



The traffic climate in China: The mediating effect of traffic safety climate between personality and dangerous driving behavior

Qian Zhang^{a,b}, Yan Ge^{a,b,*}, Weina Qu^{a,b,*}, Kan Zhang^{a,b}, Xianghong Sun^{a,b}

^a Key Laboratory of Behavioral Science, Institute of Psychology, Chinese Academy of Sciences, Beijing, China

^b Department of Psychology, University of Chinese Academy of Sciences, Beijing, China



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ABSTRACT

Traffic safety climate is defined as road users' attitudes and perceptions of traffic in a specific context at a given point in time. The current study aimed to validate the Chinese version of the Traffic Climate Scale (TCS) and to explore its relation to drivers' personality and dangerous driving behavior. A sample of 413 drivers completed the Big Five Inventory (BFI), the Chinese version of the TCS, the Dula Dangerous Driving Index (DDDI) and a demographic questionnaire. Exploratory factor analysis and confirmatory factor analysis were performed to confirm a three-factor (external affective demands, internal requirements and functionality) solution of the TCS. The reliability and validity of the Chinese version of TCS were verified. More importantly, the results showed that the effect of personality on dangerous driving behavior was mediated by traffic climate. Specifically, the functionality of the TCS mediated the effect of neuroticism on negative cognitive/emotional driving and drunk driving, while openness had an indirect impact on aggressive driving, risky driving and drunk driving based on the internal requirements of the TCS. Additionally, agreeableness had a negative direct impact on four factors of the DDDI, while neuroticism had a positive direct impact on negative cognitive/emotional driving, drunk driving and risky driving. In conclusion, the Chinese version of the TCS will be useful to evaluate drivers' attitudes towards and perceptions of the requirements of traffic environment in which they participate and will also be valuable for comparing traffic cultures and environments in different countries.

1. Introduction

Safety climate has concerned road safety researchers in recent years (Gehlert et al., 2014). Researchers have noted that the development of scientific safety studies in the context of road traffic has occurred in four stages (Özkan and Lajunen, 2011). At the beginning, technical safety measures were the focus; then, behavioral and individual factors gradually became the primary research targets. In the third stage, ergonomics and sociotechnical systems drew public attention, and more recently, in the fourth stage, road safety researchers have focused on the impact of traffic culture and climate (Gehlert et al., 2014; Guggenheim and Taubman-Ben-Ari, 2015; Krishen et al., 2015; Leviäkangas, 1998; Özkan and Lajunen, 2011; Schlembach et al., 2016).

Safety culture and safety climate are interrelated concepts. Although they have only recently been introduced into the field of traffic safety, they have been valued in other work organizations for a long time (Beus et al., 2010). Safety culture was defined as “the product of individual and group values, attitudes, competencies, and patterns of behavior that determine the commitment to, and the style and

proficiency of, an organization's health and safety programs” by the Advisory Committee on the Safety of Nuclear Installations (ACSNI Study Group (1993). Safety climate, which can be viewed as part of safety culture, represents the individual's perception of the value and importance of safety in relation to his or her organization's policies, processes and patterns among its members at any given time, as manifested by recent or current events (Griffin and Neal, 2000; Zohar, 1980, 2000, 2011). Safety culture exists at a higher level of abstraction as the underlying belief in creating a climate. Climate reflects a perception of organizational structures and how it feels to be a member of the organization; culture refers to core values and beliefs regarding how to behave within an organizational unit (Mearns et al., 1998; Neal et al., 2000). From another perspective, safety climate was considered a manifestation of safety culture (Cheyne et al., 1998; Schein, 1985). Safety climate is closely aligned with a temporal “state of safety,” a relatively unstable “snapshot” of safety culture (Bhattacharya, 2015). Therefore, safety climate is more easily measured by the participants' perception than safety culture.

Safety climate has been applied in the traffic safety research field in

* Corresponding author at: 16 Lincui Road, Chaoyang District, Beijing, 100101, China.
E-mail addresses: gey@psych.ac.cn (Y. Ge), quwn@psych.ac.cn (W. Qu).

recent years (Gehlert et al., 2014; Mader and Zick, 2014). Traffic safety climate is defined as “road users’ (e.g. drivers, bicyclists, and pedestrians) attitudes and perceptions of the traffic in a context (e.g. country) at a given point in time” (Özkan and Lajunen, 2011). As a potent and integrated concept, traffic safety climate includes all factors related to drivers, vehicles and infrastructure (Leviäkangas, 1998). It refers to an attitude encompassing cognitive, affective and behavioral components (Gehlert et al., 2014) and can be described as road users’ thoughts and feelings towards the traffic around them as well as their possible behavioral intentions (Gehlert et al., 2014).

