Transportation Research Part F 58 (2018) 1053–1060

Contents lists available at ScienceDirect

Transportation Research Part F

journal homepage: www.elsevier.com/locate/trf

Comparison of pedestrian behaviors between drivers and non-drivers in Chinese sample

Jing Xu [a,b], Juan Liu [c], Weina Qu [a,*], Yan Ge [a,*], Xianghong Sun [a], Kan Zhang [a]

[a] CAS Key Laboratory of Behavioral Science, Institute of Psychology, Beijing, China
[b] University of Chinese Academy of Sciences, Beijing, China
[c] Institute of Aviation Medicine, Air Force, Beijing, China

ARTICLE INFO

Article history:
Received 31 January 2017
Received in revised form 22 March 2018
Accepted 22 May 2018

Keywords:
Pedestrian behavior
Driver
Non-driver
Attention-related cognitive errors
Mindful attention awareness

ABSTRACT

Road safety is a serious problem worldwide. Pedestrians, as the most vulnerable road users, deserve more attention. The aims of this study were to examine the validity of the Chinese version of the pedestrian behavior scale (CPBS) in both driver and non-driver samples, and to compare pedestrian behaviors between the two samples. In addition, we assessed the association of attention with pedestrian behaviors by exploring the relationships among CPBS, Mindful Attention Awareness Scale (MAAS) and Attention-Related Cognitive Errors Scale (ARCES). Two groups were assessed, including 302 members in the population with driving experience and 307 individuals in the non-driver group without driving experience. All participants completed the CPBS, MAAS, and ARCES, and provided sociodemographic parameters. The results showed that the CPBS had acceptable internal consistency and stability structure. More importantly, pedestrian behaviors were significantly different between drivers and non-drivers. Drivers reported significantly less transgressive and aggressive behaviors compared with non-drivers. As for the relationship between attention and pedestrian behavior, the MAAS score showed a significant negative correlation with aggressive behavior in the CPBS among drivers, while the ARCES score had significant positive correlations with all three CPBS factors. In non-drivers, the MAAS score was negatively correlated with aggressive behavior and positively associated with positive behavior; the ARCES score was positively correlated with aggressive behavior.

1. Introduction

Car accidents occur every day and cause lots of injuries and deaths; therefore, traffic safety deserves more interest. Walking, as one of the most important means of short-distance transportation, accounts for 20–50% of all transportation modalities in China (Cai et al., 2005). Indeed, according to the Traffic Management Bureau of The Public Security Ministry, in year 2010, 254,075 were injured in traffic accidents, among which 17.57% were pedestrians, 36.9% were motor vehicle drivers and 16.47% were non-motor vehicles (bicycles, tricycles, etc.) drivers; while 65,225 were killed in traffic accidents, among which 24.86% were pedestrians, 34.07% were motor vehicle drivers and 16.34% were non-motor vehicles (bicycles, tricycles, etc.) drivers. These astonishing numbers indicate that more attention should be paid to pedestrian safety.

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

https://doi.org/10.1016/j.trf.2018.05.034
1369-8478/

To measure pedestrian behaviors, the pedestrian-behavior-scale (PBS) is a widely used as a self-report questionnaire (Granie, Pannetier, & Gueho, 2013; Nordfjærn & Şimşekoğlu, 2013; Qu, Zhang, Zhao, Zhang, & Ge, 2016; Simsekoglu, 2015). Many countries have revised their versions based on social environment, road conditions, culture and language. Granie et al. (2013) developed the French version in 2012, and provided an easy-to-interpret categorization of pedestrian behaviors with accident risks. It is divided into 4 factors, including transgression (related to deliberate dangerous behaviors), lapse (related to inattention), aggressive behavior (related to negative emotion and aggressive attitude toward other road users) and positive behavior (related to prosocial behaviors toward other road users). Meanwhile, Nordfjærn and Şimşekoğlu (2013) developed the Turkish version of the PBS in 2013, which has 19 items, divided into 3 factors, namely transgression (representing the deliberate breaking of safety rules), attention violations (related to violations due to lack of attention) and aggressive behavior (related to invasive behavior toward other road users). Principal component analysis (PCA) indicated that these factors have acceptable fit to the assessed data. Qu et al. (2016) combined features and items of the above two scales, taking the Chinese culture, language and road conditions into consideration, and developed an 18 item-4 factor Chinese version of the PBS. Factor one on "positive behavior", which consists of pedestrian's kind behaviors with other road users (e.g. I walk on the right-side of the sidewalk so as not to bother the pedestrian I meet), includes 5 items. Factor two on "transgression", which involves behaviors that express offenses and errors (e.g. I cross between vehicles stopped on the roadway in traffic jams), includes 6 items. Factor three on "aggressive behavior", which involves behaviors that express negative emotions toward other road users (e.g. I deliberately walk on the roadway when I could walk on the sidewalk or on the shoulder), includes 4 items. Factor four on "lapses", consists of behaviors in which the pedestrian shows lack of attention while walking (e.g. I realized that I do not remember the route I have just taken), includes 3 items. The Cronbach's alpha values of all factors fell within an acceptable range. A limitation of the above study is that the sample did not represent all types of pedestrians, because all the participants had no driving experience; to ensure reliability of the CPBS, pedestrians with driving experience were included in the current study.

