



Empathy trait may be defined as a factor that predisposes individuals with a certain ability to conceive the emotional states of others and to adjust their own emotions in line with those of others (Eisenberg and Miller, 1987). Studies suggested that empathy is a relatively stable trait over time, and may be linked to variations in genetic predispositions (Kogan et al., 2011). It is expected that individuals scoring high on the empathy trait are less likely to conduct driving violations than lower-scoring drivers, because the former may be more sensitive to the behaviour of other drivers, and have a greater ability to interpret their emotions and behavioural intentions in the traffic system. Intriguingly, however, Owsley et al. (2003) reported that elderly drivers with high empathy scores reported more error conduct than drivers reporting lower scores on this trait; empathy had no significant association with driving violations in this study.

The conformity trait may be conceptualized as a tendency to amend behaviour in line with the behaviours and responses of others. People scoring high on this trait often seek approval from others, and are usually motivated to establish an accurate perception of the surroundings and to behave in accord with this perception (Cialdini and Goldstein, 2004). The role of conformity for aberrant driving behaviour is rather unclear, as studies that have examined this association remain scarce. On one hand, one could argue that drivers with a strong conformity tendency are more likely to comply with traffic regulations. On the other hand, drivers in this category may submit to social pressure from other drivers and thereby be expected to violate regulations. A commonly observed driving behaviour in Turkish urban road traffic, for instance, is that drivers exert social pressure upon slower drivers (e.g. by sounding the horn or driving very close) in order to create pressure to increase speed.

Similarly to traits, culture may be relatively stable over time and could also relate to aberrant driver behaviours. Trait and cultural factors have often been studied in separation, but the present study aims to integrate these perspectives and examine them in parallel. Several previous studies have investigated aberrant driving behaviours and other traffic psychological factors across countries (e.g. Nordfjærn et al., 2011; Nordfjærn and Rundmo, 2009; Şimşeköglü et al., 2013; Warner et al., 2011; Özkan et al., 2006). However, a common limitation of these studies is that culture was not conceptualized within a theoretical framework and therefore cultural factors were not measured in line with cultural theory.

There are several possible theoretical approaches that may aid in measuring culture at an individual level among people within a country. The traditional approach within risk research has been to conceive culture as 'social organization' (Douglas, 1970; Douglas and Wildavsky, 1982). This framework argues that culture could be approached in terms of differences in how people perceive the surrounding environment (e.g. the tightness of bounds between people, desired level of hierarchy and social control). Some researchers argued that this theory may predict how people approach risk (Wildavsky and Dake, 1990), but this assumption has received weak empirical support (Marris et al., 1998; Olstedal and Rundmo, 2007). An alternative way of conceiving culture is to define it as differences in how people communicate by symbols (Geertz, 1973) and the relative importance drivers attribute to symbol exchange in the traffic system, such as writing, visual illustrations and sounds. This approach has been tested in relation to driver behaviours (Rundmo et al., 2012), but the ability of the framework to explain variance in driver behaviours is rather limited. Consequently, it could be argued that the cultural theories developed within the humanities have limited capability to predict aberrant driving behaviours. These theories may have stronger theoretical than empirical foundations, and as such alternative approaches to culture are needed.

In the present study we operationalize culture by its consequences on psychological constructs such as attitudes, values and beliefs (Hofstede, 1980). This framework has a strong empirical tradition and several attempts to measure culture using this theory have been made in recent decades (e.g. Hofstede, 1983; Singelis et al., 1995; Triandis, 1995). Individualism (i.e. perceiving the self as separated from others and to consist of unique attributes) and collectivism (i.e. perceiving the self as belonging to a larger group) are two of the core constructs within this theory (Markus and Kitayama, 1991). Furthermore, these two constructs may be delineated into vertical and horizontal dimensions (Singelis et al., 1995). Those who report vertical individualism conceive the self as different and distinguished from others, they usually perceive themselves to be in competition, and an important social goal is to gain higher status in the hierarchy. Horizontal individualism also fosters a tendency of conceiving the self as separated from others, but generally puts less emphasis on competition and the individual position in the social hierarchy. People reporting high vertical collectivism tend to focus on the self in relation to others, while showing a high degree of deference to the authorities in the in-group. Individuals with high horizontal collectivism also tend to perceive the self in relation to other people, but to a lower extent submit to authorities in the in-group. In addition to the individualism/collectivism dimensions, we also included the uncertainty avoidance component of the theory in the present study. Uncertainty avoidance refers to a tendency to feel uncomfortable and anxious when faced upon ambiguous and unpredictable situations.

We are not aware of studies that have linked the two dimensions of collectivism and individualism to aberrant driving behaviour. Meanwhile, there are reasons to expect that the two types of collectivism and individualism as well as uncertainty avoidance could be related to aberrant driving. Collectivism is a cultural tendency where individuals seek a strong sense of community and tend to have a collaborative approach when exposed to conflict (Souren et al., 2004). This could translate into other social situations, such as traffic, and facilitate more collaboration and lower levels of aberrant driving behaviour. On the other hand vertical individualism could be expected to facilitate higher levels of aberrant driving behaviour, because this cultural tendency is characterized by a more competitive approach to conflict and lower willingness to collaborate and compromise than the two dimensions of collectivism. Although generalization across different risk domains should be undertaken with caution, previous studies have suggested that vertical individualism is a specific risk factor related to, for instance, risky sexual behaviour (Le and Kato, 2006). Regarding uncertainty avoidance, this cultural tendency is linked to elevated stress and anxiety (Özkan, 2006). The stress and anxiety produced by uncertainty may in turn increase aggression and hostility (Merkin, 2006), two emotional factors which have been related to aberrant driving behaviour in several studies (e.g. Lajunen et al., 1998; Sullman et al., 2002).

