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The effects of situational factors and impulsiveness on drivers' intentions to violate traffic rules: Difference of driving experience

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ABSTRACT

This study aimed to explore the effects of situational variables and impulsiveness on drivers' intentions to violate traffic rules among novice, less experienced and experienced drivers in China. Specifically, eight scenarios with manipulated variables, including time pressures (high and low), descriptive norms (positive and negative) and accident base rates (high and low), were randomly presented to 232 drivers. All independent variables, except the descriptive norm, were between—subjects designs. The results showed that hypothetical high time pressure and unsafe descriptive norm increased drivers' intentions to commit violations, respectively. Moreover, the effects of situational factors and impulsiveness on their intentions to violate traffic rules depended on driving experience. Cognitive impulsiveness predicted the violation intention only of novice drivers, whereas the descriptive norm affected the intention of the remaining two groups. The stated accident base rate moderated the relationship between the descriptive norm and violation intention of experienced drivers, specifically, when the accident base rate was hypothetical high their violation intention relied more on descriptive norms. The results indicated that with increased driving experience, drivers became more sensitive to situational cues, less influenced by individual factors and, correspondingly, more likely to behave in a manner that was congruent with the surrounding situation and individuals. The potential applications for this research are the development of intervention and training programs specifically for drivers with varying levels of driving experience.

1. Introduction

It is well established that human factors contribute to approximately 95% of traffic accidents (e.g., Reason et al., 1990; Abdel-Aty and Radwan, 2000), and driving violations are the main cause of traffic accidents in Western societies (Mesken et al., 2002) and China (Xie and Parker, 2002). Violations among Western drivers include aggressive speeding, breaking the speed limit, and drinking and driving (Parker et al., 1995). In addition to the violations mentioned above, there are distinctive violations in China, such as changing lanes illegally, using a non-motor lane during traffic congestion, stopping on the road in prohibited areas, and jumping a queue when there is congestion near a junction (Xie and Parker, 2002; Jiang et al., 2008). Convenience is a prominent characteristic of these violations, which commonly occur in the urban areas of China (Jiang et al., 2008). Hence, it is important to explore the factors affecting convenient driving behavior (violation for convenience) in the Chinese context.

In the field of psychology, researchers have attempted to explain traffic violations independently using different perspectives involving the physical environment (e.g., road width, and type of street; Björklund and Åberg, 2005), predisposition of the driver (e.g., demographic and personality characteristics; Jiang et al., 2008), and social psychology (e.g., attitude, social pressure; Xu et al., 2013). Because social context and individual predisposition can affect performance (Ajzen, 1988), integrating situational factors and personality can improve the effectiveness of psychology safety studies (Ulleberg and Rundmo, 2003).

In China, traditional cultural values and modern motorization provides a unique context for driving safety studies. First, there is substantial evidence showing differences in the social psychological characteristics between Chinese and Western societies generated by contrasting cultural values (Peng et al., 2006). For instance, the Chinese are more sensitive to contextual factors because of the situation based focus of their cultural experiences, whereas Westerners primarily attend to objects and rely on rules (Nisbett et al., 2001). Consistent with these observations, driving experiences in China and the US are clearly different (Huang et al., 2006; Zhang et al., 2006). In China, there are occasionally no consistent or obvious traffic procedures to follow (Huang et al., 2006).

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Moreover, drivers in China must attend to the driving environment because there are more pedestrians and bicycles simultaneously competing for space. Therefore, social or situational factors are expected to contribute importantly within the Chinese context. Second, the increasing number of novice drivers is challenging driving safety because of China's current rapid motorization (Zhang et al., 2006; Shi et al., 2010). Novice and experienced drivers differ in terms of driving skill, risk perception, and traffic accident involvement (e.g., Crundall et al., 1999; McKnight and McKnight, 2003; Smith et al., 2009; Tseng, 2012); drivers are also guided by different cues in traffic situations and involved in traffic violations for different reasons (Cestac et al., 2010).

Therefore, the following are the aims of the present study: (1) to examine the influence of situational factors on the intentions of Chinese drivers to violate traffic rules; (2) to examine the influence of personality on traffic violation intentions; and (3) to explore the possible varying effects of the situational and personality factors on traffic violation intentions because of different degrees of driving experience. Specifically, we used descriptive norms (Björklund and Åberg, 2005), time pressure (Adams-Guppy and Guppy, 1995) and accident base rate (Greening and Chandler, 1997) as situational factors, impulsiveness as a personality factor, and driving experience as moderators in our study. The results can contribute to the theoretical development of driving safety and intervention programs specifically for drivers with varying degrees of experience.

