and colleagues, the cost of these accidents equals an estimated 4% of the global gross domestic product each year (ILO, 2010).

Nowadays, most of the bigger companies in risk industries have instituted an Environment, Health and Safety (EHS) department, a department charged to secure and improve the company's environmental, (employee) health, and (employee) safety efforts, such as assessing risks, reducing waste, and improving work conditions for employees by introducing ergonomic workstations. The matter is becoming increasingly important with increased external EHS regulations and government control (Cahill, 2010; Hofmann, Jacobs, & Landy, 1995). The importance of EHS for the public image and corporate risk profile is increasing (Chinander, Kleindorfer, & Kunreuther, 1998; Hasan & Jha, 2013). Organizations could benefit from these measures in additional ways as research has associated workplace safety with both organizational climate (for example, Neal, Griffin, & Hart, 2000) and job satisfaction (Gyekye, 2005), which are both important for employee well-being. Combining the organizational, financial, and emotional costs of workplace accidents provides a societal relevance of the topic.

In an attempt to find a conclusive solution to safety, researchers have focused on demographics like age and tenure (Mearns, Whitaker, & Flin, 2003; Gyekye & Salminen, 2009), and behavioral aspects of workers and management (for example, Cheng, Leu, Lin, & Fan, 2010; Jonson, 1982 as cited by Coyle, Sleeman, & Adams, 1995; Margolis, 1973 as cited by Coyle et al., 1995; Unsar & Sut, 2009).

Addressing safety through behavior can be advantageous to organizations since major modifications to the building, machinery, or equipment are not necessary (Swuste, Van Gulijk, Zwaard, & Oostendorp, 2014). Creating safe environments can be achieved in two ways; first, through adjustment of employee behaviors (for example, altering standard operating procedures, or training) (Swuste, Van Gulijk, & Zwaard, 2010), and second, through (for example, designing out hazards, guarding of hazards, and warning employees) (Ponnet, Reniers, & Kempeneers, 2014).

Compared to adapting machinery, equipment, and/or the building, creating effective safety instructions that explain appropriate employee behaviors can be a relatively easy and cheap way to increase safety in the work environment. Safety instructions are one of the cornerstones of the risk control system, being the translation from top management commitments into specific details (Hale & Borys, 2013). Safety instructions are instituted to specify, communicate, and control safe behavior among employees in dangerous situations, and to prevent accidents from happening (Elling, 1997; Hale, 1990; Herrerro, Saldaña, Del Campo, & Ritzel, 2002). Designing effective safety instructions is complex, and all too often, these are deemed to be too strongly focused on technical requirements (Herrero et al., 2002), to be unrealistic (Hale & Borys, 2013), or to solely serve the interests of the organization (Elling, 1997). Another problem with safety instructions is that they can be misinterpreted, resulting in unsafe behaviors (Racicot & Wogalter, 1995). So, while safety instructions can be beneficial, their design is not without problems. This is especially important in high-risk work environments where even the slightest problems with safety instructions can have catastrophic consequences. In this study, we focus on motivation and ability attitudes of warehouse employees to provide insight in how to write effective safety instructions for high-risk work environments.

In late 2013, we had the opportunity to explore the extent to which the sublevels personal motivation and external motivation, as well as personal ability and external ability, affect safety climate and safety performance.

Workplace Safety

According to the International Labour Organization and the World Health Organization, workplace safety—or occupational health—should aim at:

> …the promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations; the prevention amongst workers of departures from health caused by their working conditions; the protection of workers in their employment from risks resulting from factors adverse to health; the placing and maintenance of the worker in an occupational environment adapted to his physiological and psychological capabilities and; to summarize: the adaptation of work to man and of each man to his job. (International Labour Organization, 1998, p. 21)

Many researchers have tried to find a way to positively affect workplace safety. In their studies, safety performance was often perceived as an indicator of workplace safety. However, little consensus exists on which approach is the right one to increase the safety performance of employees.