Turkey spans the European and Asian continents, and also draws cultural inspirations from both of these continents. Kagitcibasi and Ataca (2005) showed that Turkish adults living in urban environments showed a growing appreciation of autonomy and individuality over a period of three decades beginning in 1975. This could be related to increased interaction with western cultures over time. It is therefore likely that there is substantial variation in individualism/collectivism, as well as uncertainty avoidance among individuals living in urban environments in Turkey. Due to this variation, and also because Turkish data for these cultural factors are solely available at the aggregate level from a time period when Turkey had less contact with countries in the west (Hofstede, 1980), we used individual reported data on the cultural constructs in the present study.

In one of the few studies that have examined Turkey's relative standing on horizontal and vertical individualism and collectivism, Cukur et al. (2004) reported that university students from the United States and the Philippines reported higher horizontal individualism than Turkish university students. However, the same study showed that Turkish students reported a rather high vertical individualism and did not differ significantly from the participants in the United States on this dimension. Although the Turkish students reported somewhat higher vertical and horizontal collectivism than individuals in the United States, the differences failed to reach significance. Meanwhile, studies by Hofstede (1983) have shown that Turkey has higher collectivism and lower individualistic tendencies than the United States, reporting scores similar to other countries in the Mediterranean, such as Greece, and countries in South-America, such as Brazil and Uruguay. According to the same study, Turks report a rather high uncertainty avoidance, which is also typical for countries in southern Europe (e.g. France and Spain), and substantially higher than countries like the United States and countries in Scandinavia.

### 1.1. Aims of the study

The aim of this exploratory study is to investigate the relative role of empathy and conformity traits as well as cultural individualism/collectivism and uncertainty avoidance for aberrant driving behaviours in a sample of Turkish urban drivers. Intriguingly, although cultural variables and trait factors are relatively stable over time and both may relate to aberrant driving behaviours, their relation to such behaviours has often been studied separately. Thus, an important contribution of the present study is that two important components related to driving behaviours, trait and cultural factors, are given equal importance within a single coherent study.

In line with previous work cited above, it is expected that vertical individualism and uncertainty avoidance are specific risk factors related to aberrant driving behaviour, while we expect that the two types of collectivism relate to lower levels of such behaviour. We also expect that empathy and conformity traits would relate to lower levels of aberrant driving behaviour. Driving violations (i.e. intentional deviations from safe driving practice) are generally considered to be more strongly influenced by social and motivational factors than driver errors/mistakes (i.e. unintentional deviations in the execution of safe practice), which in turn is assumed to be more influenced by cognitive load and limitations in information processing (Wickens et al., 2008). However, cultural tendencies to avoid uncertainty, to collaborate with other individuals, and to submit to the behaviour of other drivers could also influence how people process information in the traffic system and which factors they select to focus in traffic. As such, we assumed that the cultural and trait factors would relate to both of the central components of aberrant driving behaviour; driving violations and driving errors. Previous work also indicated that stable factors, such as personality characteristics, predict both driver violations and error in similar patterns, and in some cases may be stronger predictors of errors than violations (Owsley et al., 2003).

## 2. Methods and materials

### 2.1. Sampling

A community sample questionnaire survey was carried out among road users in Izmir ( $n = 239$ ) and Istanbul ( $n = 50$ ). The respondents were approached and recruited by convenience sampling in neighbourhoods with different socio-demographic characteristics by trained local research assistants with expert knowledge

about socio-demographic characteristics in these two cities. Data were also collected at various gatherings, including markets, work places and university campuses in both cities. The research assistants were instructed to target city regions with high income, mediocre income, and low income in both cities. The survey was conducted in two cities in order to increase the probability that respondents from different socio-demographic neighbourhoods were included and to increase the generalization potential to different urban environments in Turkey. There were no substantial differences in gender and age across the two samples, although there were somewhat more individuals in Istanbul that reported vertical individualism ( $t = 2.43$ ,  $p < .001$ ). Because a comparison across the Izmir and Istanbul samples was not an integral part of the aims of the present study, these two samples were not matched and were collapsed in further analyses.

The respondents completed the printed questionnaires anonymously and all approached individuals were informed about the aims of the study, voluntary participation and the methods applied to secure confidentiality. A total of 450 questionnaires were distributed and 289 were returned (response rate 64%). Because the present study focused on drivers, individuals without a driver's license ( $n = 110$ ) were removed from the sample. The final sample consisted of 179 drivers, reflecting a response rate of 40% when individuals without a driver's license were excluded from the sample. The initial sample also included individuals without a driver's license, because the survey was part of a wider investigation also focusing on non-motorized transport, such as pedestrian risk behaviour.