1.1. Measurement of traffic safety climate

To explore traffic safety climate quantitatively, a self-reported questionnaire named the Traffic Climate Scale (TCS) was developed by Özkan and Lajunen (unpublished) and was then validated in Germany (Gehlert et al., 2014). The initial structure of traffic safety climate is based on organizational climate, as there are many similarities between the two. Organizational climate, defined as “shared perceptions of organizational policies, practices, and procedures” (Hoy, 1990; Reichers and Schneider, 1990), refers to individuals’ perceptions of the practices, relationships and processes of their workplace (Nencini et al., 2016). Therefore, organizational climate is a result of interactions among individual, environmental, and instrumental variables, which refer to the three higher-order facets, including affective, cognitive and instrumental components (Carr et al., 2003). The affective facet refers to member involvement and social relations, such as participation and cooperation. The cognitive facet includes the degree of psychological demand and work-related skills or knowledge, such as innovation and autonomy. The instrumental facet relates to tasks or work processes, such as structure and hierarchy. The development of TCS takes into account the structure of organizational safety climate through external affective demands, internal requirements, and functionality, which correspond to the three components of organizational safety climate. External affective demands reflect the emotions of road users when participating in and interacting with the traffic environment or rules (e.g., “stressful,” “time-consuming,” and “dangerous”). The internal requirements factor focuses on road users’ cognition about traffic in which they participate and refers to the skills, workload and abilities that make them capable in traffic (e.g., “demands vigilance,” “demands fast reactions” or “demands knowledge of traffic rules”). Functionality measures road users’ requirements for the properties of a functional traffic system as represented by adjectives that describe the state of the traffic facilities and environment (e.g., “safe,” “free-flowing,” or “forgives mistakes”) (Gehlert et al., 2014). Previously, the TCS was validated in Germany and Lithuania and was written in German and Lithuanian (Gehlert et al., 2014; Marksaityte et al., 2014). In Germany and Lithuania, gender and age are important factors in evaluating traffic safety climate: men reported a more positive attitude than women; young male and older female drivers perceived traffic climate as safer and less challenging than older males and younger females (Marksaityte et al., 2014); and female drivers who had been involved in at least one traffic accident perceived the traffic system as more functional. However, no relationships between traffic safety climate and self-reported penalties were found.

1.2. Relationship between traffic safety climate and driving behavior

A few studies have explored the relationship between traffic climate and driving behavior. For example, Gehlert et al. (2014) found that the internal requirements of road users are related to individuals’ driving or riding style and that external affective demands are associated with individual perception: road users who experienced higher internal requirements and functionality perceived more behavioral control and a less descriptive norm (Gehlert et al., 2014). However, many studies have confirmed the important role of safety climate in traffic-related

behavior from different specific perspectives (Guggenheim and Taubman-Ben-Ari, 2015; Lee et al., 2016; Naevestad et al., 2015; Schlembach et al., 2016). Research exploring the relationship between safety climate and work-related driving behavior confirmed that traffic violations, errors and distraction were strongly related to safety climate factors (Wills et al., 2006). Consistently, Amponsah-Tawiah and Mensah (2016) found that safety climate predicts safe work-related driving behaviors. Other researchers even demonstrated that family and community climate regarding traffic influences driving behavior in young drivers (Guggenheim and Taubman-Ben-Ari, 2015; Taubman-Ben-Ari and Katz-Ben-Ami, 2012). A study by Zohar et al. not only proved that the relationship between safety climate and traffic near-miss events is represented by the actual recorded hard-braking frequency of truck drivers but also found that the relationship between safety climate and traffic near-miss events was fully mediated by the self-reported frequency of driving-safety shortcuts (Zohar et al., 2014). Another study found that self-reported speeding and aggressive driving mediated the path from attitude towards traffic safety to accident involvement (Mohamed and Bromfield, 2017).

1.3. Relationship between personality and driving behavior

The personality traits of drivers are important factors in traffic safety studies, and the big five personality traits have received much attention in this research field. Researchers found that each of the big five dimensions has a different influence on driving behavior and accident involvement (af Wählberg et al., 2017).

Conscientiousness and openness were mainly negatively correlated with dangerous driving behavior. Conscientiousness was found to have a negative relation with AD (Benfield et al., 2007; Burtäverde et al., 2016; Guo et al., 2016; Harris et al., 2014; Schwebel et al., 2006; Zhang et al., 2017), especially when it negatively correlated with angry thoughts behind the wheel, such as pejorative labeling and verbally aggressive thinking (Benfield et al., 2007). Similarly, openness was negatively related to self-reported RD behaviors as well as AD behaviors (Benfield et al., 2007; Burtäverde et al., 2016; Dahlen and White, 2006; Harris et al., 2014).

In contrast, neuroticism was mainly positively correlated with dangerous driving behavior. AD and RD were predicted by a higher neuroticism score or a lower emotional stability score (Burtäverde et al., 2016; Dahlen and White, 2006; Jovanović et al., 2011; Richer and Bergeron, 2012; Zhang et al., 2017). The path from neuroticism to driving anger was positive (Richer and Bergeron, 2012).

Additionally, the effect of agreeableness and extraversion on driving behaviors were complicated. The results for the relationship between agreeableness and dangerous driving behaviors are inconsistent. A number of studies confirmed that agreeableness negatively correlated with or predicted aggressive driving (AD), risky driving (RD) and negative cognitive/emotional driving (NCED) (Benfield et al., 2007; Burtäverde et al., 2016; Dahlen et al., 2012; Harris et al., 2014; Jovanović et al., 2011; Zhang et al., 2017). However, contrary results indicated that lower agreeableness was associated with a lower number of times that a driver violated safety rules (Guo et al., 2016). Referring to extraversion, some researchers found it to be associated with more frequent physically aggressive driving or reckless driving behavior (Benfield et al., 2007; Harris et al., 2014), while certain researchers also found it to be negatively correlated with verbally aggressive driving (Burtäverde et al., 2016).

1.4. Relationship between personality and traffic climate

Few studies have explored the relationship between personality and traffic climate, but studies of personality and safety attitude can provide some inspiration. Some personalities have a direct effect on the attitude towards safety. For example, altruism and anxiety have a positive correlation with positive attitudes towards traffic safety and rules

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