Safety Climate and Safety Culture

Workplace safety refers to actual, measurable employee well-being, but workplace safety also has a more perceptual side to it. Safety climate and safety culture are parts of this perceptual side of workplace safety. Safety climate consists of shared beliefs (that is, perceptions) of safety in the workplace (Díaz & Cabrera, 1997; Gyekye & Salminen, 2009). These shared perceptions are also referred to as perceptions of workplace safety.

The concept safety climate is often wrongly used as a synonym of safety culture. Yule (2003) looked into both concepts from a conceptual and theoretical point of view and found that, in line with the work of others (Cox & Flin, 1998; Guldenmund, 2000), the two concepts refer to different levels. Although the concepts share elements, these might not be reflective of a unitary concept, but rather work as independent concepts that complement each other (Yule, 2003).

Safety culture has to be viewed as a sub-facet of organizational culture, and exists at a higher level of abstraction than safety climate. It is characterized by "shared underlying beliefs, values, and attitudes towards work and the organization in general" (Yule, 2003, p. 3), whereas safety climate appears to be closer to operations and is "characterized by day-to-day perceptions towards the working environment and practices, organizational policies, and management" (Yule, 2003, p. 3). Perceptions of workplace safety are important for actual occupational safety as they are associated with variables relating to industrial accident rates and levels of job-related anxiety, stress, and exposure to environmental hazards (Hayes, Perander, Smecko, & Trask, 1998). Perceptions of workplace safety are indicators of safety performance (Cooper & Philips, 2004; Gyekye & Salminen, 2009; Hayes et al., 1998; Neal & Griffin, 2006). The latter seems to be partially affected by safety knowledge and motivation (Zhou, Fang, & Wang, 2008, p. 1410). The combined findings, which are in line with a variety of sources (for example, DeJoy, Schaffer, Wilson, Vandenberg, & Butts, 2004; Guldenmund, 2000; Gyekye & Salminen, 2009; Jiang, Yu, Li, & Li, 2010; Neal et al., 2000; Pousette, Larsson, & Törner, 2008; Silva, Lima, & Baptista, 2004), lead to the hypothesis (H1) that higher levels of perceptions of workplace safety (that is, safety climate) will be accompanied by higher levels of safety performance as depicted in Figure 1.

Scientific and practical studies demonstrate that the solution to workplace safety has been sought from a variety of angles. The idea that motivation and ability are responsible for performance dates back to 1955, when Maier (as cited in Burke, Sarpy, Tesluk, & Smith-Crowe, 2002) specified motivation and ability as determinants of job performance. Since then, this idea gained a lot of attention in research (Burke et al., 2002), with mixed results. Campbell *et al.* (1993, as cited in Neal et al., 2000) stated that only three determinants are responsible for individual differences in safety performance: motivation, skill, and knowledge. These findings, combined with the findings by Zhou *et al.* (2008), lead to the belief that the proposed classification (that is, motivation and ability) is the right choice to approach

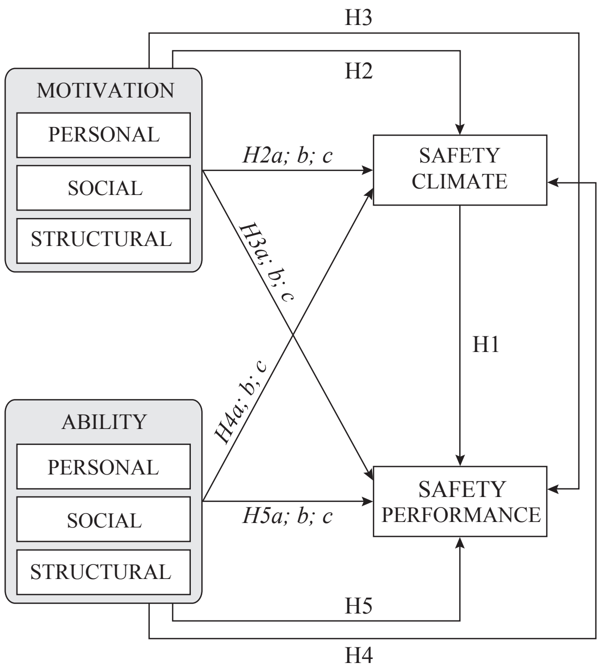

Figure 1. Hypothesized Influence of Three Levels of Motivation and Ability on Safety Climate and Safety Performance

the matter of workplace safety. Additionally, research by Hofmann *et al.* (1995) provides leads that indicate the usability of viewing motivation on different levels (for example, individual, micro, and macro). Below, we will elaborate on the concepts motivation and ability, and extend the different motivational levels as indicated by Hofmann *et al.* (1995) to ability.

