

**The Role of Individualism, Gender and Situational Factors on Probabilities of
Committing Offences in a French Drivers Sample**

Florent Varet¹, Marie-Axelle Granie², Themis Apostolidis³

¹ IFSTTAR, TS2, LMA, F-13300 Salon de Provence, France

Aix Marseille Univ, LPS, Aix en Provence, France

florent-varet@ifsttar.fr

² Univ Lyon, IFSTTAR, TS2, LESCOT, F-69675, LYON, France

marie-axelle.granie@ifsttar.fr

³ Aix Marseille Univ, LPS, Aix en Provence, France

themistoklis.apostolidis@univ-amu.fr

In press

Transportation Research Part F: Traffic Psychology and Behaviour

Corresponding author: Florent Varet

Declarations of interest: none

Funding: This work was supported by the French Institute of Science and Technology for Transport, Development and Networks; and by the Region Provence-Alpes-Cote d'Azur.

The Role of Individualism, Gender and Situational Factors on Probabilities of Committing Offences in a French Drivers Sample

ABSTRACT

Driving offences can be a cause of road crashes and their psychosocial determinants have been studied using different approaches. Recent studies have found that cultural values, transposed at individual level through the vertical-horizontal individualism-collectivism model, may be relevant for understanding offending behaviours in drivers and pedestrians. Within this framework, we propose to test these relationships in a sample of French drivers (N = 666). In addition, we aim to explore the role of situational factors and gender differences, as potential moderators for the effects of individualist and collectivist values on offending behaviours. In an online survey experiment, drivers had to evaluate their probabilities of committing several driving offences in three driving situations, manipulating traffic density level and the probability of being caught by the authorities. Statistical analyses showed that, compared to a control situation, probabilities of offending were lower in the heavy traffic condition and even lower in the high probability of being caught condition. Probabilities of offending were also higher for men than women and were positively predicted by vertical individualism. However, the main effects suggested that horizontal collectivism and vertical individualism predicted posit offences for men only, depending on situation for vertical individualism. These results were qualified by significant interactions between driving situation, gender and vertical individualism and between gender and horizontal collectivism. These findings are discussed in relation to gender differences in value expression. Perspectives to improve the relevance of the value framework mobilized, the importance to consider situational context to understand driving offending behaviours and safety implications are also discussed.

Keywords: individualism; collectivism; gender; situation; offences; driving

1. Introduction

Worldwide, road traffic crashes account for about 1.25 million deaths, 20 to 50 million injuries per year and are the main cause of death for 15-29-year-olds. In most countries they represent a cost of nearly 3% of their gross domestic product. Car occupants account for 31% of road traffic deaths worldwide (World Health Organization, 2015) and 52% in France (French National Inter-Ministerial Office of Road Safety, 2016). Among the multiple factors that may be related to road crash involvement, several studies have demonstrated the role of aberrant driving behaviours (Iversen & Rundmo, 2004; Parker, Reason, Manstead, & Stradling, 1995; Rothengatter, 1997; Sümer, 2003). Despite the lack of consensus as to their importance among other causes of road fatalities (Barraclough, af Wåhlberg, Freeman, Watson, & Watson, 2016), the role of offending driving behaviours may be questioned as a potential factor related to road fatalities.

Studies based on the Theory of Planned Behaviour (TPB; Ajzen, 1991) have shown that intentions to commit driving offences and self-reported driving offences, such as speeding and drink-driving, can be predicted by classic components of the TPB (attitudes, perceived behavioural control, subjective norms and behavioural intentions). Extended versions of the TBP have also highlighted the role of injunctive, descriptive, personal and moral norms in predicting such behaviours (e.g., Cestac, Paran, & Delhomme, 2011, 2014; Cooke, Dahdah, Norman, & French, 2016; Elliott, Armitage, & Baughan, 2003; Parker, Manstead, & Stradling, 1995). Also, research on the psychosocial determinants of aberrant driving behaviours have investigated the influence of sex roles, gender stereotypes (Degraeve, Granié, Pravossoudovitch, & Lo Monaco, 2015; Granié, 2009; Özkan & Lajunen, 2005; Pravossoudovitch, Martha, Cury, & Granié, 2015; Sullman, Paxion, & Stephens, 2017) and that of such personality traits as aggressive behaviours (Lajunen, Parker, & Stradling, 1998),

sensation seeking (Iversen & Rundmo, 2004; Ulleberg & Rundmo, 2003), empathy and conformity (Nordfjærn & Şimşekoğlu, 2014). More recently, Nordfjærn and colleagues have questioned the role of cultural factors in determining risky behaviours for both pedestrians (Nordfjærn & Şimşekoğlu, 2013; Nordfjærn & Zavareh, 2016) and drivers (Nordfjærn & Şimşekoğlu, 2014) in Middle East . They have proposed to operationalize culture at individual level through horizontal and vertical individualism and collectivism (HVIC, Singelis, Triandis, Bhawuk, & Gelfand, 1995).

In line with this proposition, we offer to examine the effects of HVIC dimensions on driving offences, in a culturally different context than those previously studied. We also propose to take into account participants' gender and important situational factors on the road – enforcement and the presence of other road users – as potential moderators of these effects.

1.1. Vertical and horizontal individualism and collectivism

Individuals oriented toward vertical individualism (VI) tend to perceive themselves as unique, independent and distinct from others. They seek to improve their own status via competition, power and achievement (Shavitt, Torelli, & Riemer, 2010). Conversely, if individuals oriented toward horizontal individualism (HI) tend to also define and perceive themselves as unique, they consider themselves equal to others (Feather, 1994; Nelson & Shavitt, 2002). They focus on being successfully self-reliant without focusing on competition (Triandis & Gelfand, 1998). Vertical collectivist (VC), on the other hand, tend to define and perceive themselves more in relation to others, seek to enhance ingroup cohesion and status and to focus on complying with authorities and traditions (Shavitt et al., 2010). Finally, individuals oriented toward horizontal collectivism (HC) also tend to define and perceive themselves more in relation to others but with a focus on sociability and within an egalitarian framework (Erez & Earley, 1987; Shavitt et al., 2010).

The HVIC approach has proposed to refine broader traditional individualism and collectivism constructs, considering that hierarchy and competition values proceed differently for each of them (Shavitt, Lalwani, Zhang, & Torelli, 2006; Shavitt et al., 2010; Shavitt, Zhang, Torelli, & Lalwani, 2006). It differs from the previous and renowned Hofstede model of cultural values (Hofstede, 1980, 1983) in which individualism and collectivism were the opposites poles of a same dimension and hierarchy values were considered through a distinct dimension (corresponding to “power distance”). Indeed, distinguishing the vertical-horizontal dimension allows us to more precisely assess implications of individualism and collectivism in a broad field of studies such as personal values, processes linked to power, identities, gender differences, self-presentation tendencies and perceptions of the social environment (Shavitt & Cho, 2016; Shavitt, Lalwani, Zhang, & Torelli, 2006; Shavitt et al., 2010). Although the HVIC approach is taking root into a classic intercultural frame and may be relevant for cultural level comparison, the importance placed on these values and their effects can be also compared at individual level (Matsumoto et al., 1999; Singelis et al., 1995; Triandis, 1995; Triandis, Bontempo, Leung, & Hui, 1990). Matsumoto et al. (1999) also refer to these two levels as the “ecological culture” and the “psychological culture”.

For instance, Nordfjærn & Şimşekoğlu (2014) have studied the relationships between HVIC and self-reported driving behaviours among a sample of urban Turkish drivers. They found that violations were positively predicted by VI and negatively by VC. The authors explained the positive effects of VI on violations by individuals’ tendency to comply more with personal rather than collective expectations and to exhibit less collaborative behaviours with other road users. Conversely, the negative effects of VC on violations was explained by a greater tendency to comply with authorities and laws, to exhibit more collaborative behaviours with other drivers and by making more compromises between personal and collective expectations (Nordfjærn & Şimşekoğlu, 2013, 2014; Nordfjærn & Zavareh, 2016).

This study (Nordfjærn & Şimşekoğlu, 2014) was conducted on a sample of urban Turkish drivers and, to the best of our knowledge, no similar study on drivers has been conducted in other countries. As suggested by the authors themselves (p. 62), it seems important to examine whether equivalent results can be observed in different cultural contexts. Indeed, although the HVIC model allows us to measure differences in the importance accorded to some values, it does not take into account the means by which people will display these values, which may differ across cultural contexts. Therefore, in the present study, we propose to examine the effects of HVIC dimensions on offending driving behaviours among a sample of French drivers. Also, we propose that relevant ways of achieving values associated with HVIC's dimensions could differ according to gender. Finally, we also propose to explore how these effects may be moderated by situational factors regarding driving context.