The drivers in this urban sample had an average annual mileage of 18474 km (Mdn = 10000, range 50.00–160000). There were 80 females (45%) and 99 males (55%) in the sample. Their age ranged from 19 to 74 years ( $M = 34.44$ ,  $SD = 14.20$ ). A total of 121 individuals (68%) reported a basic education (completed high school education or lower), while 57 respondents (32%) reported a high education (completed university degree).

### 2.2. Measurement instruments

We developed a self-administered questionnaire based on previously validated instruments. All instruments used in the present study were originally in English, except for the Driver Behaviour Questionnaire (DBQ) and the vertical and horizontal collectivism and individualism instrument, both in which had been translated into Turkish and tested in previous work (Lajunen and Özkan, 2004; Wasti and Erdil, 2007). Professional language experts proficient in both Turkish and English translated the remaining measures under the supervision of an international research group also proficient in both languages. Experts in linguistics also evaluated drafts of the questionnaire, examined the English and Turkish versions for item inconsistencies, and approved the final revision. The questionnaire was pilot-tested among 10 Turkish individuals and discussed in a focus group, which resulted in minor language amendments.

The 28-item Turkish version of the DBQ (Lajunen and Özkan, 2004) was used to measure self-reported driver behaviours over the past year. The scale includes 16 errors (e.g. 'Hit something when reversing that you had not previously seen') and 12 violations (e.g. 'Disregard the speed limit on a residential road'), which were scored on a six-point scale ranging from (1) never to (6) nearly all the time. The scale was translated to Turkish by Lajunen and Özkan (2004) and has been applied in Turkey on a number of previous occasions (e.g., Şimşekoğlu and Lajunen, 2009; Özkan et al., 2006).

Empathy trait was screened by the Empathy Quotient 8 (EQ8) (Loewen et al., 2010). The instrument includes eight items, such as 'I am good at predicting how someone will feel' and 'I find it easy

to put myself in somebody else's shoes'. The items were scored on a scale ranging from (1) strongly disagree to (5) strongly agree. The instrument has been found to have feasible reliability and validity (Loewen et al., 2010).

Information about conformity trait was obtained by the 10-item Conformity Scale (Mehrabian and Steffl, 1995). The measure consists of items such as 'I often rely on, and act upon, the advice of others' and 'Generally, I'd rather give in and go along for the sake and peace than struggle to have my way.' This instrument is scored on a scale ranging from (1) strongly disagree to (5) strongly agree.

The 37-item Turkish version of the horizontal and vertical collectivism and individualism instrument (Wasti and Erdil, 2007) was used in the present study. This version was established on basis of the original English measure of these cultural tendencies (Singelis et al., 1995). The measure is based on the theoretical assumption that collectivism and individualism divide into horizontal and vertical dimensions (i.e. horizontal collectivism, vertical collectivism, horizontal individualism and vertical individualism). Horizontal collectivism is characterized by the perception that all are interrelated and equal (e.g. 'The well-being of my coworkers is important to me'), while vertical collectivism fosters perceptions about interrelatedness, but also respects people's position in the hierarchy (e.g. 'I would sacrifice an activity that I enjoy very much if my family did not approve of it'). Horizontal individualism (e.g. 'I often do my own thing') tends to facilitate perceptions that people are independent and unique, but not striving for personal social status. Vertical individualism (e.g. 'It annoys me when other people perform better than I do') also relates to strong perceptions about uniqueness and individuality. People scoring high on this cultural factor, however, also tend to focus on competition and strive to increase their status in the social hierarchy. The converging and diverging validity of this measure has been established in previous work (Triandis and Gelfand, 1998). Singelis et al. (1995) showed that a four-factor structure had good fit in line with the theory, while Wasti and Erdil (2007) argued that a three-factor structure may yield better fit in Turkey (i.e. horizontal collectivism, vertical collectivism and horizontal individualism). The items were scored on a Likert scale ranging from (1) strongly disagree to (5) strongly agree.

Uncertainty avoidance was tapped by a seven-item instrument that segmented into one dimension in previous work (Jung and Kellaris, 2004). The drivers responded to items such as 'I tend to become anxious when I cannot predict consequences' and 'I would not take risks when an outcome cannot be predicted' on a scale ranging from (1) strongly disagree to (5) strongly agree.

The questionnaire also included measures of respondents' gender, age, educational level, whether or not they had a driver's license, and annual mileage.

Analyses of missing data showed a range of 1.1–4% on the cultural items, 0–1.7% on the trait measures and 1.1–3.9% on the DBQ items.