Motivation

Motivation has been equated with behavioral intention (Sheeran, 2002) although the Theory of Planned Behavior (TBP) (Ajzen, 1991) shows that social norms and perceived control also play a role in people's behavioral intention and actual behavior. In general, people will assume that safety behavior is a very easy choice: Not acting in a safe way will increase the risk of getting involved in an accident. Andriessen describes motivation as "the result of a—not necessarily conscious—decision making process, in which a person weights the advantages and disadvantages of different acts (different kinds of work behaviour) and then chooses the behavior with the best yield (that is, he is then motivated to that act)" (Andriessen, 1987, p. 368). It is therefore hypothesized that higher levels of motivation will lead to higher levels of safety climate (H2) and safety performance (H3). However, other levels of motivation play a role as well. Consider the following situational factors: "the esteem of colleagues (because you're seen as tough or because you are not childish), the esteem of the supervisor (because you don't hold up the work), and more convenience (because you don't constantly have to be on your toes)" (Andriessen, 1978, p. 368). These all produce counterweight to the perceived risk of accidents.

On a personal level, motivation can be viewed as the intrinsic desire or choice people make to act in a certain way. It is therefore hypothesized that higher levels of personal motivation among employees will lead to higher levels of safety climate (H2a) and safety performance (H3a).

In the early 1960s, Milgram shocked the world when he revealed the power peer pressure can exert over others in his famous experiments on obedience to authority (for further information, see Milgram, 1963). A link with the TPB (for more information, see Ajzen, 1991) is easily made, as social motivation is similar to the subjective norm. According to the TPB, the subjective norm is based on a combination of normative beliefs—"the likelihood that important referent individuals or groups approve or disapprove of performing a given behavior" (Ajzen, 1991, p. 159)—and a person's motivation to comply. In other words, we humans find it important what others think of us, and how they see us to such an extent that we might even change our behaviors for it. This notion also underlies the two-step flow theory (for more information, see Katz, 1957), which indicates that personal contacts are considered far more important than direct mass media messages. It is therefore hypothesized that higher levels of social motivation will lead to higher levels of safety climate (H2b) and safety performance (H3b).

Last, a third level of motivation was proposed by Andriessen's (1978) research, in which management exerted influence through rewards and penalties (see also Hasan & Jha, 2013). It is therefore hypothesized that higher levels of structural motivation will lead to higher levels of safety climate (H2c) and safety performance (H3c).

Ability

Ability consists of the combination of skill and knowledge people acquire through training. It is hypothesized that higher levels of ability will lead to higher levels of safety climate (H4) and safety performance (H5). Again, we hypothesize that ability consists of different levels.

Personal ability is about influencing (enhancing) the practical and theoretical know-how of individuals to enable them to perform the desired vital behaviors. Organizations (attempt to) do so by providing training and instructions to their employees. It is therefore hypothesized that higher levels of personal ability will lead to higher levels of safety climate (H4a) and safety performance (H5a).

A social level of ability is similar to social capital. Although social capital might seem a relatively new concept due to the increased attention it has been given in the last decade, it is far from new. Farr (2004) traced the term back to 1916—when Lyda J. Hanifan supposedly used the concept for the first time—and conceptualized social capital as:

> The network of associations, activities, or relations that bind people together as a community via certain norms and psychological capacities, notably trust, which are essential for civil society and productive of future collective action or goods, in the manner of other forms of capital. (p. 9)

In laymen's terms, social capital reflects as much as: the whole is greater than the sum of the parts. In this equation, "the whole" is the capital, often in forms of knowledge. The "parts" consist of actors in a specific society or social network. It is hypothesized that higher levels of social ability will lead to higher levels of safety climate (H4b) and safety performance (H5b).