1.2. Gender differences and driving behaviours

Numerous studies point at gender differences in driving behaviours. Usually, men tend to express more violations, aggressive and speeding behaviours than women (Guého, Granié, & Abric, 2014; Özkan & Lajunen, 2006; Parker, Reason, et al., 1995; Reason, Manstead, Stradling, Baxter, & Campbell, 1990) and are more risk-oriented and less safety-oriented than women on the road (Laapotti, Keskinen, Hatakka, & Katila, 2001; Meadows & Stradling, 1999). Women are generally more punishment-sensitive and men are generally more sensation seeking through risky activities (for a meta-analysis see Cross, Copping & Campbell, 2011). To explain these differences, other lines of research propose that reckless driving may constitute a cultural worldview entailing potential benefits for self-worth, through a sense of mastery and competence, social prestige and acceptance, which could be relevant for young men but not for young women (Evans, 1991; Harré, Field, & Kirkwood, 1996; Iram & Taubman Ben-Ari, 1994; Taubman Ben-Ari & Findler, 2003) because of gender differences in expectations about appropriate behaviours on the road (Tschanz, Morf, & Turner, 1998) . Therefore, reckless

driving could constitute a relevant way of achieving these values especially for men. For instance, Schreer (2002) found that entitlement, a specific dimension of narcissism, predicted aggressive driving behaviours for men but not for women. An interesting fact is that entitlement and VI are conceptually close because of their common emphasis on inequality, uniqueness, power, competition, and status and are positively correlated (Cai, Kwan, & Sedikides, 2012; Le, 2005; Raskin & Terry, 1988). Therefore, we expect that VI predicts traffic offences better for men than for women.

1.3. Driving situation, presence of enforcement and of other road users

Some studies have highlighted the role of the presence of enforcement on driving offences, and its interactions with individual differences. Within the framework of the deterrence theory, general deterrence postulates that individuals are motivated to avoid the negative consequences of committing offences if they were warned of impending penalties (Gibbs, 1985; Homel, 1988). This approach is relevant for understanding the effectiveness of traffic enforcement, such as speed enforcement (Høye, 2014; Jones, Sauerzapf, & Haynes, 2008; Kergoat, Delhomme, & Meyer, 2017; Retting, Kyrychenko, & McCartt, 2008; Stanojević, Jovanović, & Lajunen, 2013; Walter, Broughton, & Knowles, 2011). For example, Kergoat et al. (2017) showed that the announcement of a speed-enforcement message decreases speeding intentions for young drivers. Many studies have identified the certainty of being caught as a critical factor in deterrence effects (Decker, Wright, & Logie, 1993; Nagin, 2013; Nagin & Pogarsky, 2001; Von Hirsch, Bottoms, Burney, & Wikstrom, 2000). However, other studies have shown that deterrence effects on driving offences may be moderated by belonging to a social category that values offending behaviours (Fleiter, Lennon, & Watson, 2010). Considering this point and that men are generally less punishment-sensitive (Cross, Copping & Campbell, 2011) we expect that enforcement effects (decreasing traffic offences) would be lower for men than women.

Moreover, other situational factors such as the presence of other road users may affect driving behaviours with regard to traffic rules, depending on individual differences. This is the case with aggressive behaviours on the road, depending on the acts of other users but also on the age and gender of the respondent (Wiesenthal, Hennessy, & Gibson, 2000). Also, drivers report the presence of passengers and unknown road users as two different sources of social influence (Fleiter et al., 2010). Although the first is already well documented (e.g., Conner, Smith, & McMillan, 2003; Ouimet et al., 2013; Rosenbloom & Perlman, 2016; Simons-Morton, Lerner, & Singer, 2005) the last seems to be much less so. Thus, we argued that the presence of other road users may represent a risk of road accidents and encourage mistrust and cautious driving or constitute an opportunity to compete, to demonstrate one's mastery of the vehicle and dominance over others through aggressive or offending behaviours. Therefore, we expected that the presence of other road users would moderate HVIC dimensions effects on driver's offending behaviours according to their respective gender.

More broadly speaking, we think that taking account of the driving situation, following a "Person X Situation approach" (Bargh, Lombardi, & Higgins, 1988; Lewin, 1935, 1951), may be a relevant way of better understanding how individual differences can take shape in driving (Hennessy & Wiesenthal, 1997; Vingilis & Mann, 1986).

1.4. Aims and hypotheses

First, the study aimed to test the effects of HVIC dimensions on offending behaviours among a French drivers' sample. Based on results from Nordfjærn and Şimşekoğlu (2014), we expected that driving offences would be positively predicted by VI (*H1*) and negatively predicted by VC (*H2*). Second, we expected classical gender differences, with men being associated with more traffic offences than women (*H3*). Also, we expected that the positive effect of VI on offences would be greater for men than for women (*H4*). No interaction hypotheses were made for other

HVIC dimensions. Third, we expected that a high level of enforcement, compared to a low one, would decrease driving offences (*H5*) and that this effect would be lower for men than for women (*H6*). Finally, in an explanatory way, we proposed to assess how the presence of other road users might influence traffic offences and interact with HVIC dimensions and gender differences (*H7*). These hypotheses and expected relationships between variables are summarized in Figure 1.

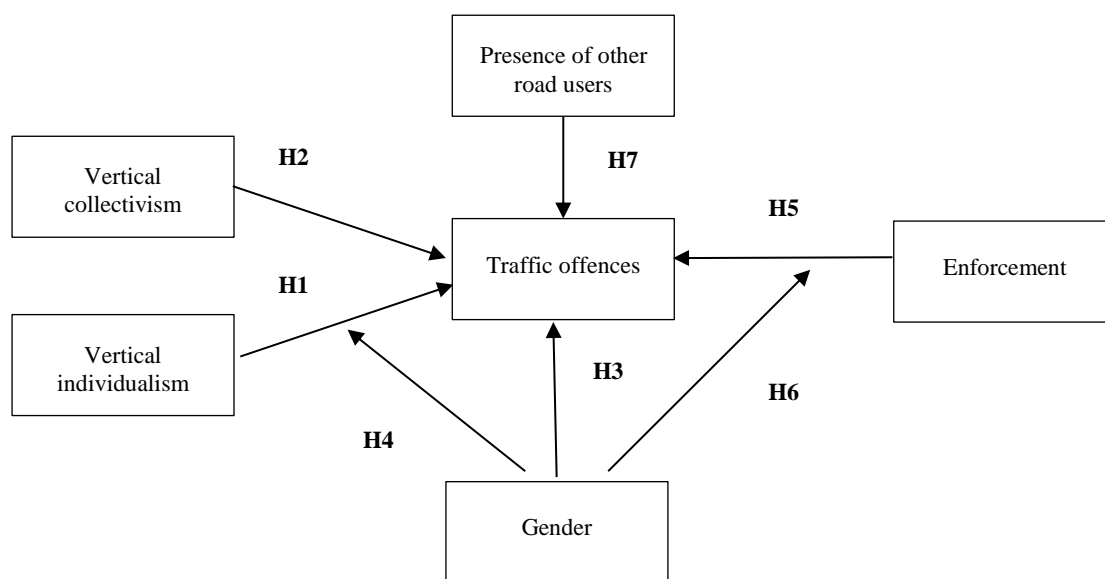


Fig. 1 Hypothesized working model of the study

2. Methods and materials

2.1. Materials and procedure

The study was based on an online questionnaire survey shared on various social network groups (Facebook groups for exchanges, sales, various inquiries and students), general discussion forums and volunteers registered on the mailing list of *Relais d'Information sur les Sciences de la Cognition* (group for distributing information on cognition sciences), in France. The shared

message informed potential participants that the study was about links between regular driving behaviours and some aspects of personality. They were also informed that holding a valid driving license was necessary for their participation and were invited to click on a link for participation. After clicking on the link, they were redirected to the LimeSurvey® web application, with an introductory page mentioning that their answers would be anonymous and confidential, and again specifying that holding a valid driving license was necessary for participation although their license status was not directly checked. The questionnaire comprised the following measurements.

2.1.1. Self-reported probabilities of committing driving offences and driving situations

Based on French traffic laws and on a French version of the Driver Behaviour Questionnaire (Guého et al., 2014), we created a 12-item self-reported scale assessing the probabilities of committing driving offences (PCDO). This presents 12 driving offence behaviours which could be detected in real situations by enforcement officers and / or by automatic systems (e.g., *“Not observing the speed limit on the highway”*, *“Driving while exceeding the blood alcohol limit”*, *“Using a mobile phone manually while driving”*). For each item, participants were asked how likely they were to adopt the presented behaviour if they were in the situation presented subsequently, on a Likert scale ranging from (1) “unlikely” to (5) “very likely”. Self-reported probabilities of committing driving offences were preferred to behavioural intentions, because behavioural intentions can restrict driving offences to deliberate behaviours, whereas drivers can break traffic rules unintentionally (e.g., speeding on the highway by not paying attention to the speedometer or the speed limitations) and become aware of it later.

