The effect of cognitive errors, mindfulness and personality traits on pedestrian behavior in a Chinese sample

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ABSTRACT

The high rate of traffic accidents involving pedestrians has become a major traffic safety problem worldwide, especially in developing countries. In the current study, we employ a Chinese version of the Pedestrian Behavior Scale (PBS) and explore its correlation with attention and personality traits. A sample of 283 adults completed the Chinese Pedestrian Behavior Scale (CPBS), which measures pedestrian behavior, and a demographic questionnaire. And 183 of them completed (1) the Attention-Related Cognitive Errors Scale (ARCES) and Mindful Attention Awareness Scale (MAAS), which measure pedestrian attention-related issues; (2) a scale to capture personality traits (including normlessness, anger, sensation-seeking and altruism). Overall, the Chinese PBS showed adequate reliability and a stable structure. Hierarchical multiple regressions were employed to examine the effects of personality traits, attention-related errors (measured by the ARCES), and conscious awareness (measured by MAAS), and the results show that MAAS, ARCES, normlessness, anger and altruism can affect pedestrian behaviors. These findings could guide the development of intervention programs through the evaluation of various pedestrian behaviors, thus reducing the frequency of pedestrian-involved traffic accidents.

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1. Introduction

A high rate of traffic accidents involving pedestrians has become a major traffic safety problem worldwide, particularly in developing countries, due to high population densities and the lack of pedestrian adherence to traffic regulations (Hamed, 2001). While traffic accidents involving pedestrians frequently occur in many countries, pedestrian-involved traffic fatalities occur more frequently in developing countries than in developed countries. The number and proportion of pedestrian deaths from road traffic fatalities in low-, middle- and high-income countries have been recorded at 227,835 (45%), 161,501 (29%) and 22,500 (18%), respectively (Naci, Chisholm, & Baker, 2009). For example, pedestrian fatalities constitute approximately 13% of all traffic-related deaths occurring in the US (Zegeer & Bushell, 2012) and represent 19% of annual traffic fatalities in Turkey (World Health Organization, 2012). Relative to Western countries, more pedestrian-involved accidents occur in China. According to the Chinese Road Traffic Accident Statistics of 2013, 25.37% of all traffic-related accidents involved pedestrians in 2012. China has witnessed a substantial increase in traffic-related injuries and fatalities due to its burgeoning population. In China, pedestrian volumes reach 40% of total egression in large cities (Zhang, Yau, & Zhang, 2014) and China had the largest number of pedestrian deaths among the world in 2009 (Zegeer & Bushell, 2012). Given the unique effects of

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economic and social development on pedestrian traffic environments, there is a critical need to measure pedestrian behaviors in China.

Although several pedestrian-related accidents occur because drivers fail to see a pedestrian, many accidents occur as a result of pedestrian transgressions or aggressive behaviors. Several traffic incidents occur due to dangerous conduct on the part of pedestrians, who may cross roads improperly, display inattentiveness, or disregard traffic signs (Bungum, Day, & Henry, 2005). Furthermore, the majority of pedestrians do not pay attention to traffic light signals and unsafely cross streets in China (Yang, Deng, Wang, Li, & Wang, 2006; Zhou, Horrey, & Yu, 2009). Approximately 20% of all pedestrians are distracted while crossing a street (Bungum et al., 2005). These results show that while irresponsible pedestrian behaviors are well known, pedestrian traffic safety awareness remains low.

Researchers have begun to examine unsafe pedestrian behaviors in recent years. Previous studies have shown that self-reported data serve as a valid source of information in this field. A number of questionnaires on pedestrian behaviors have been developed (Elliott & Baughan, 2004) and validated in New Zealand (Sullman & Mann, 2009), Spain (Sullman et al., 2011), Brazil (Torquato & Bianchi, 2010), Turkey (Yildirim, 2007), Chile (Moyano-Díaz, 1997) and France (Granié, 2009). These questionnaires have primarily measured pedestrian behaviors in terms of endangerment and transgression. Granié, Pannetier, and Guého (2013) validated a Pedestrian Behavior Scale (PBS) for identifying aggressive and positive behaviors and aberrant pedestrian behaviors toward other road users. The PBS employs a four-factor structure that considers intentional transgressions involving dangerous behaviors (e.g., "I cross the street even when the pedestrian light is red"); lapses or unintentional dangerous behaviors (e.g., "I forget to look both ways before crossing when I am thinking about something else"); aggressive behaviors involving the expression of negative emotions and aggressive interactions (e.g., "I become angry with other road users and insult them") and positive behaviors involving conciliatory social interactions (e.g., "I thank a driver who stops to let me cross"). This scale was recently validated in Turkey and segmented into three factors (transgression, attention violations and aggressive behavior) (Nordfjærn & Şimşekoğlu, 2013). Although pedestrian questionnaires have been validated in several western countries, they have not yet been validated in China, even though such questionnaires offer insight into dangerous pedestrian behaviors. This study presents a Chinese version of the pedestrian behavior scale based on Chinese cultural, linguistic, and traffic regulation features.