The last level of ability, structural ability, refers to nonhuman power. The main question revolves around the environment: How can it be used and transformed to enable change? Here, one can think of getting the right equipment, decorating a building, designing the physical lay-out of a building, and so on. The power that can exert from changes in the environment people work or live in has been proven in numerous fields, some more well-known than others (for example, Sonderegger & Sauer, 2010; Van der Woning, 2008). The inclusion of structural ability also counters criticism on the classification of safety performance as provided by Campbell *et al.* (1993, as cited in Neal et al., 2000), that situational factors should be taken into consideration, for these can be of influence as well (Neal et al., 2000). It is therefore hypothesized that higher levels of structural ability will lead to higher levels of safety climate (H4c) and safety performance (H5c).

Method

To test the hypothesized effects of motivation and ability on safety climate and safety performance, we designed a questionnaire for employees of a Dutch high-tech and high-risk warehouse.

Procedure

All employees were approached via their (direct) supervisors, and given time off from their work to complete our questionnaire. In groups of five to ten—depending on how many employees were needed in the warehouse—employees went to a conference room that was made available for this purpose. Upon entrance, participants chose an English or a Dutch language version of the questionnaire. They were then asked to carefully read the introduction and instructions on the first page, and to subsequently answer the questions. During the study, one of the researchers was continuously available for questions. The employees returned their completed questionnaires to the researcher without the involvement of supervisors or colleagues.

Participants

Of all available warehouse employees coming into contact with high-risk products ($N = 92$), 77 participated in our study. They worked at different departments in the warehouse, with activities varying from picking products to (un)loading trucks and processing incoming products. Participants were predominantly male ($n = 54$) as opposed to female ($n = 18$); 5 values were missing. The age of the participants ranged from 19 years old to 62 years old, with a mean of 40.2 years, while tenure ranged from 3 weeks to 9 years, with a mean of 4.8 years. Of the employees who disclosed their job situation, 53% were structural employees, 12% were employed as a contractor, and 13% had a flex-worker contract.

Instrument

Data were collected through a questionnaire consisting of 50 items, which were divided into eight different constructs, using a five-point Likert scale ranging from *totally disagree* to *totally agree*. The eight constructs are a mix of existing scales and questions designed for the specific professional environment of our study, and will be discussed here.

We used the six-item scale by Hahn and Murphy (2008) to measure safety climate. This scale showed good internal consistency before, with Cronbach's alpha coefficients between .71 and .85. An example item is: "The health and safety of workers is a high priority with management where I work."

We used items from several sources to measure safety performance. First, we used a shortened version of Whu, Chen and Li's (2008) scale, with reported Cronbach's alpha coefficients between .89 and .96 in earlier research. Second, we used items that were designed for our specific context, with a total of 14 items in the final scale. An example item is: "I have not been injured in the workplace within the 12 past months."

The six predictors (i.e. personal, social and structural levels of both motivation and ability) were measured using an adapted version of Williamson, Feyer, Cairns, and Biancotti's (1997) scale. We used 23 items from this instrument, of which two were reformulated, and designed seven new items for the specific context, resulting in five items per subscale, and 30 items in total. Below we provide example items of each subscale:

- Personal motivation (the intrinsic desire or choice of individuals to act in a certain way): "I feel motivated to behave safely in my workplace."
- Personal ability (the practical and theoretical know-how of individuals): "When I have worked unsafely it has been because I was not trained properly."
- Social motivation (the influence of direct colleagues on individuals' choice to act in a certain way): "It would help me to work more safely if my workmates supported safe behavior."
- Social ability (the practical and theoretical know-how of direct colleagues): "My co-workers know how to safely operate equipment."
- Structural motivation (the influence on individuals' behavior exerted by the management through rewards and penalties): "It would help me to work more safely if I was rewarded (paid more) for safe behavior."
- Structural ability (the influence of non-human, situational factors such as equipment): "When I have worked unsafely it has been because the right equipment was not provided or wasn't working."