To explore the role of the driving situation, participants were asked to complete to the scale with regards to three different situations. In the first situation, it was indicated that the behaviours took place in *“an area where traffic is low and where checks are infrequent”* (called

“low enforcement situation” or “low traffic situation”). In the second situation, it was indicated that the behaviours took place in “*an area where traffic is heavy and where checks are infrequent*” (called “heavy traffic situation”). In the third situation, it was indicated that the behaviours took place in “*an area where traffic is low and where checks are frequent*” (called “high enforcement situation”). Given that comparing the high enforcement / low traffic density situation with the low enforcement / high traffic density one is sufficient to evaluate the main effects of both enforcement and traffic density, we chose not to consider a heavy traffic and frequent checks situation. This was done to avoid overloading the procedure which could exhaust participants. The presentation order was counterbalanced for the three situations: participants were directed toward one of the six versions of the questionnaire according to their date of birth (for example, the first version if they were born between the first and the fifth of a month). Within each condition, the item presentation order was randomized by the software.

2.1.2. Horizontal and Vertical Individualism and Collectivism Scale

To our knowledge, the only French versions of the HVIC scale currently available are those developed by Rakotomalala (2010, 32 items) and Breduillieard (2009, 23 items). These scales were translated directly from English to Quebec French and some formulations were not well adapted for the French population. Also, the internal consistency of the four dimensions was not satisfactory, Cronbach’s alpha-coefficients range from .46 to .69 for Rakotomalala (2010) and from .52 to .79 for Breduillieard (2009). Sample sizes were low for both studies (respectively $N = 121$ and $N = 111$) and many of the participants were foreign students from various countries, not allowing language-related differences to be ruled out. Because these French speaking versions were not satisfactory, we examined the English versions of the scale. The 16-item version of the HVIC scale, proposed by Triandis and Gelfand (1998) presented generally acceptable properties in several studies based on various samples (e.g., Chiou, 2001; Lee & Choi, 2005; Soh & Leong, 2002). Considering the better properties of the English version

of the HVIC scale and the limitations of the Quebec French versions, we created a French version of the 16-item HVIC from the Triandis and Gelfand scale (1998). In order to offer a version adapted to the French population, we retained the translation from Rakotomalala (2010) for 11 of the 16 items and the 5 remaining items were directly translated from the English version. Each dimension contained four items for VI (e.g., “*Competition is the law of nature*”), HI (e.g., “*I rely on myself most of the time. I rarely rely on others*”), VC (e.g., “*Family members should stick together, no matter what sacrifices are required*”) and HC (e.g., “*I feel good when I cooperate with others*”). Participants were asked to rate their level of agreement for each item on a Likert scale ranging from (1) “don’t agree at all” to (7) “totally agree”.

2.1.3. Socio-demographical data

At the end of the questionnaire, participants were asked to report their gender, age, occupation (SES) and the number of years since they had obtained their driving licence (YL).

2.2. Sample

Among the 666 participants who started the survey, 227 (34%) partially completed it (and did not fill in demographic information) and 439 (66%) fully completed it (and filled in demographic information). Among these, age ranged from 18 to 80 years with an average of 32.40 (SD = 12.53), 306 were women (70%) and 133 were men (30%). The number of years since obtaining the driving license (YL) ranged from 1 to 54 years with an average length of 12.66 (SD = 12.10). Given that the correlation between age and YL was significant and very strong ($r = .97$, $p < .001$), only YL was retained for further analyses. Also, socio-economic status (SES) was coded as a continuous variable¹.

¹ We applied coding 1 for inactive (i.e., unemployed, retired), 2 for low (i.e., employees, workers), 3 for middle (intermediate professions) and 4 for high SES (i.e., executives, intellectual professions).

3. Statistical procedures

The validity and reliability of the HVIC and PCDO scales were first checked. Cronbach's alpha coefficients were computed for global and situational-specific scores of the PCDO scale. As the HVIC scale was newly translated into French, we performed an exploratory factor analysis (EFA) to check the latent structure. The Kaiser criterion of eigenvalues over 1.0, the examination of Cattell's scree-plot and the result of parallel analysis (Hayton, Allen, & Scarpello, 2004; Horn, 1965; O'Connor, 2000; Watkins, 2006) were used to determine the number of factors to be extracted. A principal component analysis (PCA) with Varimax rotation was next used with specification of the number of factors to be extracted. Cronbach's alpha coefficients were also computed for each dimension and correlations between dimensions were checked.

To test the main effects of HVIC dimensions, driving situations, gender, and their interactions on the PCDO score, we used a general linear model with repeated measures (also called "linear mixed model"). Several authors (Cohen & Cohen, 1983; Gully, 1994; Hollenbeck, Ilgen, & Sego, 1994) have recommended this analysis for mixed design with a continuous predictor (here, HVIC dimensions) and covariates (here, YL and SES), which allow for partitioning total variance into within and between components while maintaining regression's advantage of having a continuous predictor variable.

Driving situation was entered as a within-subject variable, HVIC dimensions and gender were entered as between-subject variables and YL and SES were entered as covariates because of their potential effect on driving offences (e.g., Atombo, Wu, Tettehio, & Agbo, 2017; Grimm & Treibich, 2010). All continuous predictors entered as independent variables or covariates were standardized to improve interpretability and avoid multicollinearity issues (Aiken & West, 1991; Judd & McClelland, 1989). The main effect of driving situation was further examined

with pairwise comparisons (i.e., post-hoc tests with Bonferroni correction). Significant second order interaction was followed by a separate general linear model with repeated measures for each modality of the moderator (at this stage, gender). Significant first-order interactions were followed by simple slopes regression analyses to test the effect of the predictor on PCDO score for each modality of the moderator (at this stage, driving situations) (Aiken & West, 1991; Hayes, 2013). Finally, simple slopes for each driving situations were compared with Steiger's Z test for correlated correlation coefficients² (see Dunn & Clark, 1969, 1971; Meng, Rosenthal, & Rubin, 1992). Mauchly's test of sphericity was checked before examining results of linear mixed models. When sphericity was not assumed ($p < .05$), results for within subject-variables were established with the Greenhouse-Geisser correction. Significant effects implying covariates were only reported in tables and not discussed here.

4. Results

4.1. Dimensionality and reliability of the measurement instruments

4.1.1 Self-reported PCDO scale and driving situations

Cronbach's alpha coefficients indicated an adequate reliability for the scale in each driving situation (low enforcement / low traffic $\alpha = .83$; heavy traffic $\alpha = .80$; high enforcement $\alpha = .81$), for the overall mean score (overall $\alpha = .92$) and allowed us to compute a score for each situation and for the overall mean.

4.1.2. HVIC scale

Examination of Kaiser criterion, Cattell's scree-plot and the result of parallel analysis indicated a 4-factor solution, which was then specified for the PCA. Results show that all items had a

² Steiger's Z test is based on correlation coefficients between variables, not on beta values of simple slopes. However, given that we used standardized predictors in simple slopes analysis and partial correlations for adjusting YL effect in correlation analysis, standardized beta of simple slopes and correlation coefficients were almost the same.

saturation coefficient above .45. The first factor with 5 items corresponded to the HC dimension; the second factor with 4 items to the VI dimension; the third factor with 3 items to the VC dimension and the fourth factor with 4 items to the HI dimension. All items were positioned on the expected dimensions, except item 10 (*"It is important for me that I respect the decisions made by my groups"*) which was positioned on HC although it was hypothesized as an item of VC. However, saturation of this item in the HC dimension had already been observed in previous studies (Li & Aksoy, 2007; Soh & Leong, 2002). Item 9 was removed (*"I'd rather depend on myself than others"*) as it allowed the alpha coefficient to move from .57 to .64 for the HI dimension. Regarding scale reliability, Nunnally (1978, pp. 245–246) argued that an acceptable alpha coefficient should be at least .70. However, some authors have suggested that a coefficient between .60 and .70 should be low but acceptable (e.g., Aron, Aron, & Elliot, 2005, p. 383; George & Mallery, 2003, p. 231; Hair, Black, Babin, Anderson, & Tatham, 2006; Murphy & Davidshofer, 1988, p. 89), particularly because the alpha coefficient is decreased for factors containing few items (Churchill & Peter, 1984; Peterson, 1994, p. 389). Therefore, the alpha coefficients found here were considered as acceptable (ranging from .64 to .69) and the final model explained 52.68% of variance. They are presented in Table 1. As shown in Table 2, correlations between HVIC dimensions were significant and positive (except for HC and VI) but weak (Cohen, 1988), ranging from .11 to .24.