Lapses and errors constitute the major causes of pedestrian regulation violations (Díaz, 2002). Inattentiveness arises from one's cognitive state, and this may affect pedestrian behaviors while crossing a road. First, pedestrians who are prone to inattentiveness in their daily lives may make more errors due to inattentiveness while walking. Everyone experiences a variety of cognitive failures every day, and some of these failures can have serious consequences, potentially resulting in accidents, injuries or fatalities (Robertson, 2003). The Attention-Related Cognitive Errors Scale (ARCES) can be used to measure cognitive failures (Carriere, Cheyne, & Smilek, 2008; Cheyne, Carriere, & Smilek, 2006; Smilek, Carriere, & Cheyne, 2010). Second, pedestrian behaviors are related to an individual's conscious awareness of his or her level of attentiveness in everyday activities. The Mindful Attention Awareness Scale (MAAS) assesses individual differences in the frequency of mindful states over time (Brown & Ryan, 2003). This factor is negatively correlated with cognitive error and positively correlated with attentional control (Walsh, Balint, Smolira, Fredericksen, & Madsen, 2009). However, there is little awareness of the relationship between pedestrian behaviors and attentional/cognitive states in daily life.

Pedestrian personality traits may also affect pedestrian behaviors. Previous studies have shown that personality variables such as normlessness, anger, sensation-seeking and altruism affect various behaviors and especially driving behaviors. First, normlessness is a measure of an individual's disrespect for and adherence to norms (Kohn & Schooler, 1983). One study showed that drivers with high normlessness scores are more likely to violate rules and engage in risky driving behaviors (Yang, Du, Qu, Gong, & Sun, 2013). In the context of road behaviors, normlessness may contribute to transgressive and aggressive behaviors among pedestrians. Another study showed that individuals scoring high on this trait exhibit low aversion to socially unacceptable behaviors (Ulleberg & Rundmo, 2003). Second, anger management traits may also affect pedestrian behaviors. Prior studies on driver behaviors have shown that anger is significantly related to road rage and aggressive driving (Deffenbacher, Deffenbacher, Lynch, & Richards, 2003; Nesbit, Conger, & Conger, 2007). Hence, anger may also affect pedestrian behaviors. Third, sensation-seeking refers to individual differences in the optimal levels of arousal and stimulation, manifested as a personality trait (Zuckerman, 1994). High sensation seekers prefer higher degrees of stimulation and will thus tend to seek new, unconventional and occasionally illegal experiences, which are associated with dangerous behaviors (Dahlen, Martin, Ragan, & Kuhlman, 2005). One study found that adult pedestrians who exhibit stronger tendencies toward sensation seeking are more likely to cross a road against a red light (Rosenbloom, 2006). Rosenbloom and Wolf (2002) also found that sensation-seeking levels may predict road crossing success and leniency. Fourth, altruism is related to an individual's propensity to be cooperative, tolerant, and kind hearted (Goldberg, 1999). Individuals exhibiting a high level of altruism are less hostile than those with less altruism (Dahlen, Edwards, Tubre, Zyphur, & Warren, 2012). As interactions between pedestrians and drivers may be affected by the same factors, it is worth exploring the effect of personality traits on pedestrian behaviors.

Gender factors may also affect pedestrian behaviors. In the U.S., males of all ages account for 70% of pedestrian deaths, and the pedestrian fatality rate was found to be 2.19 for males and only 0.91 for females (Clifton & Livi, 2005). At signalized crosswalk intersections, females wait longer than males (Gupta, Chatterjee, Tiwari, & Fazio, 2010), and men commit more violations than women (Özkan, Lajunen, Chliaoutakis, Parker, & Summala, 2006).