Furthermore, at the end of the questionnaire, we added five questions to measure relevant background and professional characteristics (gender, age, work tenure, type of contract (regular employee, contractor, or flex worker), and primary department of employment). Employees were also asked to grade the company's health and safety program (ranging from 1 to 10), and given the opportunity to leave remarks.

The final instrument was pretested with three experts to evaluate the items' clarity and relevance. This pretest led to some minor textual improvements. Additionally, we pretested the final questionnaire with four nonparticipating employees to confirm the comprehensibility of the items.

Analysis

We entered the data from the 77 questionnaires into SPSS 20.0, and checked the file for errors. As a result, the data of two questionnaires were removed due to a large number of missing data. Subsequently, we recoded negative items and calculated the reliability of each construct, which resulted in a factor analysis and a regrouping and relabeling of the constructs. Finally, we conducted a multiple regression analysis to validate the research model.

Results

The safety climate and safety performance scales showed good internal consistency with Cronbach's alpha coefficients of .78 and .80. None of the scales intending to measure the different levels of motivation and ability (that is, personal motivation, social motivation, structural motivation, personal ability, social ability, and structural ability) showed sufficient internal consistency (Cronbach's alpha coefficients between .12 and .59). We therefore decided to conduct Principal Components Analysis (PCA) to further investigate those data and identify the underlying structure.

Exploring the Structure of Motivation and Ability

We followed the method of principal components analysis to determine the structure underlying the items used to measure levels of motivation and ability. Initially, the factorability of the items was assessed using several well-recognized criteria. With a value of .62, the 30 items intending to measure the six different variables exceeded the recommended value of .60 on the Kaiser-Meyer-Olkin test (Kaiser, 1970, 1974). Bartlett's Test of Sphericity (Bartlett, 1954) showed statistical significance for the 30 items, which supports the factorability of the correlation matrix. Principal components analysis revealed the presence of ten components with eigenvalues exceeding 1, together explaining 74.4% of the total variance. An inspection of the scree plot revealed three cut-off points; after the second, fourth, and sixth component. Based on Catell's (1966) scree test, we decided to retain four components for further investigation. The four-component solution explained 49.3% of the total variance, with the component 1 through 4 explaining 19.3%, 16.2%, 7.1%, and 6.7% of the total variance respectively. Based on the scree test we assume that there are four variables underlying motivation and ability. To aid in the interpretation of these four components, Oblimin rotation was performed. The rotated solution revealed the presence of simple structure (Thurstone, 1947, as cited in Pallant, 2011), with all components showing several strong loadings. The different factors showed very weak intercorrelations (-.19, -.16, .03). To confirm the newly found structure of the variables, scale reliability was retested (see Table 1).

Table 1. Scale Reliability After Factor Analysis

Construct	# of items	Cronbach's
Motivation	11	.85
Personal motivation	5	.78
External motivation	6	.77
Ability	17	.81
Personal ability	5	.60
External ability	12	.86

Following these findings, the variables social motivation and structural motivation, as well as the variables social ability and structural ability were combined, resulting in the new variables external motivation and external ability. Reliability analysis showed that the internal consistency of the personal ability scale was $\alpha = .60$. Because this was still within the latitude of acceptance, we decided to retain the personal ability scale as a research instrument.

Relationships between Motivation, Ability, Safety Climate, and Safety Performance

We used regression analyses to investigate the relationships between levels of motivation, ability, safety climate and safety performance. A regression analysis was conducted to determine the extent to which safety climate significantly predicted safety performance. Results confirmed H1, hypothesizing that safety climate is a predictor of safety performance levels (see Table 2 for a summary of the analysis). Safety climate also explained a significant proportion of variance (60%) in levels of safety performance.