Table 1. *Summary of Factor Analysis Results for horizontal and vertical individualism and collectivism scale using Principal Component Analysis (varimax rotation; n = 500).*

Items	Factor 1	Factor 2	Factor 3	Factor 4
12. The well-being of my coworkers is important to me.	.77			
8. I feel good when I cooperate with others.	.72			
16. To me, pleasure is spending time with others.	.66			
10. It is important to me that I respect the decisions made by my groups.	.62			
4. If a coworker gets a prize, I would feel proud.	.44			
7. Winning is everything.		.73		
11. It is important that I do my job better than others.		.72		
3. Competition is the law of nature.		.70		
15. When another person does better than I do, I get tense and aroused.		.69		
6. Parents and children must stay together as much as possible.			.84	
14. Family members should stick together, no matter what sacrifices are required.			.77	
2. It is my duty to take care of my family, even when I have to sacrifice what I want.			.65	
5. I rely on myself most of the time; I rarely rely on others.				.72
13. My personal identity, independent of others, is very important to me.				.69
1. I often do “my own thing.”				.56
Eigenvalues	2.77	2.34	1.51	1.29
% of variance	18.48	15.59	10.03	8.58
Cronbach’s alpha	.67	.69	.69	.64

Table 2. *Bivariate correlations between horizontal and vertical individualism and collectivism dimensions (n = 500).*

	VI	HI	VC	HC
Horizontal individualism (HI)	.21**	-		
Vertical collectivism (VC)	.20**	.20**	-	
Horizontal collectivism (HC)	-.01	.11*	.24**	-

Notes. * $p < .05$. ** $p < .01$.

4.2. Effect of HVIC dimensions, gender and driving situation on PCDO.

For the model testing HVIC dimensions, no significant main effect of SES level on PCDO was found ($p > .10$), therefore the covariate was removed and the analysis reiterated. A significant main effect was found for VI, which positively predicted PCDO, $F(1,418) = 4.83$, $p < .05$, partial $\eta^2 = .01$, thus *H1 cannot be rejected*. . No other main effect was found for HVIC dimensions, all p 's $> .10$, thus *H2 was rejected*. The main effect of gender was significant, men had higher PCDO scores than women, $F(1,418) = 4.60$, $p < .05$, partial $\eta^2 = .01$, thus *H3 cannot be rejected*. The main effect of driving situation was significant, $F(1, 792) = 171.57$, $p < .001$, partial $\eta^2 = .29$. A significant driving situation*VI interaction was found, $F(2, 792) = 5.18$, $p < .01$, partial $\eta^2 = .01$ along with a significant gender*HC interaction, $F(1,418) = 7.34$, $p < .01$, partial $\eta^2 = .02$. The gender*situation interaction did not reach significance, $p > .10$, thus *H5 was rejected*. Finally, a significant second-order driving situation*Gender*VI interaction emerged, $F(2,792) = 3.79$, $p < .05$, partial $\eta^2 = .01$. Sample sizes and PCDO scores across driving situation and gender are presented in Table 3, and results for the model are presented in Table 4.

Table 3. *Self-reported probabilities of committing driving offences scores, standard deviations and sample sizes across driving situation and gender distribution (N = 429).*

	LE/LT	HT	HE	OMS	Sample size
Women	2.01 (.62)	1.67 (.53)	1.58 (.49)	1.75 (.55)	N = 299
Men	2.08 (.67)	1.78 (.55)	1.67 (.50)	1.84 (.57)	N = 130
Total	2.03 (.64)	1.70 (.53)	1.61 (.49)	1.78 (.56)	N = 429

Note. LE/LT = Low Enforcement / Low Traffic situation; HT = Heavy Traffic situation; HE = High Enforcement situation; OMS = Overall Mean Score. Standard deviations appear between brackets.

Pairwise comparisons were conducted to interpret the main effect of driving situation. PCDO were significantly higher in the low enforcement / low traffic situation (estimated marginal mean = 2.05, SD = .03) than in the heavy traffic situation (estimated marginal mean = 1.73, SD = .03), $p < .001$, and the high enforcement situation (estimated marginal mean = 1.64, SD = .026), $p < .001$. A third comparison indicated that PCDO were also significantly higher in the heavy traffic situation than in the high enforcement situation, $p < .001$. Given these results, *H5 cannot be rejected* and *H7 was partially corroborated*. Simple slopes analysis for the gender*HC interaction indicated a simple effect of HC for men, $\beta = .22$, $p = .01$, $R^2 = .05$, predicting an increase in PCDO, but not for women, $p > .10$.

Results of separate general linear models with repeated measures across genders are presented in Table 5 for men and Table 6 for women. Among men, analyses revealed a significant driving situation*VI interaction, $F(2,214) = 5.42$, $p < .01$, partial $\eta^2 = .04$. VI positively predicted PCDO in the low enforcement / low traffic situation, $\beta = .19$, $p < .05$, $R^2 = .04$, but not in the heavy traffic situation, $\beta = .16$, $p > .05$, nor in the high enforcement situation, $\beta = -.002$, $p >$

.10. The Steiger's Z tests showed that the low enforcement / low traffic slope significantly differed from the high enforcement slope, $Z = 2.468$, $p < .05$, but not from the heavy traffic slope, $Z = .726$, $p > .05$. Tests also showed that the heavy traffic slope significantly differed from the high enforcement slope, $Z = 2.254$, $p < .05$. Among women, analysis indicated a main effect of VI, predicting more PCDO, $F(1,296) = 3.97$, $p < .05$, partial $\eta^2 = .01$. However, simple slopes analyses failed to reveal a statistically significant effect of VI on PCDO for each traffic situation (all p 's $> .05$). Given these results, *H4 and H7 were partially corroborated*.

Table 4. Summary of linear mixed model testing effect of HVIC dimensions on self-reported probabilities of committing driving offences ($N = 429$).

Variables	Sum of Squares	Df	Mean Square	F	Partial Eta Squared
Within-subject variables					
Situation	32.067	1.894	16.926	171.571***	.29
Situation*YL	.790	1.894	.417	4.228*	.01
Situation*Gender	.064	1.894	.034	.340	< .01
Situation*VI	.969	1.894	.511	5.183**	.01
Situation*HI	.145	1.894	.077	.778	< .01
Situation*VC	.303	1.894	.160	1.623	< .01
Situation*HC	.021	1.894	.011	.114	< .01
Situation*Gender*VI	.709	1.894	.374	3.793*	.01
Situation*Gender*HI	.264	1.894	.140	1.414	< .01
Situation*Gender*VC	.054	1.894	.029	.289	< .01
Situation*Gender*HC	.144	1.894	.076	.773	< .01
Error	78.125	791.901	.099		
Between-subject variables					
A (intercept)	3319.132	1	3319.132	4742.731***	.92
YL	8.986	1	8.986	12.840***	.03
Gender	3.219	1	3.219	4.600*	.01
VI	3.377	1	3.377	4.826*	.01
HI	.003	1	.003	.004	< .01
VC	.007	1	.007	.010	< .01
HC	1.425	1	1.425	2.035	< .01
Gender*VI	.160	1	.160	.229	< .01
Gender*HI	1.312	1	1.312	1.874	< .01
Gender*VC	.092	1	.092	.132	< .01
Gender*HC	5.135	1	5.135	7.337**	.02
Error	292.531	418	.700		

Note. For within-subject variables, reported values were established with the Greenhouse-Geisser correction because sphericity was not assumed.

* $p < .05$. ** $p < .01$. *** $p < .001$

Table 5. Summary of linear mixed model testing effect of vertical individualism on self-reported probabilities of committing driving offences for men.

Variables	Sum of Squares	df	Mean Square	F	Partial Eta Squared
Within-subject variables					
Situation	11.448	1.688	6.780	56.233***	.31
Situation*YL	.858	1.688	.508	4.213*	.03
Situation*VI	1.102	1.688	.653	5.415**	.04
Error	25.856	214.436	.121		
Between-subject variables					
A (intercept)	1245.743	1	1245.743	1676.628***	.93
YL	4.071	1	4.071	5.479*	.04
VI	1.946	1	1.946	2.618	.02
Error	94.362	127	.743		

Note. For within-subject variables, reported values were established with the Greenhouse-Geisser correction because sphericity was not assumed.

* $p < .05$. ** $p < .01$. *** $p < .001$

Table 6. Summary of linear mixed model testing effect of vertical individualism on self-reported probabilities of committing driving offences for women.

Variables	Sum of Squares	df	Mean Square	F	Partial Eta Squared
Within-subject variables					
Situation	29.047	2	14.524	161.082***	.35
Situation*YL	.174	2	.087	.965	< .01
Situation*VI	.044	2	.022	.243	< .01
Error	53.376	592	.090		
Between-subject variables					
A (intercept)	2692.903	1	2692.903	3890.250***	.93
YL	4.977	1	4.977	7.189**	.02
VI	2.750	1	2.750	3.973*	.01
Error	204.897	296	.692		

Note. For within-subject variables, reported values were established without correction because sphericity was assumed.

