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National correlates of self-reported traffic violations across 41 countries

J.C.F. de Winter *, D. Dodou

Department of BioMechanical Engineering, Faculty of Mechanical, Maritime and Materials Engineering, Delft University of Technology, Delft, The Netherlands

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ABSTRACT

Less developed countries are overrepresented in traffic accidents, but knowledge on national differences in aberrant driving behaviours is scarce. This study investigated relationships between traffic violations measured with a 7-item Driver Behaviour Questionnaire and traffic accident involvement for an international crowdsourced sample. At the level of respondents ($N = 6006$), self-reported violations correlated moderately with self-reported accidents (Spearman $\rho = .26$). At the national level ($N = 41$), self-reported non-speeding violations (a composite consisting of three types of aggressive violations, tailgating, and using a mobile phone without a hands-free kit) correlated strongly with road traffic death rate per population ($\rho = .77$) and with developmental status ($\rho = -.79$), whereas self-reported speeding violations (a composite of speeding on a motorway and on a residential road) did not ($\rho = -.08$ and .22, respectively). Moreover, self-reported non-speeding violations correlated strongly with mean annual temperature ($\rho = .58$), while self-reported speeding violations did not ($\rho = -.16$). These cross-national correlates of traffic violations can be explained by developmental factors that lead to violation-provoking traffic situations or by the effect of temperature on aggression.

1. Introduction

According to the World Health Organization (WHO, 2015), 1.25 million road traffic fatalities occur annually worldwide. In 2013, the road traffic death rate per 100,000 population was 24.1, 18.4, and 9.2 in low-, middle-, and high-income countries, respectively (WHO, 2015). It is well established that less developed countries are overrepresented in traffic accidents (Bishai, Quresh, James, & Ghaffar, 2006), but knowledge on aberrant driving behaviours across countries is scarce.

One of the most popular tools in traffic psychology is the Driver Behaviour Questionnaire (DBQ), in which respondents indicate how often they commit particular types of aberrations in traffic (Reason, Manstead, Stradling, Baxter, & Campbell, 1990). A small number of studies have used the DBQ to investigate differences in traffic violations between countries. Özkan, Lajunen, Chliaoutakis, Parker, and Summala (2006) collected DBQ data from six countries and found that Greek drivers scored highest on aggressive violations ("Sound horn to indicate your annoyance", "Get angry, give chase", and "Aversion, indicate hostility"), followed by Iranian and Turkish drivers; drivers in Great Britain, Finland, and the Netherlands reported the lowest number of aggressive violations. Conversely, drivers in Great Britain, the Netherlands, Finland, and Iran reported more speeding violations than did Greek and Turkish drivers. Wallén Warner, Özkan, Lajunen, and Tzamalouka (2011) showed that Finnish and Swedish drivers reported fewer aggressive but more speeding violations than did Turkish and Greek drivers. Within the Arab Gulf, Bener, Özkan, and Lajunen (2008) found higher violations scores for drivers in the United Arab Emirates than drivers in Qatar and noted that the violations scores in both populations were higher than those reported for European countries in other studies.

The aforementioned cross-national DBQ studies suggest that drivers in Southern Europe report more aggressive violations but fewer speeding violations than drivers in Northern Europe. This geographic distinction coincides with cross-national differences in developmental status, which in turn are associated with the quality of road infrastructure, social norms, and traffic culture, including formal and informal rules (Özkan et al., 2006). In Southern countries, poor road infrastructure, weak law enforcement, and limited education about traffic rules may create dangerous and stressful traffic situations that trigger aggressive violations. On the other hand, due to the opportunity for speeding granted by high-quality road infrastructure, drivers in Northern countries might commit more speeding violations than drivers in Southern countries.

The North–South distinction coincides not only with developmental status but also with temperature. Research suggests that aggression increases with temperature, both across geographic regions (e.g., from North to South in the United States, see Anderson, Anderson, Dorr, DeNeve, & Flanagan, 2000) and across time (e.g., seasonal winter/summer effects, as reviewed by Anderson, 2001). By analysing 60 studies and 45 datasets spanning from 10,000 BC to today and by investigating the association between temperature/weather and various types of violence (violent crimes, domestic violence, murders, political instability, civil conflicts, etc.), Hsiang, Burke, and Miguel (2013) concluded that human conflict increases with temperature. At the level of the individual driver, Kenrick and MacFarlane (1986) studied horn honking as a

* Corresponding author at: Faculty of Mechanical, Maritime and Materials Engineering, Delft University of Technology, Mekelweg 2, 2628 CD Delft, The Netherlands.
E-mail address: j.c.f.dewinter@tudelft.nl (J.C.F. de Winter).

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result of a 12-s stall of a car in front of a green light over a four-month spring/summer period in Arizona, and found a significant correlation of .34 between ambient temperature and a composite variable of the number of honks and the latency to honking. Temperature also seems to be associated with economic productivity, although it is uncertain whether the association is linear (Horowitz, 2009) or non-linear (see Burke, Hsiang, & Miguel, 2015, suggesting that economic production peaks at 13 °C). It remains to be investigated to what extent a country's climate is associated with traffic violations.

In addition to developmental status and temperature, several studies have found small differences in personality (e.g., extraversion) across Northern-Southern and Western-Eastern axes (e.g., Eysenck & Chan, 1982; Furnham & Cheng, 1999; Lynn & Hampson, 1975; Schmitt, Allik, McCrae, & Benet-Martínez, 2007). However, researchers have questioned the validity of cross-national self-reported personality scores, for the reason that respondents tend to compare themselves with implicit standards from their culture (e.g., Heine, Buchtel, & Norenzayan, 2008). One possible way to circumvent this methodological issue may be to ask respondents about their behaviours instead of their personal characteristics. For example, as part of the International Test of Risk Attitudes (INTRA), Wang, Rieger, and Hens (2009, 2016) asked respondents from 52 countries what they would prefer: "A payment of $3400 this month" or "A payment of $3800 next month". Large national differences were observed, with the percentage of participants choosing the second answer correlating strongly (about .6) with GDP per capita and measures of education enrolment and quality. These correlations may be a direct effect of wealth on temporal discounting (e.g., Becker & Mulligan, 1997) or may reflect national differences in self-control and risk taking.