1.1. The descriptive norm

In transportation psychology, the behavior of other drivers in traffic environments can impact one's driving intentions and behaviors (e.g., Wilde, 1976; Björklund and Åberg, 2005; Factor et al., 2007), which is a social influence process (Deutsch and Gerard, 1955). The mechanism of this process is individuals have the motivation to conform to social norms to get effective action or build and maintain social relationship (Cialdini and Trost, 1998). Social norms (also called informal rules; Björklund and Åberg, 2005) are "rules and standards that are understood by members of a group, and that guide and/or constrain certain social behavior without the force of law" (Cialdini and Trost, 1998, p. 152). Cialdini et al. (1990) distinguished two forms of social norms: injunctive norms (i.e., subjective norms) and descriptive norms. Injunctive norms describe the extent to which a behavior will be approved by other individuals in the social group (Cialdini et al., 1990) and have been extensively explored in the relative studies of the Theory of Planned Behavior (e.g., Elliott et al., 2005; Elliott and Thomson, 2010). Descriptive norms refer to individuals' perceptions of what is commonly performed regardless whether they are morally correct or not (Cialdini et al., 1990). In a specific situation, the behaviors of others provide direct information regarding the effectiveness of the behaviors, and individuals can utilize the information to formulate wise decisions and endorse effective action, which is the influencing process of descriptive norms (Cialdini and Trost, 1998).

Regarding the traffic environment, the actions of the surrounding drivers commonly become a straightforward reference (e.g., if others would endorse a violation, one may believe that the violation is effective, easy and not risky; Forward, 2009). However, relatively few studies have examined descriptive norms in traffic and reported conflicting results. For instance, descriptive norms can successfully predict risky over taking intentions (Forward, 2009) but not speeding intention or actual speeding behavior (Forward, 2009; Elliott and Thomson, 2010). Cestac et al. (2010) identified descriptive norms as a significant predictor of speeding intention in young drivers. One possible reason for the inconsistent results might be the bias in the questionnaires, which typically asked the respondents to judge the percentage of surrounding individuals who would commit a violation in a specific situation. The percentage will be overestimated, especially for individuals who often commit violations (Taubman-Ben-Ari et al., 1999). Therefore, we designed scenarios to manipulate the specific traffic situation to avoid this bias. We predict the following as our first hypothesis:H1:Drivers will be more willing to commit traffic violations when in a negative descriptive norm condition (a traffic violation is common) than a positive descriptive norm condition (a traffic violation is rare).

1.2. Accident base rate

Individuals tend to use summary statistics for risky events to estimate personal risk (Weinstein, 1987). Greening and Chandler (1997) noted that risk estimates are higher if the stated accident base rate is high. This conclusion might also be applicable to traffic behavior, which indicates that individuals would use accident information to estimate the probability of being personally involved in a traffic accident. In general, a subjective estimate of probability in potential hazards is negatively related to risk behavior (Cohn et al., 1995). In transportation psychology, it appears logical that a lower estimate of risk has been identified as the cause of greater involvement in traffic violations (Fernandes et al., 2010). However, recent studies questioned whether there is a causal relationship between risk perception and behavior (Ulleberg and Rundmo, 2003; Rundmo and Iversen, 2004; Machin and Sankey, 2008). In the present study, we induced the perceived likelihood of traffic accidents by manipulating the stated accident base rate. We predict the following in our second hypothesis:H2:When the accident base rate is high, drivers' intentions to be involved in a traffic violation will be lower than when the accident base rate is low.

The perceived risk in situation might also influence the utility of the descriptive norm. For instance, in a meta-analysis (Rivis and Sheeran, 2003), the descriptive norm was observed to be more important in motivating decisions to engage in risky (e.g., lottery play) than non-risky behaviors (e.g., healthy eating). A recent empirical study (Forward, 2009) regarding driving violations confirms this conclusion and shows that the descriptive norm can substantially increase the explained variance in predicting violation intentions in high risk scenarios but not low risk. That is to say, when situation is risky or uncertainty, the social evidence that descriptive norms provide becomes more important (Cialdini and Trost, 1998). Combining studies on accident base rates and descriptive norms, we predict the following:H3:The stated accident base rate moderates the effectiveness of a descriptive norm; namely, when the accident base rate is high, the violation intention of drivers might be more influenced by descriptive norm drivers.

1.3. Time pressure

Time pressure is one of the most significant situational risk factors of traffic accidents (Gabany et al., 1997; Harris et al., 2003). Three of four drivers concur that saving time is the most important motive and prevalent reason for traffic violations under time pressure (Salminen and Lahdeniemi, 2002); time pressure accounts for 13% of the variance in reported risky driving behavior (Adams-Guppy and Guppy, 1995).