* $p < .05$. ** $p < .01$. *** $p < .001$

5. Discussion

The aim of the study was to test the effects of HVIC dimensions on traffic offences. In line with H1, results showed a main effect of VI predicting higher self-reported probabilities of committing driving offences. This result is consistent with Nordfjærn and Şimşekoğlu (2014) who found that VI predicted higher driving violations for drivers. Contrary to H2, no main

effects from other HVIC dimensions on driving offences were found. This result contrasts with those of Nordfjærn and Şimşekoğlu (2014). Although they did not find effects of HI and HC on violations, they found a negative effect of VC on these behaviours. They proposed that VC may imply a greater tendency to comply with authorities and the law in traffic, and to exhibit more collaborative behaviour with other road users (Nordfjærn & Şimşekoğlu, 2013, 2014; Nordfjærn & Zavareh, 2016). However, VC is more generally defined as a trend of perceiving oneself more in relation with others, to seek to enhance the cohesion and status of the in-group and to comply with authorities and traditions (Shavitt et al., 2010). Therefore, it seems necessary to question what in-group, source of authority and tradition the driver is referring to and if these references vary according to the situation. Authority may refer to legal rules or norms of the referent group, like family or friends, which may be in opposition. Referring to legal authority and rules may also depend on their perceived legitimacy (Bradford, Hohl, Jackson, & MacQueen, 2015; Tyler, 1990, 2006), whereas understanding the role of group norms needs to take into account group identification, social categorization and their dynamics, relying on social identity theory (SIT; Tajfel & Turner, 1979) and self-categorization theory (SCT; Turner, Hogg, Oakes, Reicher, & Wetherell, 1987). Future research should consider these constructs to further understand their role in determining offending driving behaviours.

Results also demonstrated, in line with H3, that being male is associated with more driving offences. This result is consistent with previous research showing that men declare more violations, aggressive and speeding behaviours (Guého et al., 2014; Özkan & Lajunen, 2006; Parker, Reason, et al., 1995; Reason et al., 1990) and are more risk-oriented and less safety-oriented than women on the road (Laapotti et al., 2001; Meadows & Stradling, 1999). Results also show that, as predicted through H5, driving offences were less frequent when the traffic is presented as heavy (*versus* low) and even less frequent when the certainty of being caught was presented as high (*versus* low). These results confirmed the effect of the certainty of being

caught as a critical factor in deterrence (Decker et al., 1993; Nagin, 2013; Nagin & Pogarsky, 2001; Von Hirsch et al., 2000), including driving behaviours (Høye, 2014; Jones et al., 2008; Kergoat et al., 2017; Retting et al., 2008; Stanojević et al., 2013; Walter et al., 2011). However, contrary to H6, although the meta-analysis of Cross et al. (2011) reported that women are more punishment-sensitive than men, our results did not corroborate the fact that men are less sensitive to road enforcement than women. It is possible that this result was due to a floor effect in the high enforcement condition because the frequent checks were perceived as too important a threat for both genders. Proposing more nuanced levels of enforcement and more ecological material (e.g., the warning signs used in Kergoat et al. 2017) could allow to rule out this possibility.

Our results also suggest that, following H7, heavy (versus low) traffic situation decrease offending behaviours. Anticipating driving in a heavy traffic situation may involve considering spatial constraints and numerous interactions imposed by other road users which may be perceived as a source of danger in the case of rule breaking. Therefore, in such a situation, complying more with rules could be perceived as an effective means of improving the driver's own safety. Further studies should operationalize more precise theoretical frameworks to understand how the presence of other users can deter drivers from committing offences.

We have seen that HC positively predicted driving offences but only among men and regardless of the situation. In their studies, Nordfjærn and colleagues did not test the gender*HC interaction, and they did not find any main effect of HC on violations for drivers (Nordfjærn & Şimşekoğlu, 2014). However, they found a positive effect of HC on transgressions and aggressive behaviours for pedestrians (Nordfjærn & Şimşekoğlu, 2013). As an explanation of this effect, they proposed the tendency, for high horizontal collectivists, to place less emphasis on overarching authorities. However, HC appears to be correlated with conformity trait (a general tendency to conform with others, see Nordfjærn & Zavareh, 2016). Therefore, we may

suggest that HC could imply greater conformity to perceived social norms (such as normative expectations regarding gender roles), which lead to more offences among men drivers. Nevertheless, this suggestion should be investigated in further research.

Results also suggest, in accordance with H4, that VI positively predicts male drivers' offending behaviours for a low, but not a high, certainty of being caught. However, though analyses conducted on women suggested a main effect of VI, a simple slopes analyses failed to detect it. Thereby, the situational constraint of being caught seems to inhibit the expression of gender differences. Also, these results are consistent with Schreer's (2002) which showed that entitlement predicted aggressive driving behaviours for men only. These were explained by gender differences in expectations about appropriate behaviours on the road (Tschanz et al., 1998), and by gender differences in centrality of entitlement for the self. Given that high vertical individualists try to distinguish themselves from others through competitive behaviours and power seeking (Singelis et al., 1995), it is possible that these tendencies may be expressed on the road by increased more risk-taking and offending behaviours because of their potential performative, competitive and power-related nature (norm violators can be perceived as having more power, see Van Kleef, Homan, Finkenauer, Gündemir, & Stamkou, 2011). The attribution of such character and symbols to risky and offending driving behaviours would constitute specific gender cultural worldviews relevant for men and not women (Evans, 1991; Harré et al., 1996; Iram & Taubman Ben-Ari, 1994; Taubman Ben-Ari & Findler, 2003). However, it was found that conformity to stereotypical masculine and feminine traits could mediate the effect of gender on road violations (Granié, 2009; Guého, 2015). Taking account of this variable in further studies might refine our understanding of the interactions between VI/HC and gender on offending behaviours.

5.1. Implications

Our results offer potential perspectives, for research and application. From this study, we can firstly suggest that the transposition of a cultural value level approach to an individual one (through the HVIC model) may be relevant for understanding driving behaviours. However, it needs to account of how these values can make sense for the individuals and their social groups of reference. Belonging to a gender group may socially guide the ways of expressing and affirming these values, through social roles and norms. Also, referring to legal rules and legal authorities may depend on their compatibility with the norms of salient referent groups. It seems that few studies have attempted to propose theoretical connections between individualism-collectivism approaches at individual level, including the HVIC model, and theories considering group identification and social categorization, such as SIT and SCT. Such a perspective could help better understand how and when values, at individual level, can be made accessible, activated and can influence behaviours, such as driving and offending behaviours.

Secondly, our results suggest that HVIC influences may be modulated and constrained by situational influences that should be taken into account for application. For understanding the psychology of driving, this proposed approach suggests the importance of not reducing drivers' behaviour to its individual characteristics only but of considering the potential primacy and interactive nature of situational factors, as previously pointed out by some studies (e.g., Hennessy & Wiesensthal, 1997; Vingilis & Mann, 1986). In this respect, results specifically suggest that enforcement may inhibit the expression of gender differences, and more broadly, the expression of individual differences. Therefore, deterrence strategies based on enforcement may be effective in dealing with a large and heterogeneous population on the road, apart from the constraints and costs required for actions targeted and adjusted for driver types. At least in the short term, this also corroborates actions aiming to induce a continuous high perceived risk of being caught amongst drivers, for instance by deploying a large fleet of mobile speed cameras

concealed in unmarked cars, as currently planned in France (“Speeding tickets to soar as radar cars to be privatised,” 2017). However, the efficacy of these actions on drivers’ behaviours and their sensitivity to enforcement need to be evaluated for short and long-term effects.

5.2. Limitations

Some limitations must be acknowledged. The imbalance for gender sample size may explain the presence of VI and HC effects for men only, also these results must be interpreted with caution and need to be replicated in confirmatory designs to rule out potential false positives. Moreover, the study manipulated only one factor that does not permit to be confident in the causal processes involved. Developing an experimental approach to prime HVIC dimensions following commentaries of some authors (Meyers-Levy, 2006; Oyserman, 2006; Oyserman & Lee, 2008; Shavitt, Zhang, et al., 2006), and priming gender stereotypes (e.g., Schmid Mast, Sieverding, Esslen, Graber, & Jäncke, 2008) could allow to test causality assumptions. Self-reported questionnaires may also be subject to issues about desirability bias and predictive validity. However, some studies tend to show that self-reported driving behaviours are only slightly affected by social desirability (Lajunen & Summala, 2003; Sullman & Taylor, 2010) and that self-reported offences may be effective in predicting driving behaviours (Helman & Reed, 2015; Zhao et al., 2012). Also, the French proposed HVCI scale suffers from some limitations. The VC dimension was reduced to 3 items only, all referring to family, while this is not the case on the Turkish scale, although most of them also referred to family. Moreover, no back-translations were proposed. These methodological limitations may explain the absence of significant effects of VC on offending driving behaviours. Therefore, a further French validation of a longer version of the HVIC scale would be preferable.

