



# The expression of anger while driving – The role of personality and self-consciousness in a sample of Chinese drivers

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## ABSTRACT

Driving anger among Chinese drivers is common leading to aggressive and risky driving behaviours and potentially increasing involvement in road collisions. This study adopted an online survey to explore the relationship between personality, self-consciousness and driving anger expression. 559 participants completed a questionnaire consisting of the Driving Anger Scale (14-item DAS), the short version of the Driving Anger Expression Inventory (15 item DAX), the Brief HEXACO Inventory (BHI), and the Self-Consciousness Scale (SCS). A Confirmatory Factor Analysis yielded a reliable and valid three-factor structure of the Chinese 15 item DAX, labelled as “Adaptive Expression”, “Verbal Expression” and “Physical and Vehicle Expression”. Physical and Vehicle expression of anger was reported more by males and by experienced drivers compared to females and novice drivers. Traffic offenders showed more inclination towards exhibiting verbal anger expression than non-traffic offenders. In terms of dispositional traits, Humility-Honesty had a negative effect on both verbal expression and physical and vehicle expression. However, private self-consciousness was related to an increase in verbal expression and physical and vehicle expression. Importantly, Humility-Honesty and private self-consciousness moderated the relationship between trait driving anger and non-adaptive anger expressions in opposite ways. The findings could provide some support for the development of strategies to mitigate driving anger in China.

## 1. Introduction

China has witnessed a boom in its economy, urbanisation, and motorisation, accompanied by an increase in traffic injuries and fatalities. The [National Bureau of Statistics \(2019\)](#) reported there were 159,335 vehicles involved in crashes, which respectively led to 157,157 injuries and 43,413 fatalities. Risky and aggressive driving behaviours contribute to approximately 24% of these automobile crashes in China ([The Traffic Management Bureau of the Ministry of Public Security of China, 2020](#)). Driving anger has been considered as one of the predictors of aggressive and risky driving behaviours ([Bogdan et al., 2016](#); [Akbari et al., 2019](#)). Anger is an emotion that occurs frequently on Chinese roads ([Fei et al., 2019](#)). For instance, in a survey with 2023 drivers, approximately 80% admitted to experiencing anger while driving ([Chinese Medical Doctor Association, 2011](#)).

### 1.1. Driving anger, personality, and self-consciousness

Driving anger has two modalities: trait driving anger and state

driving anger ([Deffenbacher et al., 1996](#)). The former refers to an individual's proneness to become angry behind the steering wheel, impatient with the traffic, and intentionally commit traffic violations ([Spielberger, 1999](#)). In contrast, the latter is a transitory emotional construct, suggesting the surroundings induce negative feelings and lead to rage ([Spielberger et al., 1995](#)). To assess trait driving anger, [Deffenbacher et al. \(1994\)](#) developed the Driving Anger Scale (DAS), asking drivers to rate anger intensity when facing a range of anger-provoking situations. Studies have found that drivers with higher levels of trait driving anger were more likely to perform risky and aggressive driving behaviours such as speeding, running red traffic lights, tailgating, etc ([Dahlen et al., 2012](#); [Li et al., 2014](#); [Love et al., 2022](#)), driving violations and errors ([Zhang et al., 2015](#)), non-adaptive anger expressions, (i.e., verbal, vehicle and physical expression [Brandenburg et al. \(2019\)](#)), and be involved in traffic collisions ([Zhang et al., 2019](#)). Individual differences also influence trait driving anger; for instance, young drivers tend to become more angry than elder drivers ([Przepiorka et al., 2014](#); [Bogdan-Ganea and Herrero-Fernández, 2018](#)). In addition, some studies have found that trait driving anger reduces as total mileage increases

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(Ge et al., 2017). The effect of gender on trait driving anger is less clear, with some studies reporting no differences between male and female propensities (Stephens and Sullman, 2015; Zhang et al., 2018).

To understand the influence of personality on driving anger, many studies have used the Big Five personality structure (John and Srivastava, 1999). The five dimensions included in the structure are, Extraversion, Agreeableness, Neuroticism, Conscientiousness and Openness. For example, Dahlen and White (2006) found that Neuroticism was negatively related to aggressive driving behaviour and driver's trait anger. Whereas, Jovanović et al. (2011) found that trait driving anger mediated the relationship between Neuroticism and aggressive driving, and Agreeableness and Conscientiousness significantly predicted driving anger. However, the Big Five personality structure has been criticised for not revealing important variation in personalities (Pauonen and Jackson, 2000), which might hamper the investigation of cross cultural personality. Ashton et al. (2004) re-examined the personality factor structure across seven languages and reported six factors rather than five. The HEXACO personality model was developed on the basis of Ashton et al. (2004)'s work and it is regarded as an adapted model of the Big Five framework (Ashton and Lee, 2007). For example, three dimensions of HEXACO **eXtraversion (X)**, **Conscientiousness (C)** and **Openness to experience (O)** are very close to the Big Five counterparts. In addition, two HEXACO factors **Emotionality (E)** and **Agreeableness versus Anger (A)** align to Neuroticism and Agreeableness in the Big Five model. Importantly, the HEXACO model includes an additional personality dimension, termed **Honesty-Humility (H)** conceptualised by honesty, sincerity, modesty, fairness and lack of greed, and this factor has been considered as a main distinguishing feature from the Big Five framework (Lee and Ashton, 2004). As asserted by Ashton and Lee (2007), an important advantage of HEXACO was derived from the cross cultural findings, which provided cultural context and explained more of the variation in the data. In the traffic safety area, Burtäverde et al. (2017) compared the predictive power of HEXACO and the Big Five model for risky driving. The former showed higher predictive power than the latter, probably due to the H dimension. However, very few studies consider HEXACO when investigating driving anger – one exception is Abele et al. (2020), finding that both Emotionality and Honesty-Humility have a significant relationship with state driving anger.