### 2.3. Statistical procedures

Missing data were imputed by the expectation maximization (EM) algorithm. This algorithm maintained the relations between the imputed items and other values in the measures because the values of items with non-missing data were used to estimate the missing values by a maximum likelihood method. Descriptive statistics were used to describe the characteristics of the sample and  $\chi^2$  and independent samples *t*-tests were conducted as appropriate to investigate potential differences in sub-samples. Cohen's *d*-values were estimated to examine the strength of the sub-group differences. According to Cohen (1988) a small effect is around .20, a moderate effect is around .50, and a strong effect is about .80. Cronbach's alpha-coefficients and average corrected inter-item

correlations were calculated in order to examine the internal consistency of the measures. To constitute a coherent scale, the alpha-coefficients should approach .70 and the average corrected inter-item correlations should be above .30 (Hair et al., 1998). Mean composite scores were estimated for all scales and indexes. Pearson's bi-variate correlations were calculated to investigate associations between the test indices. Two linear hierarchical block regression analyses (enter method) were carried out to examine whether reported driving errors and violations were predicted by the trait and cultural factors. Demographics (gender, age, and education) and annual mileage were entered as control variables in the first block and the trait dimensions (empathy and conformity) were entered in the second block. In order to test whether the cultural factors (horizontal and vertical individualism and collectivism as well as uncertainty avoidance) added to the explained variance beyond the control variables and traits, cultural variables were entered in the third block. We used linear hierarchical block regression analysis rather than a more traditional regression approach in order to be able to disentangle the unique contribution to the explained variance accounted for by each set of variables in the equation (demographics, traits and cultural factors, respectively). Also, we wanted to test the role of personality and culture for reported driving behaviour while the other variables in the model were adjusted for in the equation. All analyses were performed in PASW Statistics 18.0.

### 2.4. Reliability of the measures

Table 1 shows factor means, standard deviations (SD) as well as reliability indices for the multi-indicator measures. The 28-item DBQ has been substantially tested in Turkey in previous work and has been reported to segment into two dimensions named driving errors and driving violations (Lajunen and Özkan, 2004; Şimşekoğlu and Lajunen, 2009). Therefore, we entered the 16 items related to driving errors and 12 items related to driving violations into two dimensions; Errors ( $\alpha = .920$ , average corrected inter-item correlation = .67) and Violations ( $\alpha = .869$ , average corrected inter-item correlation = .61). As shown in Table 1, the data also reflected satisfactory reliability indices for the uni-dimensional scales of Conformity, Empathy and Uncertainty Avoidance. Nordfjærn and Şimşekoğlu (2013) conducted a Confirmatory Factor Analysis (CFA) on the items of horizontal and vertical collectivism and individualism. This analysis tested both a three- and four-factor solution. The three-factor solution consisted of horizontal collectivism, vertical collectivism and horizontal individualism (Wasti and Erdil, 2007), while the four-factor solution consisted of horizontal collectivism, vertical collectivism, horizontal individualism and vertical individualism (Singelis et al., 1995). The four factor solution had better fit ( $\chi^2 = 1453.50$ ,  $df = 554$   $p < .001$ , RMSEA = 0.064, CFI = .96) than the three-factor solution ( $\chi^2 = 926.60$ ,  $df = 347$   $p < .001$ , RMSEA = 0.076, CFI = .74), and was consequently used in the present study. All the factor loadings in this scale obtained significance and ranged from .61 to .83.

## 3. Results

Mean rankings show that the three most common driving errors in this sample were: 'Forget where you left your car in a car park' ( $M = 2.27$ ,  $SD = 1.27$ ), 'Intending to drive to destination A, you "wake up" to find yourself on the road to destination B' ( $M = 2.18$ ,  $SD = 1.21$ ) and 'Realize that you have no clear recollection of the road along which you have just been traveling' ( $M = 2.11$ ,  $SD = 1.10$ ). The three least reported driving errors were 'Attempt to drive away from the traffic lights in third gear' ( $M = 1.46$ ,  $SD = 1.03$ ), 'Misread the signs and exit from a

**Table 1**  
Reliability and internal consistency of the instruments.

Dimensions	Mean (SD)	Number of factors	Number of items	Cronbach's $\alpha$	Average corrected inter-item correlations
Driver Behaviours:		2			
Errors	1.82 (.76)		16	.920	.67
Violations	2.17 (.91)		12	.869	.61
Horizontal and vertical collectivism and individualism:		4			
Horizontal collectivism	3.76 (.71)		10	.758	.43
Vertical collectivism	3.72 (.60)		9	.749	.43
Horizontal individualism	3.95 (.58)		9	.764	.44
Vertical individualism	3.72 (.60)		9	.793	.50
Uncertainty avoidance	3.47 (.71)	1	7	.725	.44
Empathy	3.70 (.64)	1	8	.762	.47
Conformity	2.73 (.55)	1	10	.659	.32

High scores reflect high levels of reported aberrant driving behaviours, more of the cultural tendencies, and stronger empathy and conformity tendencies.

roundabout on the wrong road' ( $M = 1.54$ ,  $SD = .97$ ) and 'Miss "Give Way" signs and narrowly avoid colliding with traffic having right of way' ( $M = 1.56$ ,  $SD = 1.03$ ).

As shown in Table A1, the three most common violations were: 'Sound your horn to indicate your annoyance to another road user' ( $M = 3.18$ ,  $SD = 1.51$ ), 'Overtake a slow driver on the inside' ( $M = 2.60$ ,  $SD = 1.40$ ) and 'Become angered by a certain type of driver and indicate your hostility by whatever means you can' ( $M = 2.43$ ,  $SD = 1.41$ ). The three least common violations were: 'Pull out of a junction so far that the driver with right of way has to stop and let you out' ( $M = 1.62$ ,  $SD = 1.00$ ), 'Drinking and driving' ( $M = 1.65$ ,  $SD = 1.12$ ) and 'Become angered by another driver and give chase with the intention of giving him/her a piece of your mind' ( $M = 1.66$ ,  $SD = 1.23$ ).