References

- Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions*. Thousand Oaks, CA: Sage.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211. [https://doi.org/10.1016/0749-5978\(91\)90020-t](https://doi.org/10.1016/0749-5978(91)90020-t)
- Aron, A., Aron, E. N., & Elliot, C. J. (2005). *Statistics for the behavioral and social sciences: A brief course* (3rd ed.). London: Pearson Prentice Hall.
- Atombo, C., Wu, C., Tettehfiio, E. O., & Agbo, A. A. (2017). Personality, socioeconomic status, attitude, intention and risky driving behavior. *Cogent Psychology*, 4(1). <https://doi.org/10.1080/23311908.2017.1376424>
- Bargh, J. A., Lombardi, W. J., & Higgins, E. T. (1988). Automaticity of chronically accessible constructs in person \times situation effects on person perception: It's just a matter of time. *Journal of Personality and Social Psychology*, 55(4), 599–605. <https://doi.org/10.1037/0022-3514.55.4.599>
- Barraclough, P., af Wählberg, A., Freeman, J., Watson, B., & Watson, A. (2016). Predicting Crashes Using Traffic Offences. A Meta-Analysis that Examines Potential Bias between Self-Report and Archival Data. *PLOS ONE*, 11(4), e0153390. <https://doi.org/10.1371/journal.pone.0153390>
- Bradford, B., Hohl, K., Jackson, J., & MacQueen, S. (2015). Obeying the Rules of the Road: Procedural Justice, Social Identity, and Normative Compliance. *Journal of Contemporary Criminal Justice*, 31(2), 171–191. <https://doi.org/10.1177/1043986214568833>

- Breduillieard, P. (2009). *L'efficacité du message publicitaire à argumentation biréférentielle au Mexique, un pays collectiviste membre de l'ALENA ?* Mémoire de maîtrise en administration des affaires non publié, Université du Québec, Montréal.
- Cai, H., Kwan, V. S. Y., & Sedikides, C. (2012). A Sociocultural Approach to Narcissism: The Case of Modern China: Chinese narcissism. *European Journal of Personality*, 26(5), 529–535. <https://doi.org/10.1002/per.852>
- Cestac, J., Paran, F., & Delhomme, P. (2011). Young drivers' sensation seeking, subjective norms, and perceived behavioral control and their roles in predicting speeding intention: How risk-taking motivations evolve with gender and driving experience. *Safety Science*, 49(3), 424–432. <https://doi.org/10.1016/j.ssci.2010.10.007>
- Cestac, J., Paran, F., & Delhomme, P. (2014). Drive as I say, not as I drive: Influence of injunctive and descriptive norms on speeding intentions among young drivers. *Transportation Research Part F: Traffic Psychology and Behaviour*, 23, 44–56. <https://doi.org/10.1016/j.trf.2013.12.006>
- Chiou, J. S. (2001). Horizontal and vertical individualism and collectivism among college students in the United States, Taiwan, and Argentina. *J Soc Psychol*, 141(5), 667–678. <https://doi.org/10.1080/00224540109600580>
- Churchill, G. A., & Peter, J. P. (1984). Research Design Effects on the Reliability of Rating Scales: A Meta-Analysis. *Journal of Marketing Research*, 21, 360-. <https://doi.org/10.2307/3151463>
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). NJ: Erlbaum: Hillsdale.
- Cohen, J., & Cohen, P. (1983). *Applied multiple regression/correlational analysis for the behavioral sciences*. Mahwah, NJ: Erlbaum.

- Conner, M., Smith, N., & McMillan, B. (2003). Examining normative pressure in the theory of planned behaviour: Impact of gender and passengers on intentions to break the speed limit. *Current Psychology*, 22, 252–263. <https://doi.org/10.1007/s12144-003-1020-8>
- Cooke, R., Dahdah, M., Norman, P., & French, D. P. (2016). How well does the theory of planned behaviour predict alcohol consumption? A systematic review and meta-analysis. *Health Psychology Review*, 10(2), 148–167. <https://doi.org/10.1080/17437199.2014.947547>
- Cross, C. P., Copping, L. T., & Campbell, A. (2011). Sex differences in impulsivity: A meta-analysis. *Psychological Bulletin*, 137(1), 97–130. <https://doi.org/10.1037/a0021591>
- Decker, S., Wright, R., & Logie, R. (1993). Perceptual deterrence among active residential burglars: A research note. *Criminology*, 31(1), 135–147. <https://doi.org/10.1111/j.1745-9125.1993.tb01125.x>
- Degraeve, B., Granié, M.-A., Pravossoudovitch, K., & Lo Monaco, G. (2015). Social representations associated with men and women drivers among French adolescents and adults. Effects of the perceiver's age, sex, and socioeconomic status. *Transportation Research Part F: Traffic Psychology and Behaviour*, 34, 1–17. <https://doi.org/10.1016/j.trf.2015.07.019>
- Dunn, O. J., & Clark, V. (1969). Correlation Coefficients Measured on the Same Individuals. *Journal of the American Statistical Association*, 64(325), 366. <https://doi.org/10.2307/2283746>
- Dunn, O. J., & Clark, V. (1971). Comparison of Tests of the Equality of Dependent Correlation Coefficients. *Journal of the American Statistical Association*, 66(336), 904–908. <https://doi.org/10.1080/01621459.1971.10482369>

- Elliott, M. A., Armitage, C. J., & Baughan, C. J. (2003). Drivers' compliance with speed limits: an application of the theory of planned behavior. *Journal of Applied Psychology*, 88(5), 964–972. <https://doi.org/10.1037/0021-9010.88.5.964>
- Erez, M., & Earley, P. C. (1987). Comparative analysis of goal-setting strategies across cultures. *Journal of Applied Psychology*, 72(4), 658–665. <https://doi.org/10.1037/0021-9010.72.4.658>
- Evans, L. (1991). *Traffic safety and the driver*. New York: Van Nostrand Reinhold.
- Feather, N. T. (1994). Values and culture. In W. J. Lonner & R. S. Malpass (Eds.), *Psychology and culture* (pp. 183–190). Boston: Allyn & Bacon.
- Fleiter, J. J., Lennon, A., & Watson, B. (2010). How do other people influence your driving speed? Exploring the 'who' and the 'how' of social influences on speeding from a qualitative perspective. *Transportation Research Part F: Traffic Psychology and Behaviour*, 13(1), 49–62. <https://doi.org/10.1016/j.trf.2009.10.002>
- French National Inter-Ministerial Office of Road Safety. (2016) *Accidentalité routière 2015 – résultats définitifs Road accident 2015 - Final results*. Retrieved from www.securite-routiere.gouv.fr/content/download/35530/340409/version/2/file/Bilan+d%C3%A9finitif+ONISR+2015.pdf
- George, D., & Mallery, P. (2003). *SPSS for Windows step by step: A simple guide and reference. 11.0 update* (4th ed.). Boston: Allyn & Bacon.
- Gibbs, J. P. (1985). Deterrence theory and research. *Nebraska Symposium on Motivation*, 33, 87–130.
- Granié, M.-A. (2009). Effects of gender, sex-stereotype conformity, age and internalization on risk-taking among adolescent pedestrians. *Safety Science*, 47(9), 1277–1283. <https://doi.org/10.1016/j.ssci.2009.03.010>

- Grimm, M., & Treibich, C. (2010). Socio-economic determinants of road traffic accident fatalities in low and middle income countries. *ISS Working Paper Series/General Series*, 504, 1–44.
- Guého, L. (2015). *Approche psychosociale des effets de l'identité sexuée sur les comportements à risque déclarés au volant et dans différents domaines chez les jeunes conducteurs*. Université d'Aix-Marseille, Aix-en-Provence.
- Guého, L., Granié, M.-A., & Abric, J.-C. (2014). French validation of a new version of the Driver Behavior Questionnaire (DBQ) for drivers of all ages and level of experiences. *Accident Analysis & Prevention*, 63, 41–48. <https://doi.org/10.1016/j.aap.2013.10.024>
- Gully, S. M. (1994). Repeated measures regression analyses: A clarification with illustrative examples. Presented at the the ninth annual conference of the Society for Industrial and Organizational Psychology, Nashville, TN.
- Hair, J. F., Black, W., Babin, B., Anderson, R., & Tatham, R. (Eds.). (2006). *Multivariate data analysis* (6th ed.). Upper Saddle River, N.J: Pearson Prentice Hall.
- Harré, N., Field, J., & Kirkwood, B. (1996). Gender differences and areas of common concern in the driving behaviors and attitudes of adolescents. *Journal of Safety Research*, 27(3), 163–173. [https://doi.org/10.1016/0022-4375\(96\)00013-8](https://doi.org/10.1016/0022-4375(96)00013-8)
- Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York: Guilford Press.
- Hayton, J. C., Allen, D. G., & Scarpello, V. (2004). Factor Retention Decisions in Exploratory Factor Analysis: a Tutorial on Parallel Analysis. *Organizational Research Methods*, 7(2), 191–205. <https://doi.org/10.1177/1094428104263675>
- Helman, S., & Reed, N. (2015). Validation of the driver behaviour questionnaire using behavioural data from an instrumented vehicle and high-fidelity driving simulator.