In essence, Chinese people have been profoundly influenced by the Confucianism perspective (Lin et al., 2020), which emphasises that people should be humble, honest and modest (Stipek, 1998). Actually, people in China are taught to preserve interpersonal harmony (Pong, 1993), and several studies have demonstrated the role of Honesty-Humility traits in Chinese people prosocial behaviours (Fang et al., 2019). However, as stated earlier, driving aggression occurs frequently on Chinese roads, and it is unclear whether the Honesty-Humility personality trait could exert a reducing effect on Chinese driver's anger and its subsequent expression in the driving context. Hence, we hypothesised that: **H1: Humility-Honesty has a significant and negative effect on non-adaptive driving anger expression.**

A further dispositional trait which may be relevant to the study of trait driving anger is that of self-consciousness (Duval and Wicklund, 1972), a form of self-awareness consisting of Private self-consciousness (Prsc) and Public self-consciousness (Pusc). Prsc represents the tendency to focus attention on inner feelings, thoughts and physical sensations (Fenigstein et al., 1975). For instance, people with higher Prsc are introspective and concerned about their intentions and motivation (Echebarria and Valencia, 1994), are less likely to be susceptible to pressure or conform in groups, and show more independence in a social context (Fenigstein, 1987). In contrast, Pusc reflects the propensity to focus on the self as a social object. In other words, individuals high in Pusc are motivated to maintain a positive public image, such as by using make-up or clothing (Miller and Cox, 1982; Oshimi, 2002), and adhere to societal norms (Ybarra and Trafimow, 1998). Fenigstein et al. (1975) developed a Self-Consciousness Scale (SCS), which contains 17 item

relating to Prsc and Pusc, with robust internal consistency ( $\alpha$  range from 0.78 to 0.84).

In driving anger-related research, only one study has considered self-consciousness, reporting that drivers with higher levels of Pusc show lower trait driving anger (Millar, 2007). However, this study was not without limitations. For example, this study only recruited university student sample. Additionally, the author merely focused on Pusc, and Prsc was not measured. Indeed, Prsc might provide more insight into driver's anger, since Fenigstein et al. (1975) indicated that Prsc is more responsive to the emotion and its transient state, so it could be assumed that drivers with higher a level of Prsc may be more sensitive to their emotion or status and respond to their feelings. In result, they might have a high trait driving anger leading to the expression of driving anger. Thus, we hypothesised that: **H2: Private self-consciousness has a significant and positive effect on non-adaptive driving anger expression.**

## 1.2. Measuring driver anger

Compared to the research focusing on driver's trait driving anger, fewer studies have focused on the behavioural expression of anger, which is potentially more dangerous than simply feeling angry while driving (Qu et al., 2016). Drivers might express anger differently, even if they have the same level of trait driving anger. For example, one angry driver might yell and honk at the trigger driver if he/she perceives hostility, whereas another angry driver might tell themselves: "Keep calm, it is not worth taking revenge, he is not doing it intentionally."

Deffenbacher et al. (2002) developed a self-reported scale called Driving Anger Expression Inventory (DAX), originally consisting of 53 item with five factors. However, the most commonly used version of DAX has 49 item with four factors, because of the low reliability of the fifth factor Displaced Aggression (Deffenbacher et al., 2002). The four remaining factors are: Verbal Aggressive Expression (e.g., "Yell at the other driver"), Personal Physical Anger Expression (e.g., "Shake my fist"), Use of the Vehicle to Express Anger (e.g., "Flash my lights at the driver"), and Adaptive/Constructive Expression (e.g., "Take deep breaths to calm down").

The 49 item version of DAX has been used in diverse driver samples in the last two decades with males showing significantly higher scores in the use of a vehicle to express anger than females, and female drivers tending to deal with anger in a more constructive way than males (Gras et al., 2016; Olandoski et al., 2019). However, Alcázar-Olán et al. (2018) found that female drivers exhibited more aggressive expression than males. In contrast, no gender differences in total aggressive anger expression were found in some studies (Stephens and Sullman, 2014; Krahé, 2018). Compared to older drivers, young drivers scored higher on total aggressive anger expression formats (Sullman et al., 2015; Mohammadpour et al., 2022). Similarly, driving experience was negatively correlated with use of the vehicle to express anger and positively linked with adaptive anger expression (Sullman et al., 2015; Mohammadpour et al., 2022).

However, the structure of the 49 item DAX is inconsistent when used in different countries or regions. For example, 30 item with three factors was found in Romania (Sărbescu, 2012), 11 item with three factors in France (Villieux and Delhomme, 2010), 47 item with four factors in Turkey (Sullman et al., 2013), 20 item with four factors in China (Ge et al., 2015), and 33 item with six factors in Mexico (Alcázar-Olán et al., 2018). This means that redundancy might exist in the 49 item DAX, and a shorter version could be developed. Additionally, determining the factor structure e.g., Confirmatory Factor Analysis (CFA) of DAX necessitates the recruitment of a large sample size, which reduces the practicality of the 49 item DAX as well. Therefore, to reduce the limitations of the 49 item DAX, Stephens and Sullman (2014) developed two short versions: 15 item and 25 item, both of them retaining the four factors of original 49 item DAX, and showing excellent internal consistency (i.e., 15 item version:  $\alpha = 0.75$  to 0.87, 25 item version:  $\alpha = 0.74$  to 0.88). As recommend by Stephens and Sullman (2014), the 15 item

version DAX shows a good balance between internal consistency and conciseness. However, fewer studies have used this version and nearly all of them were performed in western countries, such as in Denmark (Møller and Haustein, 2017) and Spain (Gras et al., 2016). To date, no studies examined and applied the 15 item version of DAX in China, only Ge et al. (2015) adapted the 49 item version DAX in China, but they only recruited participants in one city in China, so the sample representativeness might not be sufficient. Also, it is worth noting that a short version of DAX (15 item) is important in a practical setting where time is restricted or it is being used in conjunction with other aggressive driving measurements e.g., Dula Dangerous Driving Index (Dula and Ballard, 2003). Nonetheless, the factor structure, content reliability and validity of short version (15 item) of DAX have yet to be investigated in China. We did not propose any hypothesis relevant to the factor structure of 15 item DAX, because the ways of anger expression might be changed over time (Møller and Haustein, 2018).

### 1.3. Present study rationale and objectives

For a better understanding characteristics of Chinese drivers' anger expression, it requires a more depth investigation on driver's personality. Unfortunately, existing studies e.g., Ge et al. (2015); Qu et al. (2016); Zhou et al. (2022) provide no such knowledge about Chinese driver's dispositional trait differences and influence on anger expression while driving. As previous literature showed that Chinese people were deeply influenced by Confucian culture, it is inevitable to investigate how Humility-Honesty make difference in driving anger and anger expression while driving. Moreover, self-consciousness is an important concept, and it has been considered to have a close relationship to an individual's emotions and internal status. Thus, studying self-consciousness might provide a novel understanding about driver's anger and their non-adaptive anger expressions. In addition, to address the drawbacks of the 49 item DAX and improve practicality and relevance for future Chinese driving anger research, the 15 item DAX will be adapted to Chinese drivers. Accordingly, the main objective of our study was to investigate the relationship between personality and driving anger expression in a Chinese driving sample and we will achieve our main study aim by fulfilling three sub-objectives listed as follows:

- 1) Assessing the use of the 15 item version of DAX in a Chinese sample.
- 2) Understanding the predictive power of the HEXACO personality model on non-adaptive anger expression in a Chinese sample.
- 3) Examining how anger interacts with private self-consciousness and HEXACO personality traits in the expression of driving anger.