Similarly, in the present paper, we did not ask respondents about their personality, but we asked them how often they engage in violating behaviours in traffic by means of the DBQ. The aim of this paper was to investigate the relationships between self-reported violations, accident statistics, mean temperature, and the developmental status of a country. We define developmental status in terms of income per capita, life expectancy/median age, and education—the same types of variables that define the Human Development Index. Considering that the most cross-national study on traffic violations so far included six countries, this paper expands the DBQ literature by including a large number of countries around the globe, with large differences in developmental status, temperature, and traffic accidents.

2. Methods

This paper makes use of four surveys conducted via the crowdsourcing platform CrowdFlower (Table 1). Survey 1 contained 16 questions, including items on self-reported violations (by means of a 7-item DBQ introduced by De Winter, 2013) and the number of accidents in the last 3 years, and aimed to investigate violations-accidents correlations at the individual and national levels (De Winter, Kyriakidis, Dodou & Happee, 2015). Survey 2 consisted of 31 questions and investigated the public opinion on auditory displays at various levels of automated driving (Bazilinskyy & De Winter, 2015). Survey 3 contained 67 questions and investigated the public opinion on auditory, vibrotactile, and visual displays for automated driving applications (Bazilinskyy, Petermeijer, Petrovych, Dodou, & De Winter, submitted for publication). Similar to Survey 1, Surveys 2 and 3 included a question on the number of accidents in the last 3 years, and the same DBQ items as in Survey 1. Survey 4 (data not published before) contained the same questions as Survey 1, but with the response options in reverse order, except for the question about accident involvement.

The following variables were common in the four surveys and were included in the current synthesis: gender, age, driving frequency in the last 12 months, mileage in the last 12 months, number of accidents in the last 3 years, violations as measured by the 7-item DBQ (De Winter, 2013), the respondent's country, and survey completion time (Table 2). For respondents who participated in more than one of the four surveys, only their first survey was included.

The survey completion time, the annual mileage, and the DBQ scores (seven items and their mean) were rank transformed per survey (average rank for ties) and subsequently divided by the number of respondents in the survey. Next, at the level of respondents, correlations were calculated between: (1) gender, (2) age, (3) driving frequency, (4) annual mileage, (5) the number of accidents in the last 3 years, (6)–(13) the DBQ scores, and (14) survey completion time. At the national level, correlations were calculated between: (1) the respondents' mean gender (1 = female, 2 = male), (2) the respondents' mean age, (3) the respondents' mean driving frequency, (4) the respondents' mean annual mileage, (5) the respondents' mean number of accidents in the last 3 years, (6)–(13) the respondents' mean DBQ scores, (14) the respondents' mean survey completion time, (15) road traffic death rate per 100,000 population in 2013 (AccPopul) (WHO, 2015), (16) road traffic death rate per 100,000 registered vehicles in 2013 (AccVehic) (WHO, 2015), (17) GDP per capita in 2013 (GDPcap) (World Bank, 2015), (18) national performance in educational tests ("adjusted all cognitive ability sum"; Rindermann, 2007), (19) life expectancy in 2013 (World Bank, 2015), (20) motor vehicle density (cars, buses, and freight vehicles, but not two-wheelers, per 1000 people) averaged over the years 2003–2010 (World Bank, 2015), (21) median age in 2014 (Central Intelligence Agency, 2015), and (22) mean annual temperature for 1961–1990 (World Bank, 2011). All reported correlations are Spearman rank-order correlations (ρ), which is the equivalent of the Pearson product–moment correlation after rank transformation (Conover & Iman, 1981).

At the national level, a principal component analysis was conducted on the seven violations items as well as on the developmental status variables. Correlations were calculated between the violations component scores, on the one hand, and accident statistics, the developmental status component score, gender, age, and mean annual temperature, on the other. In order to investigate whether age and gender are confounders of the association between violations and accidents, a linear regression was conducted for predicting road traffic death rates per population and per registered vehicle, with the violations components, age, and gender as predictor variables.

Table 1
Overview of the four surveys.

	Survey 1	Survey 2	Survey 3	Survey 4
Data collection period	June 16, 2014 16:57 to June 17, 2014 13:36 GMT	September 2, 2014 13:03 to September 2, 2014 17:56 GMT	March 31, 2015 14:01 to April 1, 2015 4:49 GMT	December 24, 2015 10:01 to December 27, 2015 23:30 GMT
All respondents	1854	2000	3000	3250
Respondents included[a]	1428	999	1452	2127
Countries included	86	88	91	87

[a] Reasons for exclusion: (1) answering "No" to a question about whether the respondent read and understood the survey instructions, (2) reporting an age younger than 18 (thereby not adhering to the survey instructions), (3) reporting an age older than 110 years, (4) not responding or selecting "No response" in one or more multiple choice questions, (5) reporting to never have driven or drove 0 km in the last 12 months, (6) country not identified by CrowdFlower, and (7) filling out the same survey multiple times via the same IP address. The fastest 5% of the respondents per survey was also excluded (see De Winter & Hancock, 2015, who found that in their CrowdFlower survey, the fastest 4% provided relatively inaccurate responses). For Survey 3, respondents who gave a wrong answer to one or more of five questions in which they had to recognize a sound (e.g., beep, horn) were excluded as well.