- Accident Analysis & Prevention*, 75, 245–251.
<https://doi.org/10.1016/j.aap.2014.12.008>
- Hennessy, D. A., & Wiesenthal, D. L. (1997). The relationship between traffic congestion, driver stress and direct versus indirect coping behaviours. *Ergonomics*, 40(3), 348–361. <https://doi.org/10.1080/001401397188198>
- Hofstede, G. (1980). *Culture's Consequences: International Differences in Work-Related Values*. Newbury Park, CA: Sage.
- Hofstede, G. (1983). The Cultural Relativity of Organizational Practices and Theories. *Journal of International Business Studies*, 14(2), 75–89.
<https://doi.org/10.1057/palgrave.jibs.8490867>
- Hollenbeck, J. R., Ilgen, D. R., & Sego, D. J. (1994). Repeated measures regression and mediational tests: Enhancing the power of leadership research. *The Leadership Quarterly*, 5(1), 3–23. [https://doi.org/10.1016/1048-9843\(94\)90003-5](https://doi.org/10.1016/1048-9843(94)90003-5)
- Homel, R. (1988). *Policing and punishing the drinking driver: A study of general and specific deterrence*. New York: Springer-Verlag Publishing.
- Horn, J. L. (1965). A rationale and test for the number of factors in factor analysis. *Psychometrika*, 30(2), 179–185. <https://doi.org/10.1007/bf02289447>
- Høyen, A. (2014). Speed cameras, section control, and kangaroo jumps—a meta-analysis. *Accident Analysis & Prevention*, 73, 200–208.
<https://doi.org/10.1016/j.aap.2014.09.001>
- Iram, A., & Taubman Ben-Ari, O. (1994). *A study for strategic planning of road safety in the Israeli Defense Forces*. Tel-Aviv, Israel: Israeli Defense Forces, Department for Casualties and Road Safety.

- Iversen, H., & Rundmo, T. (2004). Attitudes towards traffic safety, driving behaviour and accident involvement among the Norwegian public. *Ergonomics*, 47(5), 555–572.
<https://doi.org/10.1080/00140130410001658709>
- Jones, A. P., Sauerzapf, V., & Haynes, R. (2008). The effects of mobile speed camera introduction on road traffic crashes and casualties in a rural county of England. *Journal of Safety Research*, 39(1), 101–110. <https://doi.org/10.1016/j.jsr.2007.10.011>
- Judd, C. M., & McClelland, G. H. (1989). *Data analysis: A model-comparison approach*. San Diego, CA: Harcourt Brace Jovanovich.
- Kergoat, M., Delhomme, P., & Meyer, T. (2017). Appraisal of speed-enforcement warning messages among young drivers: Influence of automatic versus human speed enforcement in a known or unknown location. *Transportation Research Part F: Traffic Psychology and Behaviour*, 46, 177–194.
<https://doi.org/10.1016/j.trf.2017.01.005>
- Laapotti, S., Keskinen, E., Hatakka, M., & Katila, A. (2001). Novice drivers' accidents and violations — a failure on higher or lower hierarchical levels of driving behaviour. *Accident Analysis & Prevention*, 33(6), 759–769. [https://doi.org/10.1016/S0001-4575\(00\)00090-7](https://doi.org/10.1016/S0001-4575(00)00090-7)
- Lajunen, T., Parker, D., & Stradling, S. G. (1998). Dimensions of driver anger, aggressive and highway code violations and their mediation by safety orientation in UK drivers. *Transportation Research Part F: Traffic Psychology and Behaviour*, 1(2), 107–121.
[https://doi.org/10.1016/S1369-8478\(98\)00009-6](https://doi.org/10.1016/S1369-8478(98)00009-6)
- Lajunen, T., & Summala, H. (2003). Can we trust self-reports of driving? Effects of impression management on driver behaviour questionnaire responses. *Transportation*

Research Part F: Traffic Psychology Behaviour, 6, 97–107.

[https://doi.org/10.1016/S1369-8478\(03\)00008-1](https://doi.org/10.1016/S1369-8478(03)00008-1)

Le, T. N. (2005). Narcissism and immature love as mediators of vertical individualism and ludic love style. *Journal of Social and Personal Relationships*, 22(4), 543–560.

<https://doi.org/10.1177/0265407505054522>

Lee, W.-N., & Choi, S. M. (2005). The Role of Horizontal and Vertical Individualism and Collectivism in Online Consumers' Responses Toward Persuasive Communication on the Web. *Journal of Computer-Mediated Communication*, 11(1), 317–336.

<https://doi.org/10.1111/j.1083-6101.2006.tb00315.x>

Lewin, K. (1935). *A dynamic theory of personality*. New York, NY, US: McGraw-Hill.

Lewin, K. (1951). *Field theory in social science*. New York, NY, US: McGraw-Hill.

Li, F., & Aksoy, L. (2007). Dimensionality of individualism–collectivism and measurement equivalence of Triandis and Gelfand's scale. *Journal of Business and Psychology*, 21(3), 313–329. <https://doi.org/10.1007/s10869-006-9031-8>

Matsumoto, D., Kouznetsova, N., Ray, R., Ratzlaff, C., Biehl, M., & Raroque, J. (1999).

Psychological Culture, Physical Health, and Subjective Well-being. *Journal of Gender, Culture, and Health*, 4(1), 1–18. <https://doi.org/10.1023/A:1023222308314>

Meadows, M. L., & Stradling, S. (1999). Are women better drivers than men? In J. Hartley & A. Branthwaite (Eds.), *The applied psychologist* (pp. 126–146). Buckingham: Open University Press.

Meng, X., Rosenthal, R., & Rubin, D. B. (1992). Comparing correlated correlation coefficients. *Psychological Bulletin*, 111(1), 172–175. <https://doi.org/10.1037/0033-2909.111.1.172>

- Meyers-Levy, J. (2006). Using the Horizontal/Vertical Distinction to Advance Insights Into Consumer Psychology. *Journal of Consumer Psychology*, 16(4), 347–351.
https://doi.org/10.1207/s15327663jcp1604_5
- Murphy, K. R., & Davidshofer, C. O. (1988). *Psychological Testing: Principles and Applications*. Englewood Cliffs, NJ: Prentice-Hall.
- Nagin, D. S. (2013). Deterrence in the Twenty-First Century. *Crime and Justice*, 42(1), 199–263. <https://doi.org/10.1086/670398>
- Nagin, D. S., & Pogarsky, G. (2001). Integrating Celerity, Impulsivity, and Extralegal Sanction Threats into a Model of General Deterrence: Theory and Evidence. *Criminology*, 39(4), 865–892. <https://doi.org/10.1111/j.1745-9125.2001.tb00943.x>
- Nelson, M. R., & Shavitt, S. (2002). Horizontal and Vertical Individualism and Achievement Values: A Multimethod Examination of Denmark and the United States. *Journal of Cross-Cultural Psychology*, 33(5), 439–458.
<https://doi.org/10.1177/0022022102033005001>
- Nordfjærn, T., & Şimşekoğlu, Ö. (2013). The role of cultural factors and attitudes for pedestrian behaviour in an urban Turkish sample. *Transportation Research Part F: Traffic Psychology and Behaviour*, 21, 181–193.
<https://doi.org/10.1016/j.trf.2013.09.015>
- Nordfjærn, T., & Şimşekoğlu, Ö. (2014). Empathy, conformity, and cultural factors related to aberrant driving behaviour in a sample of Urban Turkish drivers. *Safety Science*, 68, 55–64. <https://doi.org/10.1016/j.ssci.2014.02.020>
- Nordfjærn, T., & Zavareh, M. F. (2016). Individualism, collectivism and pedestrian safety: A comparative study of young adults from Iran and Pakistan. *Safety Science*, 87, 8–17.
<https://doi.org/10.1016/j.ssci.2016.03.005>