In a traffic environment, frustrating road situations, such as congestion, delays, running late for an important meeting, emergencies, and scheduling more appointments could increase the sense of time pressure among drivers (O'Brien et al., 2004). Under high time pressure, drivers are less likely to perceive speeding as an important risk factor and more likely to perceive punctuality as desirable (Adams-Guppy and Guppy, 1995). In the identical condition, drivers also experience higher levels of self-reported anger (O'Brien et al., 2004) and feel more activated, aroused and

stressed, thus motivating them to drive faster (Oliveras et al., 2002). Based on these studies, we predict the following:H4:Under high time pressure, drivers will be more willing to commit violations.

1.4. Impulsiveness

Impulsiveness addresses one's control over thoughts and behaviors (Patton et al., 1995). Impulsiveness was identified as a direct personality predictor of risky driving (Stanford et al., 1996), aggressive driving (Dahlen et al., 2005; Owsley et al., 2003) because individuals do not have the self-control to refrain from engaging in such behaviors. Patton et al. (1995) suggested a 3-factor structure of impulsiveness, motor impulsivity, non-planning impulsivity and cognitive impulsiveness, which refer to "acting without thinking, presenting orientation or lack of "futuring" and making quick cognitive decisions" (Evenden, 1999, p. 350), respectively. The present study aimed to determine the predictive validities of the three distinct constructs of impulsiveness on a driver's intention to violate traffic rules, and we predict the following: H5a: Motor impulsiveness positively predicts the intention of a driver to commit a traffic violation; H5b: Non-planning impulsiveness positively predicts the intention of a driver to commit a traffic violation; H5c: Cognitive impulsiveness positively predicts the intention of a driver to commit a traffic violation.

1.5. Driving experience

Young novice drivers have a disproportionately large involvement in traffic crashes in Western countries (Deery, 1999; Farrand and Mckenna, 2001; Rundmo and Iversen, 2004). In China, drivers with less than three years' experience are considered as "road killers" because they are more frequently involved in traffic accidents than experienced drivers (CRTASR, 2010). During the previous two decades, the number of vehicles in China has increased dramatically. Between 1987 and 2008, the average annual growth rate of motor vehicles exceeded 14% (Lu, 2009). Consequently, many drivers are members of the real first generation on wheels with few opportunities provided for social learning when they were young. Therefore, the rapidly increasing number of novice drivers has become a challenge to driving safety (Zhang et al., 2006; Shi et al., 2010).

In addition to the differences in the driving skills between novice and experienced drivers, one explanation for the larger contribution of the former to traffic accidents is that although they quickly acquire the necessary skills to control a motor vehicle, it takes much longer to develop the higher-order perceptual and cognitive skills necessary to safely interact with others within the driving environment (Deery, 1999). Novice drivers have limited mental capacity remaining because much of this capacity is devoted to vehicle control (Underwood et al., 2002, 2003). For this reason, novice drivers concentrate their searches on smaller areas and scan narrowly, thereby detecting hazards slower than experienced drivers, frequently failing to detect hazards, and underestimating hazards associated with a range of driving situations (Finn and Bragg, 1986; Fisher et al., 2006; Scialfa et al., 2012; Chapman and Underwood, 1998). By contrast, experienced drivers show a greater sensitivity to the overall situation (Underwood et al., 2003) and would not violate traffic rules unless they felt they had control over a specific situation (Cestac et al., 2010). Therefore, we hypothesize that the effects of situational factors and impulsiveness on their intentions to violate traffic rules depended on driving experience, specifically: H6a: With an increase in driving experience, the violation intention of drivers is increasingly guided by situational factors; H6b: With an increase in driving experience, the violation intention of drivers is decreasingly guided by impulsiveness.

2. Method

2.1. Participants

A total of 232 adults with a current driving license, aged 18–60 years (mean = 34.55 years, SD = 9.01), participated in this study. Of these, 189 were non-professional drivers (82.9%), and 116 were females (50.4%; with two participants not reporting gender). The participants were recruited from local residential communities (n = 152) and an introductory psychology course at the Institute of Psychology, Chinese Academy of Sciences (n = 80). More than half of the sample (60.8%) had been involved in at least one accident; 83.1% had watched at least one accident, and 18.0% had previous traffic convictions. Years of driving ranged from 0.5 to 28, with an average of 6.62 years. Driving experience was classified into three categories: 76 participants were novice (less than 3 years, mean driving experience = 1.40 years, SD = 0.56), 79 were less experienced drivers (from 3 to less than 10 years, mean driving experience = 5.29 years, SD = 1.81), and 77 were experienced drivers (10 years or more, mean driving experience = 13.69 years, SD = 4.44), with no significant difference in gender ratio among the three groups. This split standard was consistent with previous studies (Smith et al., 2009) and China road crash data (CRTASR, 2010).

