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Rule obedience as a mediator between normlessness and risky driving in hazy conditions

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ABSTRACT

Objective: With the increasing severity of haze and its detrimental effect on public health and visibility, hazy conditions has become a popular subject among the public and scholars. However, little is known about how haze affects risky driving behaviors and the role of normlessness. The present study examined this issue with a repeated within-subjects design.

Methods: A total of 100 drivers completed two almost identical questionnaires in different weather conditions (clear and hazy) at an interval of at least two weeks. Respondents' personality traits (normlessness), risky driving behaviors (ordinary violations, aggressive violations, errors and lapses), and degrees of rule obedience were assessed. A mediation analysis with bootstrapping was conducted to identify the direct and indirect effects of normlessness related to hazy conditions and risky driving behaviors.

Results: Respondents reported more aggressive violations, ordinary violations, errors, lapses, and total risky driving behaviors as well as a lower level of rule obedience in hazy conditions than in clear conditions. Normlessness significantly predicted ordinary violations, errors and total risky driving behaviors through rule obedience; that is, rule obedience fully mediated the association between normlessness and ordinary violations, errors and total risky driving behaviors. However, normlessness was not associated with any effect on aggressive violations and lapses. Compared with accident-free respondents, accident-involved respondents were less likely to comply with traffic rules.

Conclusions: Consistent with previous studies, the results indicated the importance of normlessness in predicting risky driving behaviors and highlighted the importance of rule obedience in the association between normlessness and risky driving behaviors in hazy conditions.

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1. Introduction

Driving safety, especially for driving in adverse weather conditions, is always a focus for traffic and the public. Studies suggested that accidents occurred more often and that outcomes were more severe in adverse weather conditions (e.g., rain, snow, and fog) than in optimal weather conditions (Abdel-Aty, Ekram, Huang, & Choi, 2011; Bergel-Hayat, Debbarh, Antoniou, & Yannis, 2013). As an extreme adverse weather condition, haze not only has harmful effects on public health

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but also has severe outcomes related to traffic (Sun, Zhuang, Tang, Wang, & An, 2006; Tan et al., 2009), especially when visibility is less than 3 km (China Meteorological Administration, 2010). In recent years, hazy conditions have attracted the attention of many Chinese people because severe haze frequently shrouds most cities in China. A large number of studies examined the cause of haze and its detrimental effects on human health, but less attention were devoted to the influence of haze on risky driving behaviors and the role of personality in these behaviors.

Studies have shown that risky driving behaviors could be influenced by weather conditions (Paleti, Eluru, & Bhat, 2010; Snowden, Stimpson, & Ruddle, 1998; Zhang, Yau, & Chen, 2013). For example, Zhang et al. (2013) analyzed traffic accident data from 2006 to 2010 in Guangdong, China, and found that weather and poor visibility were significant predictors of traffic violations. Although most of the literature consistently reported a compensatory reduction in speed and longer headway distance in adverse weather conditions (e.g., haze, fog or rain) due to reduced visibility (Mueller & Trick, 2012; Tu, Li, Sun, & Dai, 2014; Tu, Zhang, Liu, & Sun, 2015; Zhu, Rong, & Zhou, 2010), mixed findings were also reported (Broughton, Switzer, & Scott, 2007; Caro, Cavallo, Marendaz, Boer, & Vienne, 2009; Snowden et al., 1998; Sumner, Bagulay, & Burton, 1977). For example, Snowden et al. (1998) indicated that some drivers drove faster with increasing fog concentration because in such situations, they lacked visual cues regarding their speed. Using a driving simulator, Broughton et al. (2007) explored driving behaviors under clear conditions and under conditions of two different fog density levels. The results indicated significant individual differences between drivers. At higher speeds, two groups of participants could be identified in foggy conditions: one group stayed within the visibility range of the lead vehicle, and another group lagged beyond the visibility range. Varied driving behaviors may also be associated with individual differences, such as personality.

Normlessness is a personality trait considered extremely important in relation to driving safety. Normlessness involves the belief that socially unacceptable behaviors are needed to achieve certain goals. Individuals with high normlessness scores may be indifferent to traffic safety. These people believe that it does not matter whether they break rules, and they do not care whether they violate laws as long as they can achieve a certain goal. Empirical studies have shown that drivers who scored high in normlessness engaged in more risky driving (Oltedal & Rundmo, 2006; Ulleberg & Rundmo, 2003) and were more frequently ignorant of traffic rules when compared to drivers who scored low in normlessness (Iversen & Rundmo, 2002). Chen (2009) demonstrated that, compared to anger, sensation seeking, or anxiety, normlessness had the greatest indirect power in predicting unsafe driving behaviors based on risk-taking attitudes. Yang, Du, Qu, Gong, and Sun (2013) found that normlessness not only significantly predicted aggressive violations but also effectively predicted ordinary violations.

However, little attention has been devoted to the influence of personality on the relationship between haze and self-reported risky driving. Thus, it remains unclear how risky driving behaviors differ in clear and hazy conditions and how normlessness affects risky driving behaviors in different weather conditions (i.e., clear or hazy). The expectation in the current study was that haze may lead to more risky driving behaviors due to its negative effect on the traffic environment. In addition, we speculated that normlessness may significantly predict risky driving behaviors when people are driving in hazy conditions.

2. Method

2.1. Respondents

This research complied with the American Psychological Association's Code of Ethics and was approved by the postdoctoral institution review board of the Department of Industrial Engineering at Tsinghua University. Respondents were recruited by *WeChat*, and all of them provided written informed consent.

Respondents were required to complete two almost identical questionnaires online through a website link under two different weather conditions. One was completed on a clear day, and the other was completed on a hazy day. The interval between the two questionnaire completion times was at least two weeks (M = 27.40 days, SD = 11.45) to eliminate any possible practice effect. Due to uncertainty about weather and respondents' free time, the timing of filling out the first questionnaire primarily depended on the weather. However, we also counterbalanced the order of questionnaire completion according to the data collection progress. For example, when we found that the number of questionnaires completed under clear conditions far exceeded the number under hazy conditions, we suspended access to the questionnaire link; we provided access to the questionnaire link again when hazy conditions resumed. According to the classification of the Air Quality Monitoring and Analysis Platform, only moderate, heavy and severe haze (when the Air Quality Index (AQI) exceeded 150) were included in this study. Light haze (AIQ = 111–150) was not included due to the difficulty in distinguishing light haze from weather without haze.

Respondents were required to meet the following criteria: (1) they needed to possess a valid driver's license, and (2) they needed to have driven in hazy conditions. A total of 253 questionnaires were collected, and respondents with one or more of the following characteristics were excluded: (1) those who had a valid license but never drove (to reach this goal, questionnaire links would be suspended automatically when participants reported driving zero miles in the last year or zero hours in the last month); (2) those who filled out questionnaires only once; and (3) those who completed questionnaires without following instructions (e.g., questionnaires were completed under the same weather conditions, including filling out both on a hazy day or both on a clear day). For points (2) and (3), the researchers screened the questionnaires one by one to ensure the