## 2. Materials and methods

### 2.1. Procedure

Online tools for collecting data have been shown to be an acceptable method (Zhang et al., 2019), and there is a high internet penetration (70.4%) in China (China Internet Network Information Center, 2021). We conducted our data collection via an online survey (<https://www.wjx.cn>) using a survey company (Wen Juan Xing). Besides, we asked them did not recruiting so many university students, because they might not drive frequently. The research aims, anonymity and confidentiality were assured to all participants in that their data was only going to be used for scientific research and will not be shared with any third parties. The participants needed to agree with the consent form before turning to the survey, and they were all required to hold a valid Chinese driving license. The study ethics were approved by the Faculty Ethics Committee.

### 2.2. Participants

601 participants were recruited, and 559 valid samples emerged

after data cleaning (e.g., the responses were contradictory, the same scores were selected for one or more scales, extreme completion time). Age ranged from 20 to 58 years old ( $M = 32.11 \pm 5.48$ ), and the remaining demographic information is shown in Table 1.

### 2.3. Survey items

The survey first asked participants to report their social-demographic information (age, gender, year their driving license was acquired, and the traffic penalty points they received in the last year). They were then presented with the Chinese version of the Brief HEXACO Inventory (Wu et al., 2020), responding to 24 item with six dimensions (H, E, X, A, C and O) on a 5-point scale (from 1= "strongly disagree" to 5= "strongly agree"). This inventory is easy to understand and requires a short time to respond, showing high convergent validity (de Vries, 2013). The Chinese version of the Self-Consciousness Scale was then presented (SCS; Fan and He, 2013), on a 5-point scale (from 1= "extremely uncharacteristic" to 5= "extremely characteristic"). This scale usually includes three dimensions, Private self-consciousness (Prsc, e.g., "I'm alert to changes in my mood"), Public self-consciousness (Pusc, e.g., "I usually worry about making a good impression"), and Social Anxiety (SA, e.g., "Nervous in large groups"). However, only the items relevant to Prsc and Pusc were included in the questionnaire (17 item), aligning to the research questions.

The propensity to experience driving anger was measured by the short version (14 item) of the Driving Anger Scale (DAS; Deffenbacher et al., 1994). This required respondents to rate the amount of anger they feel when encountering 14 anger provoking situations on a 5-point scale (from 1= "not at all" to 5= "very much"). The Chinese version of the 14 item DAS (Zhang et al., 2015) was used in the present study, which shows good internal reliability and convergent validity (Zhang et al., 2018).

Finally, the 15 item DAX (Stephens and Sullman, 2014) was included in the survey to explore the frequency with which drivers express their anger while driving on a 4-point scale (from 1= "almost never" to 4= "almost always"). As there existed no short Chinese version of the DAX, a back translation method was used to create one. Initially, two English translators independently and concurrently translated the English version of the 15 item DAX to Chinese, then they discussed and compared their own translation results. This discussion was undertaken to ensure the accuracy, fluency, and appropriateness in the context of Chinese culture. After this step, the translators delivered a joint Chinese version of the DAX with which they were both satisfied. Next, an advanced translator who was proficient both in English and Chinese revised and back translated the joint Chinese version to English to

**Table 1**  
Participant background information.

	N	Proportion
<b>Gender</b>		
Males	272	48.7%
Females	287	51.3%
<b>Age groups</b>		
18–25 years old	23	4.1%
26–36 years old	456	81.6%
37–44 years old	57	10.2%
Over 44 years old	23	3.2%
<b>Tenure of the driving license</b>		
≤1 year	11	2.0%
2–3 years	125	22.4%
4–5 years	181	32.4%
6–10 years	171	30.6%
> 10 years	71	12.7%
<b>Traffic penalty points received in the last year</b>		
0–1	287	51.3%
2–4	165	29.5%
5–8	95	17.0%
9–12	12	2.1%

evaluate if there were any errors. Finally, this revised version was shared with nine volunteer drivers to indicate whether there were any confusing words and sentences through an online We-chat meeting. The modification (e.g., Changing the word description “Physical fight” to “Physical conflicts”, etc.) of the scale was based on the feedback from the nine drivers.

2.4. Data analysis

The variables were checked for normality such that absolute values of skewness and kurtosis within 3 and 7 respectively can be considered normally distributed (Byrne, 2010). As recommended by Brown (2015), the robust Maximum Likelihood (ML) approach Mean-Adjusted Maximum Likelihood (MLM) can be used when applying Confirmatory Factor Analysis (CFA), using the Mplus software estimator package. Meanwhile, several indicators including  $S-B\chi^2/df$ , Comparative Fit Index (CFI), Tucker-Lewis Index (TLI) and Root Mean Square Error of Approximation (RMSEA) were used to reflect the goodness of fitness of the model. The threshold of adequacy model fit of these indices were  $<5S-B\chi^2/df$ , CFI and TLI over than 0.90, and  $RMSEA < 0.06$  (Hu and Bentler, 1999).

The intercorrelation between socio-demographic characteristics, trait driving anger, HEXACO personality, self-consciousness and aggressive expressions of driving anger were reported after confirming the structure of the 15 item DAX. A MANCOVA was used to explore whether there were significant differences in driving anger expressions among gender, driving experience and traffic penalty points whilst controlling for age. Furthermore, to investigate how personality traits and self-consciousness predicted the aggressive expression of driving anger, a Hierarchical Multiple Regression (HMR) was carried out.

3. Results

3.1. The factor structure of the 15 item DAX

First, the DAX data were analysed by Principal Components Analysis (PCA), with the varimax rotation approach. The value of Kaiser-Meyer-Olkin (KMO) was 0.85, and Bartlett test of sphericity was significant at 0.001 level, indicating that the data were appropriate for structure analysis. A three-factor structure emerged after this procedure and all the eigenvalues of these factors exceeded 1, explaining 51.87% of the total variance. Items loading  $< 0.40$  and showing cross loading issues were removed, such as, item 3 “Try to get out of the car and tell the other driver off” and item 6 “Do to drivers what they did to me”.