Multiple linear regression analyses were used to develop a model for predicting levels of safety climate based on levels of motivation, and ability (both for motivation and ability as a main construct and with sublevels of motivation and ability). Statistics and regression coefficients are depicted in Table 2. From the analysis it showed that only ability as a whole significantly ($p < .001$) predicted safety climate, while the second analysis showed that only external ability

Table 2. Summary of Hierarchical Regression Analysis for Variables Predicting Safety Climate

	Model 1			Model 2		
Variable	B	SE B	β	B	SE B	β
Motivation	-.14	.08	-.16			
Ability	.87	.11	.70***			
Personal motivation				-.13	.08	-.17
External motivation				.04	.08	.05
Personal ability				.12	.08	.13
External ability				.76	.09	.71***
Adjusted R^2		.54			.56	
F for change in R^2		38.46***			21.80***	

** p < .05; ** p < .01; *** p < .001.*

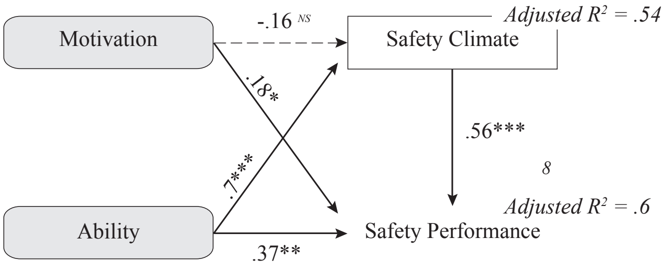

Figure 2. Regression Model Depicting the Causal Relation of Motivation and Ability on Safety Climate and Safety Performance. Dashed Lines Indicate Non-Significance.

** p < .05; ** p < .01; *** p < .001.*

significantly ($p < .001$) predicted safety climate. The two predictor model (motivation and ability) was able to account for 54% of the variance in safety climate, while the four predictor model was able to account for 56% of the variance in safety climate.

Multiple linear regression analyses were used to develop a model for predicting levels of safety performance based on levels of safety climate, motivation, and ability, both for motivation and ability as a main construct (Figure 2) and with sublevels of motivation and ability (Figure 3). Statistics and regression coefficients are depicted in Table 3. From the analysis it showed that all predictors significantly–safety climate ($p < .001$), ability ($p = .001$), and motivation ($p = .022$)–predicted safety performance, while the second analysis showed that only safety climate ($p < .001$), personal motivation ($p = .004$),

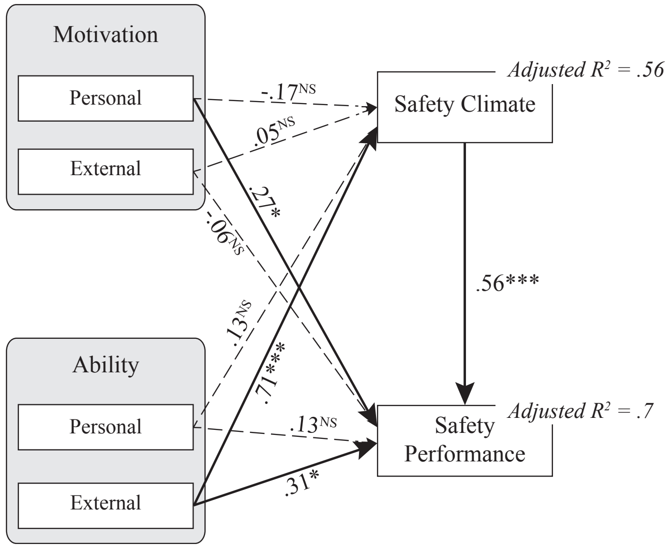

Figure 3. Regression Model Depicting the Causal Relation of the Two Levels of Motivation and Ability on Safety Climate and Safety Performance. Dashed Lines Indicate Non-Significance.

** p < .05; ** p < .01; *** p < .001.*

and external ability ($p = .005$) significantly predicted safety climate. The three predictor model (safety climate, motivation, and ability) was able to account for 68% of the variance in safety climate, while the five predictor model was able to account for 70% of the variance in safety climate.