2.2. Design

The descriptive norms, stated accident base rate, time pressure, and impulsiveness were the independent variables in this study. The descriptive norm had two levels (safe driving norm and unsafe driving norm) and was designed as a within-subjects variable. The stated accident base rate and time pressure had two levels (high and low) and featured between-subjects designs.

The descriptive norms, time pressure, and accident base rate were manipulated in eight scenarios. It should be noted that our characterization of time pressure as being late may be a better reflection of the pressures of modern living than the varying degrees of congestion used in earlier studies, which found mixed results for this hypothesis (O'Brien et al., 2004).

The scenario is described as follows:

You are driving alone through an urban area to the railway station to see a friend off. You are approaching an intersection when the light changes from green to red. The situation in front of you is as follows: Traffic is congested; you are waiting for the light to turn green in a queue. The order of traffic is good, and there are few vehicle violations (the order of traffic is bad, vehicles commonly commit violations). According to official statistics, this area is an accident hotspot, which indicates that accidents frequently occur (in this area, traffic accidents rarely occur). At this moment, you are not in a hurry, and sufficient time remains for you to drive to the railway station (you are under time pressure to arrive at the railway station on time). Waiting in the queue, you are looking outside and observe that there are few bicycles in the non-motor lane.

2.3. Measure and procedure

The participants were asked to read a written introduction regarding the research by a professional researcher and informed that their responses would be anonymous. The participants were then randomly assigned to four groups, which were defined by the version of the scenarios that combined time pressure (high and low) with the stated base rate (high and low). The participants in each group were presented two versions of the scenario, in which both positive and negative descriptive norms were manipulated. To minimize the order effects, the participants were randomly allocated to two different versions of the questionnaire, in which the order of the scenario presentation was reversed. An equal number of

participants were assigned to each experimental condition ($n = 58$). There were no significant differences for any experimental group in the participants' impulsiveness, gender, age, driving age, or self-report traffic convictions. After reading the scenario, the participants were questioned on violation intention, perceived descriptive norm, perceived possibility of traffic accident and perceived time pressure (the latter three questions are for the manipulation check); impulsiveness was then measured. Finally, demographic data were obtained. After the questionnaire was submitted, a small gift was provided for participation.

2.3.1. Intention to violate

When the participants completed reading the scenarios, they were asked to indicate their intention to perform a behavior on a 5-point scale ranging from 1 (impossible) to 5 (very possible). On the first scale, the participants were asked to indicate the likelihood that they would drive on a cycle path. On the second scale, the participants were asked to indicate the likelihood that they would remain and wait for a traffic light to turn green (the score of the question was inverted). The scores were summed and averaged with a higher score indicating a greater intention to violate traffic rules, $\alpha = 0.78$, mean = 2.30, SD = 0.97.

2.3.2. Questions for the manipulation check

Immediately after the participants completed the items pertaining to their intention to violate traffic rules, they were asked to indicate their perceived descriptive norm, possibility of traffic accident and time pressure. On the first scale, the participants were asked to judge the probability that the surrounding individuals would engage in a traffic violation using a 5-point scale ranging from 1 (none) to 5 (very probable). On the second and third scales, the participants were asked to judge the probability of traffic accidents happening in this area [from 1 (none) to 5 (very probable)] and indicate how much time pressure they felt in the described situation [from 1 (none) to 5 (a large amount)].

2.3.3. Impulsiveness

A brief Barratt impulsiveness scale, version 15, was employed in the present study (Spinella, 2007). Each subscale of impulsiveness was assessed using 5 items. A sample item for motor impulsiveness is "I act on impulse"; a sample item for non-planning is "I plan for the future" (inverted); a sample item for cognitive impulsiveness is "Easily bored solving thought problems". The items were scored on a 4-point Likert scale ranging from 1 (rarely/never) to 4 (almost always/always). Based on CFA (confirmative factor analysis) results, the three dimensions of impulsiveness showed good fit to the data (GFI = 0.95, IFI = 0.98, CFI = 0.98, RMSEA = 0.03, Chi-square = 94.85, df = 81, $p = 0.14$). The reliability test resulted in alpha values of 0.68, 0.70, and 0.68 for motor impulsiveness, non-planning and cognitive impulsiveness, respectively. The scores were summed, with higher scores indicating greater impulsiveness. Mean scores on motor, non-planning, and cognitive impulsiveness were 10.17 (SD = 2.11), 11.08 (SD = 2.84) and 10.57 (SD = 2.40), respectively.