The following factor structure confirmation work was determined by CFA in Mplus 6.0. The model initially showed a poor fit to the data ( $S-B\chi^2/df = 3.906$ , CFI = 0.910, TLI = 0.898 and RMSEA = 0.072). Two items (item 7 “Think of positive things to do” and item 14 “Accept there are frustrating situations”) were deleted in the subsequent analysis, because the loading value was less than 0.40. In addition, the Lagrange Multiplier Tests (LM) suggested that three error pairs (e2-e9, e2-e12, and e1-e13) should be theoretically covaried, which followed the rules of MIs equal and greater than 10.0. Finally, the last modified model goodness of fitness indices reached an excellent level (i.e.,  $S-B\chi^2/df = 2.483$ , CFI = 0.970, TLI = 0.957 and RMSEA = 0.048). Table 2 shows the structure of the 11 item DAX. All item loadings were greater than 0.50, the Composite Reliability (CR) of each factor was more than 0.70, indicating adequate convergent validity (Fornell and Larcker, 1981).

These three factors were separately labelled as “Adaptive Expression” (AE), “Verbal Expression” (VE), and “Physical and Vehicle Expression” (PVE). In Table 2, item 4 “Roll down the window to communicate my anger” was allocated to “Personal Physical Aggressive

Table 2  
The factor structure of the 11 item DAX.

Factor	Items	Mean (SD)	Factor loading	Skewness	Kurtosis
<b>Adaptive Expression (AE)</b> [CR = 0.807]		<b>3.08 (0.676)</b>		-0.47	-0.41
DAX10	Tell myself it's not worth getting mad at	3.06 (0.817)	0.84	-0.35	-0.83
DAX11	Tell myself it's not worth getting involved	3.07 (0.812)	0.81	-0.43	-0.62
DAX15	Tell myself to ignore it	3.11 (0.774)	0.63	-0.46	-0.46
<b>Verbal Expression (VE)</b> [CR = 0.788]		<b>2.27 (0.701)</b>		0.19	-0.59
DAX2	Make negative comments about the other driver aloud	2.57 (0.874)	0.61	0.43	-0.69
DAX4	Roll down the window to communicate my anger	2.36 (0.872)	0.66	0.10	-0.62
DAX9	Swear at the other driver aloud	2.33 (0.947)	0.68	0.21	-0.86
DAX12	Yell at the other driver	1.82 (0.839)	0.82	0.77	0.24
<b>Physical and Vehicle Expression (PVE)</b> [CR = 0.759]		<b>1.32(0.435)</b>		1.64	2.35
DAX1	Drive right up on the other driver's bumper	1.18 (0.408)	0.63	2.17	3.71
DAX5	Try to scare the driver	1.49 (0.687)	0.71	1.18	0.63
DAX8	Drive a lot faster	1.41 (0.685)	0.67	1.83	3.03
DAX13	Try to get out and have a physical conflicts	1.25 (0.511)	0.65	1.98	3.09



Expression” in Stephens and Sullman (2014) study, but it appeared in the “Verbal Expression” in this Chinese sample, which might be due to participants making verbal aggressions to other drivers (e.g., “Reviling that driver”) even after rolling down the vehicle window. Meanwhile, item 13, “Try to get out and have a physical fight” and item 1, “Drive right up on the other driver’s bumper” were originally labelled as “Personal Physical Aggressive Expression” and “Use of Vehicle to express Anger”, but they were jointly named Physical and Vehicle Expression (PVE) in the present study.

3.2. Relationships among demographic variables, trait driving anger and driving anger expression

The intercorrelation results are shown in the Table 3. Age and tenure of driving license were weakly and positively correlated with PVE, whilst gender positively correlated with AE ( $r = 0.192, p < 0.01$ ). Additionally, driver’s traffic penalty points in the last year were positively correlated to non-adaptive expressions of driving anger (VE and PVE), although it is difficult to determine causality. Meanwhile, trait driving anger was moderately related to VE and PVE ( $r = 0.322$  and  $0.257, p < 0.01$ ).

To probe whether there were driving anger expression differences among demographic variables, a MANCOVA approach with age as a covariate was conducted. Cohen’s  $f$  (Cohen, 1988) was adopted as a measure to evaluate the effect size, with  $0.10 < f < 0.25$  being a small effect,  $0.25 < f < 0.40$  being a medium effect, and  $f \geq 0.40$  being a large effect. Results can be found in the Table 4.

With regards those participants who had received penalty points in the previous year and those who had not, there were no differences in reported AE ( $F = 2.236, p = 0.135$ ). However, they demonstrated a significant difference in PVE ( $F = 17.388, p < 0.001$ ), such that those who had received traffic penalty points exhibited higher PVE scores. In addition, female drivers were more prone to choose a constructive manner (AE) to express their anger compared to male drivers ( $F = 22.093, p < 0.001$ ).

Driver licencing tenure was divided into three groups: 1–3 years, 4–9 years, and over 10 years. The significant differences between three groups were revealed for AE factor. Further, *posthoc* tests identified a significant difference in engaging PVE between novice and experienced drivers (over 10 years of experience), indicating that novice drivers show less inclination to express anger verbally and physically than those who had over 10 years of experience.

3.3. Predicting the non-adaptive expression of driving anger using dispositional traits

Hierarchical Multiple Regression (HMR) was used to examine the role of socio-demographic variables and dispositional traits in predicting driver’s non-adaptive anger expression (VE and PVE). It should be noted that only the demographics and dispositional traits that had a significant correlation with VE and PVE were considered in each predicting model. Gender, driving experience and traffic penalty points were entered to control for their effect in the first step. Dispositional traits (HEXACO personality and self-consciousness) were then added into the second step. Trait driving anger was entered last in the regression model. It should be noted that all the assumptions of HMR were tested and found to be satisfied (Osborne and Waters, 2002). Regarding the VE & PVE prediction model, all the predictors tolerance exceeded 0.20 with  $VIF < 3$ , suggesting that the predictors were free from significant overlaps (Bowerman and O’Connell, 1990).

With regards VE (Table 5), in Step 1 traffic penalty points received in the last year explained 9% of the variance, but it was insignificant after entering the HEXACO personality traits (H, E, X, C, and O) and self-consciousness in Step 2. It can be seen that Humility-Honesty and Openness to experience exerted significant reducing effects on VE. In contrast, Prsc moderately increased verbal anger aggression ( $\beta = 0.281,$

Table 3  
Intercorrelations among variables.