Following the less well-established identification of the general importance of external ability for both safety climate and safety performance, we conducted a

Table 3. Summary of Hierarchical Regression Analysis for Variables Predicting Safety Performance

	Model 1			Model 2			Model 3		
Variable	B	SE B	β	B	SE B	β	B	SE B	β
Safety climate	.58	.06	.78***	.42	.08	.56***	.411	.08	.56***
Motivation				.12	.05	.18*			
Ability				.34	.1	.37**			
Personal motivation							.15	.05	.27**
External motivation							-.04	.05	-.06
Personal ability							.08	.05	.13
External ability							.243	.08	.31*
Adjusted R^2		.60			.68			.70	
F for change in R^2		98.63***			44.35***			29.2***	

** p < .05; ** p < .01; *** p < .001.*

regression analysis for the separate items of those scales. This allowed us to see which elements needed to be highlighted in the design of safety instructions. The regression analysis showed that for safety climate, the strongest indicator was that "Our management supplies enough safety equipment." For safety performance, awareness that "My co-workers use their personal protective equipment correctly" is the most important aspect. We will explore the implications of these findings in the discussion.

Discussion

This study confirms the relation between safety climate and safety performance (H1) as hypothesized and shown in previous research (DeJoy et al., 2004; Guldenmund, 2000; Gyekye & Salminen, 2009; Jiang et al., 2010; Neal et al., 2000; Neal & Griffin, 2006; Pousette et al., 2008; Silva et al., 2004), and the finding that this relation is partially affected by knowledge (that is, ability) and motivation (Zhou et al., 2008). Additionally, this study shows that the Safety Climate scale developed by Hahn and Murphy (2008), as well as the shortened version of the safety performance scale developed by Whu *et al.* (2008) can be seen as reliable, as they showed good internal consistency, which reconfirms their usability for future research.

This study shows the importance of two levels of motivation and ability as predictors of safety climate and safety performance. Making use of factor analysis, we were able to distinguish between personal and external motivation, and between personal and external ability. The latter showed the strongest power in predicting safety climate and safety performance.

The research model was based on the assumption that higher (sub)levels of motivation and ability would result in higher levels of safety climate and safety performance. The results from the regression analysis confirm the predicted relations between motivation and safety performance (H3), between ability and safety climate (H4), and between ability and safety performance (H5). However, the model was able to predict a greater sum of the variance in safety climate (56%) and safety performance (70%) with the inclusion of the different sublevels, compared to only motivation and ability (54% for safety climate, and 68% for safety performance). This indicates that the inclusion of different levels, as done by Hofmann *et al.* (1995), is justified.

For motivation, only the subconstruct of personal motivation proved to be a significant predictor for safety performance, thereby confirming hypothesis H3a. Of both the ability subconstructs, only external ability proved to be a significant predictor, for both safety climate and for safety performance after controlling for safety climate. Thus, hypothesis H4b and H5b were confirmed. This indicates that higher levels of (external) ability predict higher levels of safety climate and safety performance.

Although not statistically significant, the direction of motivation and its sublevels as predictors of safety climate differed from the hypothesis. Instead of a positive relation, the relation between (personal) motivation and safety climate was negative. This indicates that a person will feel less motivated to pursue safety if he or she perceives the environment as safe. A similar result was found for external motivation as a predictor of safety performance, which indicates that higher levels of external motivation result in lower levels of safety performance. This implies that an increase in effort to motivate an employee externally results in lower levels of safety performance as perceived by that employee. These findings are in line with previous research into risk behavior (Brewer, Weinstein, Cuite, & Herrington, 2004).

Implications for Safety Instructions

The findings of this research—that personal motivation and external ability are the largest predictors of safety climate and safety performance—have important implications for practitioners. If motivation and ability are not the singular constructs they are commonly thought to be, materials used to enhance or affect them should be changed accordingly.