2.4. Statistics

This study was a mixed design in that both within-subjects (i.e., descriptive norms) and between-subjects (i.e., time pressure, accident rate and impulsiveness) factors were used. Of these factors, impulsiveness is a continuous variable. Hierarchical linear modeling (HLM; Bryk and Raudenbush, 1992) was selected because it was useful for examining within-subjects (Level 1) and between-subjects (Level 2) effects with no need for considering the attributes of the variables (Hurt et al., 1999). Several scenario studies which having Likert scale measures have used a similar analytical approach (e.g., Ilies et al., 2011; Rotundo and Sackett, 2002).

The HLM involves a two-stage approach to this type of multilevel data. In the context of the current study, descriptive norms were used as the Level 1 independent variables predicting the intention to commit a violation because it was a within-subjects design. The second stage used regression parameters from the first stage (i.e., the intercepts and slopes; e.g., Bryk and Raudenbush, 1992) as dependent variables and the between-subjects variables (i.e., time pressure, accident base rate, and impulsiveness) as predictors to examine the main effect of Level 2 predictors (for Level 1 intercept) and interaction between Level 2 and Level 1 predictors (for Level 1 slopes).

3. Results

3.1. Manipulation check

All of the manipulations were effective. Participants considered that committing a traffic violation to be significantly more common in a negative descriptive norm situation (mean = 3.31, SD = 1.15) than that in a positive descriptive norm condition (mean = 2.84, SD = 1.13), $t_{(231)} = -7.21$, $p < 0.001$. Compare to those under a hypothetical low time pressure (mean = 2.54, SD = 1.10), the participants under a hypothetical high time pressure (mean = 4.10, SD = 0.77) reported higher level of time pressure perception, $t_{(230)} = 12.47$, $p < 0.001$. Compare to those under a hypothetical low accident base rate condition (mean = 2.56, SD = 0.99), the participants under a hypothetical high accident base rate condition (mean = 3.54, SD = 0.84) reported higher level of accident base rate, $t_{(230)} = 7.90$, $p < 0.001$.

3.2. Hierarchical linear model (HLM)

Gender, age, and driving experience influence driving behavior (e.g., Smith et al., 2009; Forward, 2009; Cestac et al., 2010; Shi et al., 2010). However, in the current study, they were not significantly related with the driver's violation intention. Thus, they were not being taken into account in further analysis.

We conducted model 1 to test H1, which stated that the intention to commit a violation would be higher when the descriptive norm was stated negatively. In model 1, the descriptive norm was entered as the Level 1 predictor for the violation intention. The results supported a significant main effect for the descriptive norm on violation intention (see Table 1). This result indicated that drivers were more willing to engage in a traffic violation if most individuals committed a traffic violation. Thus, H1 was supported.

To test the main effect of accident base rate (H2), time pressure (H4) and impulsiveness (H5), these variables were entered into model 2 as the Level 2 predictor for the intercept term from Level 1 (see Table 1). The result indicated that time pressure significantly influenced the Level 1 intercept, which indicated that drivers reported a higher likelihood of committing a traffic violation under high time pressure. Thus, H4 was supported. However, the main effect of the accident base rate and three dimensions of impulsiveness were not significant. Thus, H2 and H5 were not supported.

H3 stated that the interaction between the accident base rate and descriptive norm influenced the intention to commit traffic violations. The analysis was conducted in model 3, in which the accident base rate was introduced as the Level 2 predictor for the slope term from the Level 1 model (see Table 1). The results indicated that the interaction between the accident base rate and descriptive norm was not significant. Thus, H4 was not supported.

Table 1
HLM results: effects of situational factors and impulsiveness on violation intention ($N = 232$).

Models	Parameter estimates								Deviance	Chi^2
Model 1 L1: Violation = $\beta_0 + \beta_1$ (descriptive norm) + e_0 L2: $\beta_0 = \gamma_{00}$ $\beta_1 = \gamma_{10}$	β_0 2.36**	β_1 0.26**	–	–	–	–	–	–	1302.04	878.73**
Model 2 L1: Violation = $\beta_0 + \beta_1$ (descriptive norm) + e_0 L2: $\beta_0 = \gamma_{00} + \gamma_{01}$(time pressure) + γ_{02} (base rate) + γ_{03}(motor impulsiveness) + γ_{04} (no planning impulsiveness) + γ_{05} (cognitive impulsiveness) $\beta_1 = \gamma_{10}$	γ_{00} 1.50**	γ_{10} 0.26**	γ_{01} 0.74**	γ_{02} 0.03	γ_{03} 0.03	γ_{04} 0.01	γ_{05} 0.04	–	1275.51	718.22**
Model 3 L1: Violation = $\beta_0 + \beta_1$ (descriptive norm) + e_0 L2: $\beta_0 = \gamma_{00} + \gamma_{01}$(time pressure) + γ_{02} (base rate) + γ_{03}(motor impulsiveness) + γ_{04} (no planning impulsiveness) + γ_{05} (cognitive impulsiveness) $\beta_1 = \gamma_{10} + \gamma_{11}$ (base rate)	γ_{00} 1.43**	γ_{10} 0.38**	γ_{01} 0.74**	γ_{02} 0.15	γ_{03} 0.03	γ_{04} 0.01	γ_{05} 0.04	γ_{11} −0.24	918.96	829.38**