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 Gender	1															
2 Age	-0.085*	1														
3 Years licensed	-0.244**	0.509**	1													
4 Traffic penalty points	-0.001	0.002	-0.027	1												
5 VE	-0.054	-0.045	-0.018	0.096*	1											
6 PVE	-0.116**	0.087*	0.113**	0.157**	0.388**	1										
7 AE	0.192**	-0.090*	-0.058	-0.394**	-0.371**	-0.394**	1									
8 DAS	0.034	0.032	-0.009	0.149**	0.322**	0.257**	0.204**	1								
9 H	0.177**	0.073	0.026	-0.111**	-0.200**	-0.271**	-0.007	-0.150**	1							
10 E	0.249**	-0.112**	-0.213**	-0.003	0.084**	-0.097*	0.146**	0.090*	0.090*	1						
11 X	0.011	0.034	0.172	0.025	-0.125**	-0.185**	0.168**	0.174**	-0.203**	-0.230**	1					
12 A	-0.024	0.006	0.080	-0.050	-0.078	0.059	0.106*	-0.047	-0.047	-0.103*	0.086*	1				
13 C	-0.030	0.137**	0.179**	-0.004	-0.161**	-0.211**	0.193**	0.246**	-0.262**	0.429**	0.429**	0.014	1			
14 O	0.000	-0.061	0.060	-0.046	-0.152**	-0.060	0.121**	-0.045	-0.125**	0.245**	0.245**	0.095*	0.241**	1		
15 Prsc	0.002	-0.023	0.003	0.022	0.245**	0.149**	-0.002	0.239**	-0.066	0.005	0.133**	-0.038	0.198**	0.126**	1	
16 Pusc	0.021	0.023	0.047	-0.026	-0.099*	-0.083	0.098*	-0.193**	0.000	0.027	0.233**	0.038	0.149**	0.157**	-0.001	1

Note: 1 = Male, VE = Verbal Expression, PVE = Physical and Vehicle Expression, AE = Adaptive Expression, DAS = Total DAS score, H = Humility-Honesty, E = Emotionality, X = eXtraversion, A = Agreeableness vs. anger, C = Conscientiousness, O = Openness to experience, Prsc = Private self-consciousness, Pusc = Public self-consciousness. \* $p < 0.05$ , \*\* $p < 0.01$ .

**Table 4**  
Summary of MANCOVA results for traffic penalty points, gender and licence tenure.

Driving anger expression	Traffic penalty points					
	Traffic points in the last year Mean (SD)	No traffic points in the last year Mean (SD)	F	p	Cohen's f	
Adaptive Expression (AE)	3.04 (0.696)	3.12 (0.653)	2.236	0.135	0.06	
Verbal Expression (VE)	2.33 (0.689)	2.20 (0.710)	<b>4.883</b>	<b>0.028*</b>	<b>0.11</b>	
Physical & Vehicle Expression (PVE)	1.40 (0.471)	1.25 (0.381)	<b>17.388</b>	<b>0.000***</b>	<b>0.18</b>	
	Gender		F	p	Cohen's f	
	Males Mean (SD)	Females Mean (SD)				
Adaptive Expression (AE)	2.95 (0.703)	3.21 (0.625)	<b>22.093</b>	<b>0.000*</b>	<b>0.20</b>	
Verbal Expression (VE)	2.31 (0.709)	2.23 (0.693)	1.867	0.172	0.06	
Physical & Vehicle Expression (PVE)	1.38 (0.463)	1.27 (0.401)	<b>6.734</b>	<b>0.010**</b>	<b>0.11</b>	
	Licence tenure			F	p	Cohen's f
	1–3 years Mean (SD)	4–9 years Mean (SD)	More than 10 years Mean (SD)			
Adaptive Expression (AE)	3.21 (0.639)	3.06 (0.663)	2.94 (0.777)	<b>6.840</b>	<b>0.001***</b>	<b>0.16</b>
Verbal Expression (VE)	2.31 (0.700)	2.26 (0.693)	2.25 (0.752)	0.122	0.885	0.00
Physical & Vehicle Expression (PVE)	1.25 (0.397)	1.33 (0.423)	1.44 (0.531)	2.278	0.103	0.09

Note: \*p < 0.05, \*\*p < 0.01, \*\*\*p < 0.001.

**Table 5**  
Summary of HRM results for Verbal Expression (VE).

	HMR model for Verbal Expression (VE)	Standardized $\beta$	t	R <sup>2</sup>	$\Delta R^2$	F
Step 1	Traffic penalty points	<b>0.096</b>	<b>2.265*</b>	0.09	0.09	<b>5.225*</b>
Step 2	Traffic penalty points	0.065	1.655	0.160	0.151	<b>13.048***</b>
	Humility-Honesty	<b>-0.161</b>	<b>-3.811***</b>			
	Emotionality	0.049	1.164			
	eXtraversion	-0.039	-0.858			
	Conscientiousness	-0.080	-1.721			
	Openness to experience	<b>-0.169</b>	<b>-4.025***</b>			
	Prsc	<b>0.281</b>	<b>6.950***</b>			
	Pusc	-0.051	-1.242			
Step 3	Traffic penalty points	0.039	0.937	0.198	0.038	<b>15.083***</b>
	Humility-Honesty	<b>-0.137</b>	<b>-3.305***</b>			
	Emotionality	0.021	0.499			
	eXtraversion	-0.022	-0.497			
	Conscientiousness	-0.072	-1.583			
	Openness to experience	<b>-0.164</b>	<b>-3.995***</b>			
	Prsc	<b>0.228</b>	<b>5.575***</b>			
	Pusc	-0.015	-0.373			
	Trait driving anger	<b>0.239</b>	<b>5.693***</b>			

Note: \*p < 0.05, \*\*p < 0.01, \*\*\*p < 0.001.

p < 0.001), and all the dispositional traits explained 15.1% of the variance in VE. Trait driving anger additionally accounted for 3.8% prediction power in anger expression via verbal means in the final step.

For PVE prediction (Table 6), all the socio-demographic characteristics (i.e., gender, years of driving and traffic penalty points) showed significant effects in the first step, which provided 4.6% predictive power. In the second step, all the personality dimensions had a significantly negative effect on PVE, with Conscientiousness displaying the greatest weight among all HEXACO personality traits ( $\beta = -0.188$ ,  $p < 0.001$ ). However, regarding self-consciousness, merely the private aspect remained in the model, because Pusc insignificantly correlated with PVE ( $r = 0.083$ , ns), and Prsc exerted a positive effect on PVE ( $\beta = 0.180$ ,  $p < 0.001$ ). Such dispositional traits added in the second step contributed to 15.6% model prediction power. Lastly, in step 3, trait driving anger remained a significant predictor of PVE ( $\beta = 0.169$ ,  $p < 0.001$ ), which additionally contribute to 2.1% variance in explaining PVE.