Table 2 shows gender differences in the DBQ scales as well as, cultural and trait dimensions. Females reported more driving errors than males ( $t = 2.68$ ,  $p < .001$ ,  $d = -.39$ ), whereas differences

in driving violations failed to reach significance. Males reported somewhat higher vertical individualism than females ( $t = -2.19$ ,  $p < .05$ ,  $d = .32$ ), whereas females reported stronger empathy tendencies than males ( $t = 2.35$ ,  $p < .05$ ,  $d = -.36$ ). The remaining differences in cultural and personality tendencies failed to reach significance.

Pearson's correlations between the test indices are reported in Table 3. Being male was associated with lower empathy, more vertical individualism tendencies and fewer reported driving errors. Empathy and the two types of collectivism also increased with age, while driving errors and violations were reduced with increased age. Empathy was positively related to conformity and uncertainty avoidance, and also with the two types of collectivism and horizontal individualism. Empathy was also related to fewer driving errors and violations. Conformity was associated with increased uncertainty avoidance and positively related to both types of collectivism, while a negative relation was found between

**Table A1**  
Reported driving behaviours in the sample.

Type	Behaviour item	Mean (SD)
E	Hit something when reversing that you had not previously seen	2.00 (1.00)
E	Intending to drive to destination A, you "wake up" to find yourself on the road to destination B	2.18 (1.21)
V	Drinking and driving	1.65 (1.12)
E	Get into the wrong lane approaching a roundabout or a junction	1.87 (1.11)
E	Queuing to turn left onto a main road, you pay such close attention to the main stream of traffic that you nearly hit the car in front of you	1.77 (1.04)
E	Fail to notice that pedestrians are crossing when turning into a side street from a main road	1.69 (.97)
V	Sound your horn to indicate your annoyance to another road user	3.18 (1.51)
E	Fail to check your rear-view mirror before pulling out, changing lanes, etc.	2.03 (1.49)
E	Brake too quickly on a slippery road or steer the wrong way in a skid	1.71 (1.05)
V	Pull out of a junction so far that the driver with right of way has to stop and let you out	1.62 (1.00)
V	Disregard the speed limit on a residential road	2.24 (1.30)
E	Switch on one thing, such as the headlights, when you meant to switch on something else, such as the wipers	1.66 (1.08)
E	On turning left nearly hit a cyclist who has come up on your inside	1.57 (.99)
E	Miss "Give Way" signs and narrowly avoid colliding with traffic having right of way	1.56 (1.03)
E	Attempt to drive away from the traffic lights in third gear	1.46 (1.03)
E	Attempt to overtake someone that you had not noticed to be signalling a right turn	1.59 (.98)
V	Become angered by another driver and give chase with the intention of giving him/her a piece of your mind	1.66 (1.23)
V	Stay in a motorway lane that you know will be closed ahead until the last minute before forcing your way into the other lane	1.71 (.99)
E	Forget where you left your car in a car park	2.27 (1.27)
V	Overtake a slow driver on the inside	2.60 (1.40)
V	Race away from traffic lights with the intention of beating the driver next to you	1.66 (1.22)
E	Misread the signs and exit from a roundabout on the wrong road	1.54 (.97)
V	Drive so close to the car in front that it would be difficult to stop in an emergency	1.84 (1.07)
V	Cross a junction knowing that the traffic lights have already turned against you	1.78 (1.02)
V	Become angered by a certain type of driver and indicate your hostility by whatever means you can	2.43 (1.41)
E	Realize that you have no clear recollection of the road along which you have just been traveling	2.11 (1.10)
E	Underestimate the speed of an oncoming vehicle when overtaking	1.98 (1.07)
V	Disregard the speed limit on a motorway	2.31 (1.44)

Items scored from (1) never to (6) nearly all the time.

E = Errors.

V = Violations.

**Table 2**  
Gender differences in reported driving behaviour, culture and trait tendencies.

Dimension	Mean		SD		t-Value	Cohen's d
	Males	Females	Males	Females		
<i>Driver behaviour:</i>						
Errors	1.68	1.98	.57	.93	2.68***	-.39
Violations	2.24	2.09	.92	.89	-1.09	.17
<i>Cultural tendencies:</i>						
Vertical collectivism	3.75	3.67	.66	.53	-.86	.13
Horizontal collectivism	3.78	3.72	.58	.51	-.78	.11
Horizontal individualism	3.91	4.01	.56	.59	1.21	-.17
Vertical individualism	3.26	3.04	.71	.65	-2.19*	.32
Uncertainty avoidance	3.44	3.54	.69	.73	.89	-.14
<i>Trait tendencies:</i>						
Empathy	3.60	3.83	.66	.60	2.35*	-.36
Conformity	2.76	2.70	.54	.56	-.73	.11

High scores reflect high levels of reported aberrant driving behaviours, more of the cultural tendencies, and stronger empathy and conformity tendencies.

\*  $p < .05$ .

\*\*\*  $p < .001$ .