As driving becomes a convenient choice in modern life, driving experience turns out to be an important factor that impacts many other aspects of life. Researchers have demonstrated that driving experience can influence the driver's distribution of attention and danger perception (Dong, Chang, Sun, & University, 2014; Dou, 2015; Konstantopoulos, Chapman, & Crundall, 2010; Li, Ji, Sun, Wang, & Yang, 2013; Zhao et al., 2014). Konstantopoulos et al. (2010) analyzed drivers' eye movement to explore the effects of driving experience on visual attention. Driving instructors (DIs) and learner drivers (LDs) were enrolled as drivers with different driving experiences. The results showed that the strategy of eye movement enables DIs to collect more information of a given situation and maintain awareness of potential hazards. Dou et al. (2015) found that experienced drivers react faster to less hazard situation, with safer eye movement patterns compared with novice drivers. Consistently, Zhao et al. (2014) compared performance between drivers and non-drivers in a change detection task with static driving scenes, and found that driving experience not only enriches the road knowledge of the driver, but also improves the ability to allocate visual attention to changes and potential hazards. In addition, researchers used the situational questionnaire of driver hazard perception, and concluded that the more experience the driver has, the higher the hazard perception, identification, anticipation and reaction. However, the current study focused on pedestrian behaviors, aiming to assess whether drivers and non-drivers are different while using the road as pedestrians. Taubman-Ben-Ari and Shay (2012), and Nordfjærn and Şimşekoğlu (2013) found a significant positive correlation between risky driving and pedestrian behaviors; indeed, individuals who reported risky pedestrian behaviors also tended to report risky driver behaviors in these studies. Nordfjærn and Şimşekoğlu (2013) concluded that the tendency to take risk can be considered a stable trait that influences the individual's behavior on the road regardless of the road user's role. Obviously, although all individuals were pedestrians, some of them were drivers in some circumstances. We hypothesized that drivers could be more cautious while walking on the streets than non-drivers since driving experience enriches the awareness of potentially dangerous situations on the road.

To ensure a safe road environment, pedestrian behaviors deserve more attention. Several reasons have been disclosed as causes of pedestrian-involved accidents, including pedestrians crossing the road illegally, relatively low sense of speed, inattention, and distraction (Bungum, Day, & Henry, 2005; Judith, Saidi, & Jamario, & White, 2015; Lichenstein, Smith, Ambrose, & Moody, 2012). Among these factors, "attention" has been mentioned several times. In young children, attention helps recognize the right opportunity to cross the road fast and accurately; more precisely, it relies on selective and divided attention (Tabibi & Pfeffer, 2003, 2007). Meanwhile, individuals of university age are more likely to be distracted by headphones while crossing the road, which makes them more vulnerable to injury. After collecting large amounts of news from 2004 to 2012, Lichenstein et al. (2012) found a total of 116 injuries or deaths in pedestrians using headphones, including 68% males and 67% under 30 years old. Also, distraction may pose a safety risk to pedestrians, decrease sensory perception, make them more likely to be hit by an oncoming car, and lead to more dangerous behaviors (Byington & Schwebel, 2013; Nasar, Hecht, & Wener, 2008). When crossing an intersection, distracted pedestrians tend to miss more safe road-crossing sites, take longer to cross the road, and look away from the street instead of looking left and right, more often (Byington & Schwebel, 2013).

As mentioned above, attention is a serious factor affecting pedestrian safety. Absent-mindedness in everyday life sometimes causes tiny inconveniences such as keys left at home, but can also have life-threatening consequences such as parents locking a baby in the car in hot weather (Carriere, Cheyne, & Smilek, 2008). On the one hand, the Attention Related Cognitive Errors Scale (ARCES) measures the general tendency to make attention errors in everyday life. Qu et al. (2016) highlighted the associations of attention-related states in daily life with pedestrian behaviors. They found that the ARCES is positively correlated with transgression, lapse and aggressive behaviors in pedestrian behaviors. We assumed individuals likely to