### 3.4. The interaction between private self-consciousness, Humility-Honesty and trait driving anger with non-adaptive anger expression

In both the VE and PVE regression models, merely both Prsc and Humility-Honesty showed a significant influence among all dispositional traits, but their effects on non-adaptive anger expression were separately positive and negative. Following this, the moderating effect of Prsc and Humility-Honesty was respectively examined based on trait driving anger with regard to anger expression (i.e., VE & PVE). Anger expression was calculated by means of items underlying the VE and PVE factors. Trait driving anger was entered as an independent variable, non-adaptive anger expression as a dependent variable. The moderators were Prsc, and Humility-Honesty with control of other HEXACO personality traits and Pusc, all moderating analysis was conducted in PROCESS plugin of SPSS 23.0 (Hayes, 2018). The results of moderating analysis of Prsc and Humility-Honesty were respectively listed in Table 7, Fig. 1, Table 8, and Fig. 2. It should be noted that other HEXACO personality traits were also testified, but their moderating effects on non-adaptive

**Table 6**  
Summary of HMR results in Physical and Vehicle Expression (PVE).

HMR model in Physical and Vehicle Expression (PVE)		Standardized $\beta$	$t$	$R^2$	$\Delta R^2$	F
Step 1	Gender	-0.093	-2.170*	0.046	0.046	9.007***
	Years of driving	0.095	2.211*			
	Traffic penalty points	0.159	3.842***			
Step 2	Gender	-0.025	-0.605	0.192	0.156	16.308***
	Years of driving	0.148	3.626***			
	Traffic penalty points	0.142	3.674***			
	Humility-Honesty	-0.158	-3.815***			
	Emotionality	-0.126	-3.006**			
	eXtraversion	-0.155	-3.568***			
	Conscientiousness	-0.188	-4.188***			
	Prsc	0.180	4.601***			
Step 3	Gender	-0.031	-0.754	0.213	0.021	16.502***
	Years of driving	0.138	3.415***			
	Traffic penalty points	0.120	3.122**			
	Humility-Honesty	-0.142	-3.467***			
	Emotionality	-0.144	-3.457***			
	eXtraversion	-0.135	-3.118**			
	Conscientiousness	-0.178	-4.009***			
	Prsc	0.140	3.505***			
	Trait driving anger	0.169	3.993***			

Note: \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

**Table 7**  
Moderating results of Private self-consciousness (Prsc) on non-adaptive anger expression.

Variables	Standardised $\beta$	$R^2$	$t$	$p$
Trait driving anger	0.158	0.154	5.888***	0.000
Prsc	0.142		5.378***	0.000
Trait driving anger $\times$ Prsc	0.094		2.178*	0.029

Note: \* $P < 0.05$ , \*\*\* $p < 0.001$ .

anger expression while driving were all insignificant.

As expected, the interaction term (Trait driving anger  $\times$  Prsc) produced a significant increased prediction in the regression model (See Table 7). Fig. 1 visually decomposes the moderating effect of prsc on the expression of driving anger. It can be seen that the association between trait driving anger and aggressive driving anger expression was stronger when there was higher level of prsc (Low prsc gradient of slope = 0.0893,  $p < 0.001$ , High Prsc gradient of slope = 0.1704,  $p < 0.001$ ).

It can be found in Table 8, the interaction term (Trait driving anger  $\times$  Humility-Honesty) showed a significant and negative effect on non-adaptive anger expression. Fig. 2 depicts the relationship between trait driving anger and non-adaptive anger expression on two levels of Humility-Honesty. Accordingly, drivers with higher Humility-Honesty

trait displayed less anger and non-adaptive anger expression than drivers with low levels of Humility-Honesty (Low Humility-Honesty gradient of slope = 0.0637,  $p < 0.001$ , High Humility-Honesty anger gradient of slope = 0.1412,  $p < 0.001$ ).

#### 4. Discussion

##### 4.1. The psychometric adaptation of the 15 item Chinese DAX

An important objective of the present study was to determine the structure of the 15 item DAX in a sample of Chinese drivers. Our CFA results indicated that the 11 item with a three-factor solution showed

**Table 8**  
Moderating results of Humility-Honesty on non-adaptive anger expression.

Variables	Standardised $\beta$	$R^2$	$t$	$p$
Trait driving anger	0.158	0.147	7.671***	0.000
Humility	-0.057		-3.975***	0.000
Trait driving anger $\times$ Humility-Honesty	-0.085		-2.72**	0.006

Note: \* $p < 0.05$ , \*\* $p < 0.01$ .

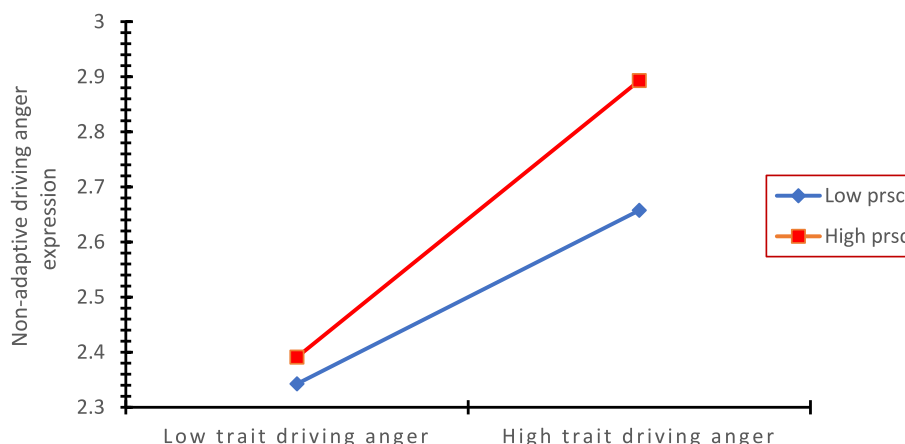


Fig. 1.

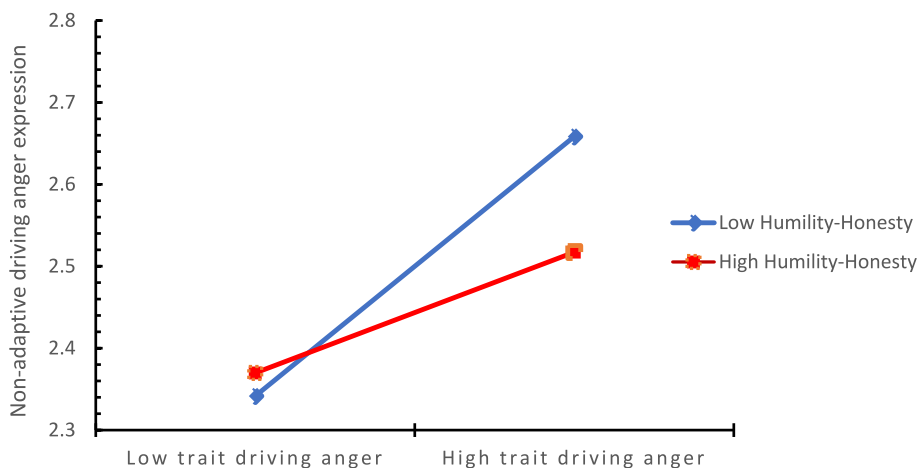


Fig. 2. Moderating effect between trait driving anger and Humility-Honesty predicting the expression of driving anger.