**Table 3**  
Pearson's correlations between the test indices.

Factors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) Gender (Ref. female)		.27***	.17	.48***	-.17**	.06	-.07	.06	.07	-.09	.16**	-.20***	.08
(2) Education (Ref. basic)			.18**	.35***	.02	.03	-.07	.00	.01	-.17**	.00	-.09	-.04
(3) Annual mileage				.12	.10	-.04	-.12	.28***	.06	.12	.17	.09	-.02
(4) Age					.17**	.08	.00	.18**	.28***	-.21***	.15	-.20***	-.27***
(5) Empathy						.15**	.20***	.40***	.16**	.24***	.13	-.31***	-.17**
(6) Conformity							.22***	.16**	.24***	-.34***	.13	.15**	.17**
(7) Uncertainty avoidance								.31***	.21***	.12	.04	.02	.10
(8) Horizontal collectivism									.59***	-.18**	-.28**	-.19**	-.10
(9) Vertical collectivism										-.16**	-.48***	-.13	-.15**
(10) Horizontal individualism											.20**	-.09	.01
(11) Vertical individualism												.24***	.21**
(12) DBQ Errors													.61***
(13) DBQ Violations													

High scale scores reflect high levels of reported aberrant driving behaviours, more of the cultural tendencies, and stronger empathy and conformity tendencies.

\*\*  $p < .05$ .

\*\*\*  $p < .001$ .

horizontal individualism and conformity. Conformity was associated with higher levels of driving errors and violations. In regards to the inter-correlations between the cultural factors, uncertainty avoidance was associated with higher levels of horizontal and vertical collectivism, while the two types of collectivism were positively associated. As expected, there was a negative association between the collectivism and individualism dimensions. The associations of the cultural factors with driving errors and violations were rather modest, but vertical individualism was in particular related to greater levels of reported driving errors and violations.

Table 4 reports the outcome of a hierarchical block regression analysis aimed to test whether conformity and empathy in addition to the cultural factors predict driving errors, while adjusting for demographics and exposure. The trait variables added to the explained variance in driving errors ( $F$ -change = 14.24,  $p < .001$ ). The addition of the cultural variables in the third block resulted in a further significant improvement of the model ( $F$ -change = 2.33,  $p < .05$ ).

After partialling out the impacts of demographics and exposure, empathy was related to lower levels of reported driving errors ( $\beta = -.33$ ,  $p < .001$ ), while conformity was slightly, but significantly, related to higher levels of reported error conduct ( $\beta = .14$ ,  $p < .05$ ). Vertical individualism ( $\beta = .22$ ,  $p < .001$ ) and uncertainty avoidance ( $\beta = .14$ ,  $p < .05$ ) predicted higher levels of driving errors. This model explained 20% of the variance in driving errors.

A similar hierarchical block regression analysis aimed to test whether conformity and empathy in addition to the cultural factors predict reported driving violations while adjusting for

demographics and exposure is reported in Table 5. Demographic characteristics had a substantially stronger impact in this model compared to the model reported in Table 4. This was especially true for increased age, which was strongly associated with lower levels of reported driving violations ( $\beta = -.44$ ,  $p < .001$ ) while controlling for all other factors in the model. The demographics and exposure control block also had the most substantial contribution to the explained variance in this model ( $F$ -change = 8.54,  $p < .001$ ). Meanwhile, the two traits ( $F$ -change = 4.04,  $p < .01$ ) and the cultural factors ( $F$ -change = 2.10,  $p < .05$ ) also contributed to significant model improvements, beyond the demographic and exposure variables. Increased empathy was related to lower levels of driving violations ( $\beta = -.24$ ,  $p < .001$ ), while conformity was slightly related to higher levels of driving violations ( $\beta = .13$ ,  $p < .05$ ). Vertical individualism was associated with higher levels of driving violations ( $\beta = .18$ ,  $p < .01$ ), while vertical collectivism predicted fewer violations ( $\beta = -.13$ ,  $p < .05$ ). The model explained 18% of the variance in driving violations.

#### 4. Discussion

The present study showed that empathy trait was related to reduced levels of reported driving errors and violations, whereas conformity trait related to slightly increased levels of both these driver behaviour components. Although the two traits explained a larger proportion of variance in driving errors and violations than the cultural factors, the cultural factors also caused significant

**Table 4**  
Trait and cultural factors predicting reported driving errors.

Block	Indicators	Standardized beta	Unstandardized B	F-change
1	Gender (Ref. female)	-.17*	-.28*	3.53**
	Age	-.21**	-.01**	
	Education (Ref. basic)	.03	.07	
	Annual mileage	-.10	-.16*	
2	Empathy	-.33***	-.44***	14.24***
	Conformity	.14*	.21*	
3	Horizontal collectivism	-.10	-.05	2.33*
	Vertical collectivism	-.07	-.09	
	Horizontal individualism	-.05	-.05	
	Vertical individualism	.22***	.32***	
	Uncertainty avoidance	.14*	.16*	

Dependent variable = composite score of DBQ errors.

Adjusted  $R^2 = .20$ .

\*  $p < .05$ .

\*\*  $p < .01$ .

\*\*\*  $p < .001$ .