Notes: (1) L1 = Level 1; L2 = Level 2. (2) Code: high time pressure = 1 and low time pressure = 0, high base rate = 0 and low base rate = 1, positive descriptive norm = 0 and negative descriptive norm = 1. (3) Deviance is a measure of model fit. The smaller the deviance is, the better the model fits.
** $p < 0.001$ (two-tailed).

3.3. Driving experience

We hypothesized that the determinants of traffic violation intentions would depend on a driver's driving experience. To test this hypothesis, we examined situational factors and impulsiveness using the HLM separately for the three categories of driving experience. The descriptive norm was used as the Level 1 independent variable predicting the intention to commit a violation. Accident base rate, time pressure, and impulsiveness were introduced in Level 2 as predictors for the intercept term from Level 1 (the main effect of accident base rate, time pressure, and impulsiveness). Accident base rate was also introduced in Level 2 as a predictor for the slope term from Level 1 (the interaction between accident base rate and descriptive norm).

The results show that descriptive norm influenced the intention of drivers to commit a violation but only for those with a minimum of three years driving experience and not novice drivers. This result indicated that novice drivers were not sensitive to social influences (see Table 2). For experienced drivers (with more than 10 years driving experience), the main effect of the accident base rate was significant, thus indicating that participants under the low accident base rate condition reported more willingness to commit a violation. The interaction between the descriptive norm and the accident base rate was also significant. Specifically, when the base rate was high, the descriptive norm significantly influenced the intention of drivers to violate traffic rules (positive descriptive norm: mean = 1.96, SD = 0.91; negative descriptive norm: mean = 2.62, SD = 1.13, $t_{(39)} = -4.47$, $p < 0.001$). However, when the accident base rate was low, the descriptive norm did not significantly influence the intention of drivers to violate traffic rules (positive descriptive norm: mean = 2.10, SD = 1.05; negative descriptive norm: mean = 2.31, SD = 1.05, $t_{(36)} = 1.13$, $p = 0.27$). Cognitive impulsiveness significantly predicted violation intention among novices but not those with more driving experience.

The results suggested that novices committed traffic violations mainly because of internal cognitive impulsiveness and were less influenced by the traffic environment (descriptive norm and accident base rate), whereas those who had more driving experience were more sensitive to situational cues.

4. Discussion

The current study explored the effects of situational factors (i.e., descriptive norms, accident base rate, and time pressure) and impulsiveness on the drivers' intentions to convenient driving and the possible variation generated by different levels of driving experience. The following sections focus on the effect of situational factors and impulsiveness and the different roles of these factors for drivers with varying levels of driving experience. The limitations of the present study and the implications of our findings for designing interventions are also discussed.

4.1. Situational factors

The first aim of the present study was to explore the contribution of situational factors on the violation intention of drivers. The results indicated that the violation intention of drivers significantly varied in different contexts.

First, the descriptive norm is an important determinant of traffic violations in China, thus indicating that the violation intention of Chinese drivers largely relies on the actions of most other drivers in a traffic situation. The present study also showed the descriptive norm influenced drivers' violation intentions of experienced drivers only when they perceived a high level of probability of traffic accidents. This result is consistent with the most widespread perspective in this research field, which states that despite the positive incentives for norm-abiding behaviors, the effect of the descriptive norm depends on the situation (Cialdini et al., 1991; Cialdini and Goldstein, 2004). The descriptive norm is more important for motivating decisions to engage in risky rather than healthy behavior (Rivis and Sheeran, 2003) and other similar behaviors in risky situations (Forward, 2009), which can help to avoid undesirable consequence and get effective action (Cialdini and Trost, 1998).

Table 2
HLM results for the three categories: effects of situational factors and impulsiveness on violation intention.

	Novice driver	Less experienced diver	More experienced driver
Fixed effect			
For intercept			
γ_{00} (intercept)	0.95**	1.85**	1.25**
γ_{01} (time pressure)	0.78**	0.46*	0.88***
γ_{02} (accident base rate)	−0.06	−0.13	0.63**
γ_{03} (motor impulsiveness)	0.05	0.03	0.04
γ_{04} (non-planning impulsiveness)	0.01	−0.03	0.04
γ_{05} (cognitive impulsiveness)	0.11**	−0.03	−0.05
For slope			
γ_{10} (descriptive norm)	−0.09	0.45**	0.70***
γ_{11}(base rate × descriptive norm)	0.26	−0.05	−0.89***
Random effect			
Deviance	411.79	454.05	420.95
Chi-square	291.27***	266.10***	207.47***
N	76	79	77

Notes. (1) γ = level 2 regression parameter estimates. (2) Code: high time pressure = 1 and low time pressure = 0, high base rate = 0 and low base rate = 1, positive descriptive norm = 0 and negative descriptive norm = 1. (3) Deviance is a measure of model fit. The smaller the deviance is, the better the model fits.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$ (two-tailed).