adequate reliability and validity. Herein, the factors were respectively named “Adaptive Expression” (AE), “Verbal Expression” (VE) and “Physical and Vehicle Expression” (PVE). This three-factor structure was similar to the previous research (Villieux and Delhomme, 2010; Sullman, 2015). As suggested by Villieux and Delhomme (2010) driving anger expression should be differentiated between verbal and non-verbal expression, and all the items underlying “Personal Physical Aggressive Expression” were removed in their studies (Villieux and Delhomme, 2010; Sullman, 2015), because of the low scores among these items (i.e., Mean = 1.15 and Mean = 1.09). However, such items relevant to a physical way of anger expression were retained in the present study in a joint factor named PVE, presumably because of the higher rating score among these items (Mean = 1.37), compared to the abovementioned two studies. Besides, it appears that the four-factor solution of the 15 item DAX may not be appropriate for the eastern driving world, because a recent study conducted in Vietnam by Trung Bui et al. (2022), reported a two-factor structure of the 15 item DAX. They integrated all the non-adaptive anger expression forms into one factor called “Aggressive Expression”, whereas the four factors solution of the 15 item DAX was confirmed in Spain (Gras et al., 2016) and Denmark (Møller and Haustein, 2017). Actually, the factor “Personal Physical Aggressive Expression” has been considered unreliable when confirming the DAX structure by several researchers (Sullman et al., 2017), because participants might not be willing to answer the items related to this factor, thus not providing enough variance to retain this factor (Sărbescu, 2012; Brandenburg et al., 2019). Therefore, similar aggressive anger expression forms are integrated into one unitary factor resulting in a three-factor structure (Sărbescu, 2012; Sullman et al., 2017). Herein, items in the PVE factor could be considered as more severe than verbally expressed anger while driving (e.g., “Drive right up on the other driver’s bumper”).

The score on verbal anger expression (VE) in the present study was higher than in the 20 item version DAX (i.e., Original 49 item) adapted by Ge et al. (2015) in China (Mean = 2.27 versus Mean = 1.86). One of the reasons of high scores in VE could be linked with the COVID-19 pandemic (e.g., lockdown restriction), because the results of Stephens et al. (2022)’s work showed that the COVID-19 pandemic could make drivers frustrated and stressed, and it has been recognised as a trigger of driver’s aggression. Overall, drivers scored highest on AE scale compared to VE and PVE, which is in line with prior studies (Brandenburg et al., 2019; Mohammadpour et al., 2022). On the one hand, drivers are more likely to be a safe and good-mannered driver while they drive, and they might attempt to control their anger even if they encounter anger-provoking events. On the other hand, social desirability could influence their response, and they tend to build a positive image when facing the social context.

The validity of the Chinese 15 item DAX was also demonstrated in this study, via the significantly positive association among VE, PVE, trait driving anger and self-reported traffic penalty points received in the last year. A positive correlation between traffic penalty points, VE and PVE was found, with a stronger association with PVE than VE, which might indicate that the 15 item Chinese version of DAX could be regarded as a potential tool to identify violators of traffic rules. The analysis supports this point in that the traffic offenders report more verbal and physical and vehicle anger expression while driving than non-traffic offenders. The gender differences in driving anger reported in this study indicated that female drivers were more prone to deal with anger in an adaptive/constructive way compared to males which is in agreement with previous studies (Gras et al., 2016; Olandoski et al., 2019). In terms of driving experience, drivers with over 10 years of experience had a higher tendency to express their anger in a physical and vehicle way compared to novice drivers (driving 1–3 years). This result is in line with Møller and Haustein (2018)’s study but conflicts with others (Bogdan-Ganea and Herrero-Fernández, 2018). A previous study claimed that a driver’s risk perception could significantly affect their behaviour (Machado-León et al., 2016). Thus, experienced drivers might be confident about their driving skill, and perhaps engage in dangerous behaviours such as driving faster using the vehicle to express anger, which might in turn increase the probability of performing angry behaviours. However, it is not enough to conclude a specific and strong statement related to driving experience and anger expression in the present study, because of the bias of years of driving variable.

A significant but weak and positive correlation was observed between traffic penalty points and non-adaptive anger expression ( $r_{VE} = 0.096, p < 0.05, r_{PVE} = 0.157, p < 0.01$ ), with penalty points predicting both types of anger forms. These findings support the results of a recent study where Chinese driver’s penalty points positively correlated with their risky driving behaviours (Dong et al., 2019). This might imply that use of a traffic points system may encourage risky driving behaviours, and its effectiveness in reducing crashes will gradually diminish over time (Mehmood, 2010).

#### 4.2. The relationship between personality and the expression of driving anger

Within the HEXACO model, Emotionality did not predict the likelihood of expressing anger in the form of Verbal Expression (VE). Perhaps, the weak positive but significant correlation ( $r = 0.084, p < 0.05$ ) between Emotionality and the VE in the present study was not powerful enough. As Burtäverde et al. (2017) asserted, individual differences in Sentimentality and Fearful aspects could vary widely, so the association between them might not be always strong. Another reason might be due



to the irritability content excluded in Emotionality of the HEXACO (Ashton and Lee, 2009) and such facets covered in Emotionality of the HEXACO might not be important in explaining VE.

More importantly, Humility-Honesty and Openness to experience showed a significant and negative relationship with VE in the present study, supporting our hypothesis *H1*. This result was contrasted to another study e.g., (Abele et al., 2020). This might be due to cultural differences, because Chinese drivers showed a high degree of Humility-Honesty (Mean = 3.69, SD = 0.701, Means not reported in Abele et al. (2020)'s study), suggesting drivers in China have a high level of fairness, modesty and sincerity, as advocated in the Confucianism culture (Stipek, 1998). Thus, those with a higher level of Humility-Honesty showed less greed and desire to take risk, which could reduce VE while driving. In terms of Openness to experience, a significant and negative effect on VE was found in the present study. Several studies indicated that a driver's risk perception and careful driving increased as Openness to experience increased (Taubman - Ben-Ari and Yehiel, 2012; Sween et al., 2017). This might imply that drivers with a high level of Openness to experience showed more risk perception, controlling the expression of verbal anger. However, previous work by Abele et al. (2020) has not found a significant association between Openness to Experience when predicting non-adaptive anger expressions. This finding should be seen with more caution when applying in future studies and other driving populations.