**Table 5**  
Trait and cultural factors predicting reported driving violations.

Block	Indicators	Standardized beta	Unstandardized B	F-change
1	Gender (Ref. female)	.27***	.39***	8.54***
	Age	-.44***	-.08***	
	Education (Ref. basic)	.03	.13	
	Annual mileage	-.11	-.14	
2	Empathy	-.24***	-.35***	4.04**
	Conformity	.13*	.19*	
3.	Horizontal collectivism	.07	.11	2.10*
	Vertical collectivism	-.13*	-.20*	
	Horizontal individualism	-.02	-.04	
	Vertical individualism	.18**	.24**	
	Uncertainty avoidance	.10	.14	

Dependent variable = composite score of DBQ violations.

Adjusted  $R^2 = .18$ .

\*  $p < .05$ .

\*\*  $p < .01$ .

\*\*\*  $p < .001$ .

model improvements beyond the control and trait variables. Vertical individualism, in which the self is perceived as independent and in competition with other individuals for status in the hierarchy, was related to higher levels of reported driving violations and errors. Vertical collectivism was associated with reduced levels of driving violations, while uncertainty avoidance was slightly related to more driving error conduct. In regard to demographic and exposure variables, male gender, higher age and higher mileage were all related to lower levels of error conduct. Male gender was also related to higher levels of driving violations, while higher age was associated with lower levels.

In line with the initial hypothesis and in contrast with previous findings (Owsley et al., 2003), we found that empathy was related to lower levels of error conduct and lower levels of driving violations. This discrepancy may be due to age differences in the samples, because the study by Owsley et al. (2003) was conducted among older adults, while the present sample was rather young. In spite of a general lack of empirical studies examining empathy in relation to aberrant driving behaviours, several studies showed that altruism (i.e. individual devotion to the welfare of other individuals) is linked to lower levels of aberrant driver behaviours (Lucidi et al., 2010; Ulleberg and Rundmo, 2003).

According to the empathy-altruism hypothesis, empathy facilitates altruistic motivation for increasing the welfare of another person, and empathy may as such be an emotional precursor of altruistic motivation (Stocks et al., 2009). The present findings suggest that, similar to altruism, increased empathic tendencies may translate into reduced levels of aberrant driving behaviours. Future studies could examine whether the role of empathy for aberrant driving behaviours is mediated through altruistic motivation.

An alternative interpretation, however, is that the self-report nature of the DBQ influenced the results. People who report high empathy scores may be more motivated to present their driving as more careful and less prone to error than it actually is. However, the opposite assumption may also be true; individuals with high empathy may be more likely to give candid responses on questionnaires related to violations and error conduct (Owsley et al., 2003). Also, if the DBQ was substantially influenced by social desirability in the present study, one could have expected that drivers with high conformity would report fewer errors and violations in line with what is perceived socially and politically desirable; rather surprisingly, we found the opposite tendency. Moreover, several studies reported that social desirability is only a minor issue in

DBQ responses (Lajunen and Summala, 2003; Sullman and Taylor, 2010).

In opposition to the hypothesis, the results showed that conformity was slightly, but significantly, related to both reported driving errors and violations. This poses a challenge for interpretation as one would expect that drivers with a desire to act in accord with social conventions, expectations and norms to be more likely to drive in line with traffic regulations. However, this may depend upon the specific location or country where driving takes place. Turkish urban road traffic is characterized by high congestion and applications of informal traffic norms, which are not necessarily safety-oriented (Şimşekoğlu et al., 2012). Imitating and conforming to the unsafe behaviours of other drivers may eventually increase aberrant behaviours in this specific traffic environment. This finding needs replication in larger and more representative samples, therefore future studies could examine the role of conformity for driving behaviours across countries with highly regulation-oriented traffic systems (e.g. Germany, Holland, Sweden, Norway) and less regulation-oriented traffic systems (e.g. Turkey and Iran).

In addition to traits, the present study showed that cultural factors may be relevant for aberrant driving behaviours. In accordance with the hypothesis, drivers who reported a tendency of conceiving the self as separated from others and a competitive approach in regards of status in the hierarchy (i.e. vertical individualism), tended to report more driving errors and violations. Furthermore, individuals who reported a tendency to perceive the self as interrelated with others and reported a strong respect for authority (i.e. vertical collectivism) had fewer driving violations, as expected. Potentially, and in line with the assumption of Singelis et al. (1995), vertical individualism may foster a more competitive and less collaborative approach in the traffic environment, making them more self-focused and prone to conduct violations in order to, for instance, reach their destination in time. Given the congested traffic environment in Turkish cities collaboration with other drivers are essential and drivers reflecting high levels of vertical individualism could as such represent a risk group in the system. Drivers scoring high on this cultural factor may perceive themselves as more autonomous, to have specific social rights in traffic, and expect others to give way. Drivers reporting high vertical collectivism may, in contrast, collaborate with other drivers to a greater extent and be more compromising and patient in road traffic. Studies to come should examine whether this also applies in samples outside Turkey or if this solely applies in this specific context.