An additional situational factor we intended to examine was the stated accident base rate. In general, a higher level of perceived risk for a particular behavior is associated with a lower likelihood that an individual would commit that behavior (Cohn et al., 1995). However, our experiment demonstrated that the provided accident base rate information influenced the perceived likelihood of an accident but not the behavior intentions of the novices and less experienced drivers. Similar results have also been observed in the studies of Ulleberg and Rundmo (2003) and Rundmo and Iversen (2004), who observed that the probability of traffic accidents and concerns were non-significant predictors for risky driving behavior. One possible reason is that inexperienced drivers don't have sufficient mental capacity to process the accident base rate information (Underwood et al., 2002, 2003), which would be supposed to guide the following behavior. On the contrary, their personal behavior might provide direct feedback to their risk perception (Horvath and Zuckerman, 1992). Machin and Sankey (2008) observed that the risk perception of traffic accidents is positively correlative to risky driving behavior, and their explanation of this result is that drivers report more risk perception because they engage in risky driving behaviors more frequently. Fernandes et al. (2010) also concur that the above relationship may exist. Thus, the increment of accident risk may not necessarily lead to a change in violation intention. Another possible reason could be optimism bias, i.e., individuals consider themselves superior to other drivers, thus leading them to underestimate their personal risk of involvement in accidents (Greening and Chandler, 1997; Branstrom et al., 2006). Therefore, the change in the perception of the probability of traffic accidents in our research may not necessarily result in a higher perceived personal risk.

In addition, time pressure affects all drivers' intentions to violate traffic rules, regardless of driving experience; thus, time pressure is a robust factor influencing drivers' intentions. This result is consistent with most studies that include this factor (Oliveras et al., 2002).

4.2. Impulsiveness

Our result showed that the effect of impulsiveness was more limited than expected. Specifically, only cognitive impulsiveness predicted violation intentions among novices, whereas motor impulsiveness and non-planning were non-significant predictors. Cognitive impulsiveness refers to the inability of an individual to control a cognitive process; thus, one with high cognitive impulsiveness is lacking of the ability to think rationally while driving (Spinella, 2007). Our result differed from previous studies that suggested impulsiveness significantly predicts risky driving behaviors (Dahlen et al., 2005; Owsley et al., 2003). However, it was important to note what our dependent variable was intention to violation for convenience, which were different from those used in previous research, such as aggressive driving (Dahlen et al., 2005) or breaking the speed limit (Owsley et al., 2003). The result of the current study was also contrary to that presented by Yagil (2001) who combined personality traits and situational factors, thereby demonstrating a stronger effect of personality traits compared to situational factors. It was previously discussed that Chinese society makes the individual feel very much a part of a large entity (Nisbett et al., 2001; Peng et al., 2006); therefore, if one resides in a complex social world with many role relationships, his or her attention is likely to be directed outside of oneself and toward others in the social field. Therefore, these individuals are more likely to be influenced by the environment rather than their individual traits.

4.3. Driving experience

In transportation psychology, both situational/social influences and personal differences are powerful determinants of traffic behavior. The present study observed varying effects of situational influences and personal factors on traffic violation intentions, which depended on driving experience. This result indicated that situational features contributed more importantly to experienced drivers, whereas personality features were stronger predictors for novice drivers. Experienced drivers had greater intentions to follow the traffic rule to get effective results if most drivers in the identical traffic environment didn't violate the traffic rules. These drivers also considered the probability of traffic accidents: When the accident base rate is high, they would have less intention to violation and modified their traffic behavior in ways that were congruent with how most individuals acted to avoid the undesirable results. By contrast, novice drivers were willing to commit violations mainly because of cognitive impulsiveness, but they were not influenced by social environment. A similar result was presented by Cestac et al. (2010) who observed that violation intention was neither influenced by injunctive norms nor perceived behavioral control among novices; however, sensation seeking influenced the intention to violate traffic rules in the least experienced drivers but not those with more driving experience. Consistent with the norm focus theory (Cialdini et al., 1991), namely, in a complex environment with goal conflicts, shifting individuals' attention to a specific

source of information changes his or her response in manners consistent with the most dominant cue. In the current research, because of focusing most of their cognitive resources on controlling the vehicle, the novice drivers had less remaining cognitive ability to externally attend to the traffic situation (Underwood et al., 2002, 2003); consequently, these drivers became less influenced by situational factors. By contrast, experienced drivers shared a common interpretation of what behaviors were expected in a particular situation and behaved in congruent manners with the situation or with individuals in the same environment, because they attended more to their surroundings.