With regard to the prediction of Physical and Vehicle Expression (PVE), Emotionality, eXtraversion, Humility-Honesty and Conscientiousness personality traits exerted a negative effect on PVE. In terms of Emotionality, as de Vries (2013) claimed that Anxiety (e.g., Worrying about the unsecured future), Fear (e.g., Fear of the physical injury/hurt) and Dependence (e.g., Need the emotional support from others) contents were present in the Emotionality factor of HEXACO, and these facets might lead to risk avoidance actions (Peters and Slovic, 1996). In this sense, drivers attached more importance to such aspects of Emotionality as they might be motivated to protect themselves and not become involved in troublesome situations, especially with regards potential outcomes such as being involved in a collision and/or potentially being arrested for physical violence. As expected, the negative effect of Conscientiousness on anger aggression was consistent with previous studies (Ehsani et al., 2015; Aghabayk et al., 2022). Finally, the results of eXtraversion partially supported the findings of Abele et al. (2020), but eXtraversion here showed negative effect on PVE instead of VE. A possible reason might be because high eXtraversion has a positive and strong association with individual happiness level and life satisfaction (Aghababaei and Arji, 2014), and the latter further significantly predicted safe driving performance (Isler and Newland, 2017). In other words, drivers may not be willing to get involved in physical conflict with others, it might bring negative impact to their life. The quite low frequency of performing such behaviours (Mean = 1.32) could support this point to some extent.

#### 4.3. The moderating effect of private self-consciousness, Humility-Honesty trait driving anger and the expression of anger

Trait driving anger was a significant and positive predictor of the aggressive expressions of driving anger, which is consistent with previous studies (Trung Bui et al., 2022). Additionally, an important finding in this study was that Private self-consciousness (Prsc) showed a positive relationship with both aggressive forms of driving anger expression, in addition to trait driving anger. The results showed that drivers displaying a high degree of Prsc reported more verbal, physical and vehicle anger expression, supporting hypothesis *H2*. More importantly, Prsc moderated the relationship between trait driving anger and non-adaptive driving anger expressions. The present study found that drivers with higher levels of Prsc, irrespective of having high or low trait driving anger, were more likely to engage in aggressive driving anger. In this aspect, our results supported the assertion by Fenigstein et al. (1975) and Ohira (1989) that people with a high level of Prsc were

concerned with attuning their desires, showed more aggression and lower tendency to suppress anger than those with low levels of Prsc. However, this is the first study to examine the relationship between Prsc and driving anger to the best of our knowledge, and this should be further explored in other countries and regions.

In another moderating analysis, Humility-Honesty inversely interacted with trait driving anger to influence driving anger expression. When drivers were angry, high Humility-Honesty was related to less non-adaptive expression of driving anger than low Humility-Honesty. This finding supports earlier work that indicated Humility reduces anger and aggression (Summerell et al., 2020). It is not surprising to get this result, because Humility-Honesty relates to the tendency to be fair humble and modest in social interaction (Thielmann and Hilbig, 2018). However, the transferability of this finding should be looked at with more caution, because Confucianism culture profoundly influenced Chinese people, which internalise and shape their personality and guide their behaviours (Fang et al., 2019).

#### Practical implications:

Based on the current findings, we suggest a number of practical applications. Firstly, the 15 item version of DAX was adapted and used in our study, and as such could be used to distinguish between offenders and non-offenders in the Chinese traffic context. The added benefit is that this version of the DAX is short and so can be combined with other scales, without making questionnaires overly long. Secondly, males and experienced drivers showed a high inclination to express anger in non-constructive ways, and so a traffic safety campaign or training (e.g., emotional regulation training, prosocial traits cultivations e.g., Humility-Honesty) could target those drivers to improve their emotional regulation ability while driving. Thirdly, the effect of private aspects of self-consciousness could be considered as a contributor to the expression of driving anger. In this sense, Prsc could be regarded as a dispositional trait for identifying unsafe drivers. A learner driver's dispositional trait could also be investigated before formal driving license acquisition, and appropriate training or intervention be given to cultivate prosocial dispositional traits (e.g., Humility-Honesty and Conscientiousness), which could reduce risk taking performance while driving.

In conclusion, the Chinese version of 15 item DAX was a reliable and valid tool for assessing how drivers handle their anger expression while driving. The CFA results yield three factors, 11 item structure of 15 item DAX (e.g., "Adaptive Expression", "Verbal Expression" and "Physical and Vehicle Expression"), which can be used for classifying traffic offenders and non-traffic offenders. Also, the understanding of personality and anger expression while driving were explored. Chinese drivers showed a high score on the Humility-Honesty factor which was negatively related to their non-adaptive anger expression (i.e., VE and PVE). More importantly, a moderating effect of private self-consciousness was found between trait driving anger and non-adaptive anger expression. This leads to more engagement in aggressive expressions of driving anger, irrespective of lower or higher trait driving anger. In contrast, Humility-Honesty negatively moderated the relationship between trait driving anger and non-adaptive expression of driving anger. These findings and evidence could provide some support for the development of strategies to mitigate driving anger in China.

#### Limitations and future work:

Similar to most other driving anger studies, all the data were collected via self-reported surveys, and even though they are considered to be a reliable tool when investigating driver's behaviours and psychological aspects (Lajunen and Summala, 2003; Arthur et al., 2005), social desirability can still be an influencing factor. Unfortunately, we did not use the social desirability scale to measure its effect in the present study, and future work could involve relevant social desirability measurements to control for these effects. Meanwhile, using a self-report

method raises the issue of discrepancy between anger expression and driving behaviours in a real setting, so future studies might be able to explore this with the help of a driving simulator or naturalistic driving investigations. We acknowledge that merely considering tenure of driving license in the present work might not totally reflect driver's driving experience, because those who hold driving license may be driving infrequently, so a measure of driving mileage should be included in future work. In addition, merely assessing driving violations through traffic penalty points in the past year might not be accurate and comprehensive, and it would be good to ask respondents to report crash involvement history and traffic fines in future studies. Furthermore, to ensure the survey was not too long, we used the brief version of the HEXACO personality scale. Perhaps the inclusion of more items could assess the individual personality dimension in a more accurate way, so future work could consider using the long version of HEXACO inventory in a Chinese sample. The magnitude of the effects of personality on driving anger and its expression might be greater and more distinguishable.

### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### Data availability

Data will be made available on request.

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