The drivers generally reported rather high uncertainty avoidance, and this cultural concept was slightly related to higher levels of driving errors. Uncertainty avoidance is related to the perception that events are unpredictable and it has been suggested that uncertainty avoidance is strongly correlated with neuroticism (Özkan, 2006). Neuroticism may, in turn, relate to aberrant driving behaviours and accident involvement (Matthews et al., 1991). The anxiety and stress produced by high uncertainty avoidance may also be instrumental for the strong tendency to express emotions and aggression to other drivers (e.g. 'Sound your horn to indicate your annoyance to another road user') reported in the present study. Hofstede (2001) also argued that this is a common psychological process in countries with high uncertainty avoidance, such as Turkey. It was somewhat surprising, however, that uncertainty avoidance did not predict driving violations in addition to driving errors. However, the regression analysis showed fairly equal coefficients for uncertainty avoidance on the two types of aberrant driving behaviours, and the coefficient for errors barely reached significance. As such this finding needs replication in larger samples supplied with observed driving behaviour.

Related to the above, it is somewhat counterintuitive that the beta coefficients were slightly stronger for errors than for violations in our prediction models. However, the coefficients mainly followed the same patterns in terms of statistical significance, with the exceptions that uncertainty avoidance only reached significance in the prediction of errors whereas vertical collectivism solely reached significance in the violation prediction model at the .05 level. A possibility is that culture and personality traits predispose individuals to perceive the traffic system in specific ways which may promote or decrease the risk of error conduct. It could be that research that has merely focused on errors in relation to attention, perceptual capacity and information processing could have underestimated the role of cultural and trait factors related to driving errors. It is also well known that perceptual attention and processing is influenced by both trait and cultural variables (e.g. Nielsen and Sarason, 1981; Li-Jun et al., 2000). Recent studies of both trait and cultural variables have also accommodated both violations and errors in the prediction models, and generally found that violations and errors are predicted by these factors in fairly similar patterns (e.g.; Owsley et al., 2003; Öz et al., 2010). Perception and attention in traffic may be guided by more than limitations in human physiology and information processing as both psychological and cultural factors influence how we make sense out of the traffic environment and system.

Some limitations of the present study should be acknowledged. First, the sample was established on the basis of convenience sampling in different neighborhoods in two Turkish cities. Even though these cities are two of the most populous in Turkey, with high levels of immigration from across the country, the findings need to be replicated in larger and more representative samples. Correlation analyses, for instance, showed that male drivers in the present study were rather old compared to female drivers. Because older drivers tend to drive more safely than young drivers (Summala, 1987) this could have inflated male driver's responses in a safer direction. This could also explain why we did not find significant differences in driving violations between males and females. Second, the data were based on a self-report measure of driving behaviours. However, there are a number of factors that may mitigate this limitation. The DBQ is a well-established screening tool for driving behaviours applied across a range of studies. A meta-study showed that both the error and violation components of the DBQ predicted accident involvement prospectively and retrospectively (De Winter and Dodou, 2010). Also, social desirability has been found to have limited impact on the responses of this scale (Lajunen and Summala, 2003; Sullman and Taylor, 2010; Wickens et al., 2008) and self-report driver behaviours were also correlated with observed aberrant driver behaviours in another study (West et al., 1993). Meanwhile, it should be noted that scholars recently argued that the DBQ may be subject to common systematic bias in self-reports, which in turn could explain why it predicts other self-report measures, such as reported accident involvement (af Wahlberg and Dorn, 2012). Although the DBQ may be a feasible tool when the aim is to study the underlying factors of driving behaviour, as opposed to merely describing observed driving behaviour or accident patterns, we acknowledge that more large-scale studies linking accident criteria from different sources (e.g. accidents registers, insurance records and company data) should be conducted before strong conclusions are drawn about the criterion validity of the DBQ. Intriguingly, data from other sources than self-reports could also have their own weaknesses, such as under-reporting or over-reporting of certain accident types and differences in registration practice across regions (see also De Winter and Dodou, 2012). This could be particularly relevant in developing middle-income countries such as Turkey. Third, the present study used a cross-sectional method that does not allow for causal inferences. However, both traits and

cultural factors tend to be relatively stable over time, and there are also theoretical justifications (e.g. Trait Theory and Culture as Consequences Theory) for using these constructs as precursors of behaviour (Costa and McCrae, 1992; Hofstede, 1980). Finally, because the present study is one of the first to investigate the specific traits and cultural factors in relation to driver behaviours, the approach was somewhat exploratory.

#### 4.1. Conclusions and applications

The reported limitations set aside, the present study suggests that empathy and conformity relate to lower and higher levels of aberrant driver behaviours, respectively. Vertical individualism was associated with higher levels of driving errors and violations, and uncertainty avoidance was also related to higher levels of reported driving errors. In contrast, vertical collectivism was associated with lower levels of reported violations. Increased age was also a strong predictor of lower levels of reported violations, while male gender was related to increased levels.

Driving behaviour interventions carried out in Turkish urban environments could benefit by taking into account trait and cultural differences. The present findings suggest that safety-promoting campaigns may increase the effectiveness by strengthening drivers' resistance to social pressure from other drivers to conduct traffic violations. Based on our results, it may be suggested that there is a potential to reduce aberrant driving behaviour through interventions tailored to create a more compromising and collaborating approach, and that provide opportunities for the expression of competitive tendencies in domains other than road traffic. Also, stress management and tension-reducing approaches could be integrated into Turkish urban traffic campaigns. The current results also imply that young male drivers should be specifically targeted in terms of violations.

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