4.4. Study limitations, further research, and practical implications

Some limitations that may affect the reliability and generalizability of the present results should be noted. The first limitation concerns the representativeness of the sample. Although we attempted to use a sufficiently representative sample, a larger sample for such a study is more desirable. Another limitation is that intention, rather than behavior, has been investigated in the present study. Despite a fairly large number of studies suggesting that intention can predict future behavior, the relationship between behavioral intention and actual behavior is occasionally controversial (Ajzen, 1991). It is possible that the results might not be replicated if real behavior was assessed. The third limitation pertains to other factors that affect drivers' intentions to violate traffic rules and may not have been considered in the present study. For instance, in the present study, cognitive impulsiveness has been observed to be a predictor of violation intention among novices but not experienced drivers. Many personality traits have been identified as risk factors for traffic violations in previous studies, including sensation seeking (Jonah, 1997; Burns and Wilde, 1995; Sumer, 2003), normlessness (Rundmo and Iversen, 2004), and trait anger (Deffenbacher et al., 2000). However, it is not clear whether the relationships between these personality traits and traffic violations are affected by driving experience. Hence, more personality traits should be considered in future studies.

Despite these factors, from an applied perspective, the present results have strong practical utility. Time pressure has been observed to be the strongest situational factor influencing the intention of drivers to violate traffic rules during traffic congestion. Intervention strategies aimed at reducing traffic violations under high time pressures could include the following: Urging drivers to travel alternative routes during rush hours to avoid congestion when time is at a premium (Goh, 2002), encouraging flexible work hours (Chin, 1996), varying tolls based on the time of day or congestion (Ben-Elia and Ettema, 2009; Burris and Pendyala, 2002) to reduce congestion at rush hours, and selectively increasing law enforcement at congested locations during rush hours (Pucher et al., 2005).

The results of the present research also indicate that future researchers must consider driving experience related differences in traffic safety intervention programs. Our results show that experienced drivers are more sensitive to descriptive norms and accident base rate, thus implying that providing positive descriptive norms information or posting warning information along roadside in high risk areas are important and useful to reduce traffic violations (e.g. Van Houten et al., 1980, 1985; Van Houten and Nau, 1983; Wrapson et al., 2006). However, it is difficult to providing real positive descriptive norms information because the violation rate is higher in China than in developed countries (Xie and Parker, 2002; Zhang et al., 2006; Shi et al., 2010). A more effective attempt to reduce driving violations is to talk to those who violate traffic rules that obedience is the common and normal behavior, as they often underestimated it (Forward, 2009; Taubman-Ben-Ari et al., 1999). By contrast, because novice drivers violate traffic rules mainly because of individual differences, using a personality assessment test as a screening procedure during initial training should be encouraged (Machin and Sankey, 2008). Educators should also pay attention to drivers with high cognitive impulsiveness and provide additional safety intervention programs for them. Interventions may be developed to increase driver awareness of the negative aspects of their personality and adverse influences of these aspects on their driving behavior. Effective strategies for the self-regulation of impulsiveness should also be considered. One such strategy is a self-control training (SCT) regimen (Finkel et al., 2009; Gailliot et al., 2007; Densona et al., 2011), which involves a physical regulation task and is effective at improving performance in self-control tasks.

5. Conclusion

In conclusion, the study has provided insights into the effects of situational factors and impulsiveness on the intention to violate traffic rules among novice, less experienced and experienced drivers in China. Time pressure affects all drivers regardless of driving experience; thus, it is a robust factor influencing their intention to commit traffic violations. The effects of descriptive norm, stated accident base rate, and cognitive impulsiveness depend on driving experience. Specifically, descriptive norm, accident base rate and the interaction between descriptive norm and accident base rate affect the intention of experienced drivers to commit convenient driving behavior, whereas cognitive impulsiveness predict the intention of novice drivers. The results demonstrate that situational features play a relatively more important role among experienced drivers, whereas personality features are stronger predictors among novice drivers. The results also suggest that traffic intervention programs should focus on reducing traffic time pressure first. The intervention program aimed at experienced drivers need to emphasize that obeying traffic rule should be a normal behavior among them and provide high accident base tare information. The effects of personality on the intention of novice drivers to commit traffic violations also suggested that those at risk should be given more attention and receive specific self-regulation training during their initial education classes.

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