According to Geller (2003, as cited in Saleh, 2011, p.5), safety is internally derived, meaning that individuals must understand the why behind the "rules" and "procedures." The necessity of personal motivation in safety instructions was also found in a study by Elling (as cited in Hale, 1990), who found that 71% of the employees thought too little motivation was given to follow the instructions. The inclusion of personal motivation also forces writers of safety instructions to think beyond the interests of the organization (Elling, 1997), and to extend the focus beyond merely technical requirements (Herrero et al., 2002) and being unrealistic (Hale & Borys, 2013), which is common criticism on contemporary safety instructions. Personal motivation could be included in safety instruction by raising the risk awareness (Harvey, Bolam, Gregory, & Erdos, 2001) of employees, for example through mentioning negative outcomes of non-compliance.

A noteworthy finding from this study is the fact that external ability plays an important role in affecting levels of safety climate and safety performance. The additional analysis into the relation between external ability on the one hand and safety climate and safety performance on the other showed that the top 5 items were related to the availability, training, and use of safety equipment. Although the importance of external ability is seemingly eliminating the need for ability of the individual, the fact that the ability of the co-workers and the organization is of such great importance to the individual employee stresses the importance of proper training of every employee in the organization (Burke et al., 2006; Dedobbeleer & German, 1987). We propose that external ability in an organization can serve as a form of behavioral modeling through which the individual employee can see how he or she should interpret safety instructions and put them into practice (Racicot & Wogalter, 1995), as well as enhance the self-efficacy of employees through proxy efficacy (Bray, Gyurcsik, Culos-Reed, Dawson, & Martin, 2001). Proxy efficacy "reflects one's confidence in the skills and abilities of a third party or parties to function effectively on one's behalf" (Bray, Gyurcsik, Culos-Reed, Dawson, & Martin, 2001, p. 426), but is also thought to work the other way around, contributing to successful behavioral adaptation (Bandura, 1997, as cited by Bray, Gyurcsik, Culos-Reed, Dawson, & Martin, 2001). One way in which external ability could be incorporated in safety instructions is by emphasizing that employees are and can be a role model to their colleagues. Such inclusion could (partly) account for the effect coworkers can have on individual behavior (for example, "My co-workers use their personal protective equipment correctly"). An additional benefit here could be that personal motivation and external ability can strengthen each other through proxy efficacy.

The other important items resulting from the additional analysis place an emphasis on the management. We therefore propose expressing management commitment in safety instructions. However, one should be cautious here. Hale (1990, p. 4) states that: "Imposed safety rules are often seen as in conflict with other imposed rules of a higher priority" (for example, production). This notion, mirrored to the *heroes* described by Bergson (Dragga, 2011, p. 6), points out that if management sets safety as their priority but does not walk the talk, then the behavior that is seen as heroic is that of production and not safety. This imposes serious threats to the safety of every single employee.

Limitations and Implications for Research

Notwithstanding the contribution of this research to the understanding of workplace safety, and its confirmation of previous findings, it has some limitations. Although the coverage among employees achieved in the organization was high (around 90%), the number of participants ($N = 75$) is up for improvement. We recommend to replicate this research in different settings and organizations to verify our findings. A second limitation comes from barriers that exists in "capturing" behavior and emotions through the use of questionnaires. This limitation is twofold, as it refers both to the measurement of actual thoughts and emotions, and to the fact that the questionnaire was unable to "capture" all of the hypothesized sublevels of motivation and ability. The latter may have occurred because such a perceived difference between the levels was absent, or because the items in the combined scale cancelled each other out. The latter would explain why there is no statistically significant finding for social motivation, a force that has been shown to be of influence numerous times in previous research (for example, Ajzen, 1991; Andriessen, 1978; Milgram, 1963). While some research has indicated that external motivation in the form of rewards and penalties is effective (for example, Hasan & Jha, 2013), there are strict limitations and also a large number of opponents (for example, Schwartz & Sharpe, 2010). Future research should therefore further investigate this gap between the proposed sublevels and the findings in this research.

Conclusion

This study investigated the presence of sublevels of motivation and ability, and their relation with safety climate and safety performance. The findings indicate that including the subconstructs personal motivation and external ability is more valuable than measuring motivation and ability as a whole. Our findings indicate that in the design of safety instructions, focusing on personal motivation and external ability seems a promising strategy for contributing to a healthy and safe work environment.

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