- Nunnally, J. C. (1978). *Psychometric Theory* (2nd ed.). New York: McGraw-Hill.
- O'Connor, B. P. (2000). SPSS and SAS programs for determining the number of components using parallel analysis and Velicer's MAP test. *Behavior Research Methods, Instruments, & Computers*, 32(3), 396–402. <https://doi.org/10.3758/bf03200807>
- Ouimet, M. C., Pradhan, A. K., Simons-Morton, B. G., Divekar, G., Mehranian, H., & Fisher, D. L. (2013). The effect of male teenage passengers on male teenage drivers: Findings from a driving simulator study. *Accident Analysis & Prevention*, 58, 132–139. <https://doi.org/10.1016/j.aap.2013.04.024>
- Oyserman, D. (2006). High Power, Low Power, and Equality: Culture Beyond Individualism and Collectivism. *Journal of Consumer Psychology*, 16(4), 352–356. https://doi.org/10.1207/s15327663jcp1604_6
- Oyserman, D., & Lee, S. W. S. (2008). Does culture influence what and how we think? Effects of priming individualism and collectivism. *Psychological Bulletin*, 134(2), 311–342. <https://doi.org/10.1037/0033-2909.134.2.311>
- Özkan, T., & Lajunen, T. (2005). Why are there sex differences in risky driving? the relationship between sex and gender-role on aggressive driving, traffic offences, and accident involvement among young turkish drivers. *Aggressive Behavior*, 31(6), 547–558. <https://doi.org/10.1002/ab.20062>
- Özkan, T., & Lajunen, T. (2006). What causes the differences in driving between young men and women? The effects of gender roles and sex on young drivers' driving behaviour and self-assessment of skills. *Transportation Research Part F: Traffic Psychology and Behaviour*, 9(4), 269–277. <https://doi.org/10.1016/j.trf.2006.01.005>

- Parker, D., Manstead, A. S. R., & Stradling, S. G. (1995). Extending the theory of planned behaviour: The role of personal norm. *British Journal of Social Psychology*, 34(2), 127–138. <https://doi.org/10.1111/j.2044-8309.1995.tb01053.x>
- Parker, D., Reason, J., Manstead, A., & Stradling, S. (1995). Driving errors, driving violations and accident involvement. *Ergonomics*, 38(5), 1036–1048. <https://doi.org/10.1080/00140139508925170>
- Peterson, R. A. (1994). A Meta-Analysis of Cronbach's Coefficient Alpha. *Journal of Consumer Research*, 21, 381-. <https://doi.org/10.1086/209405>
- Pravossoudovitch, K., Martha, C., Cury, F., & Granié, M.-A. (2015). Sex and Age Differences in the Endorsement of Sex Stereotypes Associated with Driving. *The Spanish Journal of Psychology*, 18. <https://doi.org/10.1017/sjp.2015.94>
- Rakotomalala, O. T. (2010). *L'efficacité des modes de communication d'un changement organisationnel selon divers paramètres culturels*. Thèse de doctorat en psychologie non publiée, Université de Sherbrooke, Sherbrooke.
- Raskin, R., & Terry, H. (1988). A principal-components analysis of the Narcissistic Personality Inventory and further evidence of its construct validity. *Journal of Personality and Social Psychology*, 54(5), 890–902. <https://doi.org/10.1037/0022-3514.54.5.890>
- Reason, J., Manstead, A., Stradling, S., Baxter, J., & Campbell, K. (1990). Errors and violations on the roads: a real distinction? *Ergonomics*, 33(10–11), 1315–1332. <https://doi.org/10.1080/00140139008925335>
- Retting, R. A., Kyrychenko, S. Y., & McCartt, A. T. (2008). Evaluation of automated speed enforcement on Loop 101 freeway in Scottsdale, Arizona. *Accident Analysis & Prevention*, 40(4), 1506–1512. <https://doi.org/10.1016/j.aap.2008.03.017>

- Rosenbloom, T., & Perlman, A. (2016). Tendency to commit traffic violations and presence of passengers in the car. *Transportation Research Part F: Traffic Psychology and Behaviour*, 39, 10–18. <https://doi.org/10.1016/j.trf.2016.02.008>
- Rothengatter, T. (1997). Psychological Aspects of Road User Behaviour. *Applied Psychology*, 46(3), 223–234. <https://doi.org/10.1111/j.1464-0597.1997.tb01227.x>
- Schmid Mast, M., Sieverding, M., Esslen, M., Graber, K., & Jäncke, L. (2008). Masculinity causes speeding in young men. *Accident Analysis & Prevention*, 40(2), 840–842. <https://doi.org/10.1016/j.aap.2007.09.028>
- Schreer, G. E. (2002). Narcissism and aggression: Is inflated self-esteem related to aggressive driving? *North American Journal of Psychology*, 4, 333–341.
- Shavitt, S., & Cho, H. (2016). Culture and consumer behavior: the role of horizontal and vertical cultural factors. *Current Opinion in Psychology*, 8, 149–154. <https://doi.org/10.1016/j.copsyc.2015.11.007>
- Shavitt, S., Lalwani, A. K., Zhang, J., & Torelli, C. J. (2006). The Horizontal/Vertical Distinction in Cross-Cultural Consumer Research. *Journal of Consumer Psychology*, 16(4), 325–342. https://doi.org/10.1207/s15327663jcp1604_3
- Shavitt, S., Torelli, C. J., & Riemer, H. (2010). Horizontal and Vertical Individualism and Collectivism: Implications for Understanding Psychological Processes. In M. J. Gelfand, C. Chiu, & Y. Hong (Eds.), *Advances in Culture and Psychology* (pp. 310–350). Oxford: Oxford University Press. Retrieved from <http://www.oxfordscholarship.com/view/10.1093/acprof:oso/9780195380392.001.0001/acprof-9780195380392>

- Shavitt, S., Zhang, J., Torelli, C. J., & Lalwani, A. K. (2006). Reflections on the Meaning and Structure of the Horizontal/Vertical Distinction. *Journal of Consumer Psychology*, 16(4), 357–362. https://doi.org/10.1207/s15327663jcp1604_7
- Simons-Morton, B., Lerner, N., & Singer, J. (2005). The observed effects of teenage passengers on the risky driving behavior of teenage drivers. *Accident Analysis & Prevention*, 37(6), 973–982. <https://doi.org/10.1016/j.aap.2005.04.014>
- Singelis, T. M., Triandis, H. C., Bhawuk, D. P. S., & Gelfand, M. J. (1995). Horizontal and Vertical Dimensions of Individualism and Collectivism: A Theoretical and Measurement Refinement. *Cross-Cultural Research*, 29(3), 240–275. <https://doi.org/10.1177/106939719502900302>
- Soh, S., & Leong, F. T. L. (2002). Validity Of vertical and Horizontal Individualism and Collectivism in Singapore: Relationships with Values and Interests. *Journal of Cross-Cultural Psychology*, 33(1), 3–15. <https://doi.org/10.1177/0022022102033001001>
- Speeding tickets to soar as radar cars to be privatised. (2017, February 22). *The Connexion*. Retrieved from <https://www.connexionfrance.com/French-news/Speeding-tickets-to-soar-as-radar-cars-to-be-privatised>
- Stanojević, P., Jovanović, D., & Lajunen, T. (2013). Influence of traffic enforcement on the attitudes and behavior of drivers. *Accident Analysis & Prevention*, 52, 29–38. <https://doi.org/10.1016/j.aap.2012.12.019>
- Sullman, M. J. M., Paxton, J., & Stephens, A. N. (2017). Gender roles, sex and the expression of driving anger. *Accident Analysis & Prevention*, 106, 23–30. <https://doi.org/10.1016/j.aap.2017.05.016>

- Sullman, M. J. M., & Taylor, J. E. (2010). Social desirability and self-reported driving behaviours: Should we be worried? *Transportation Research Part F: Traffic Psychology and Behaviour*, 13(3), 215–221. <https://doi.org/10.1016/j.trf.2010.04.004>
- Sümer, N. (2003). Personality and behavioral predictors of traffic accidents: testing a contextual mediated model. *Accident Analysis & Prevention*, 35(6), 949–964. [https://doi.org/10.1016/S0001-4575\(02\)00103-3](https://doi.org/10.1016/S0001-4575(02)00103-3)
- Tajfel, H., & Turner, J. C. (1979). An integrative theory of intergroup conflict. In S. Worchel & W. Austin (Eds.), *The social psychology of intergroup relations* (pp. 33–48). Pacific Grove, CA: Brooks/Cole.
- Taubman Ben-Ari, O., & Findler, L. (2003). Reckless driving and gender: An examination of a terror management theory explanation. *Death Studies*, 27(7), 603–618. <https://doi.org/10.1080/07481180302898>
- Triandis, H. C. (1995). *Individualism and collectivism*. Boulder, CO: Westview Press.
- Triandis, H. C., Bontempo, R., Leung, K., & Hui, C. H. (1990). A Method for Determining Cultural, Demographic, and Personal Constructs. *Journal of Cross-Cultural Psychology*, 21(3), 302–318. <https://doi.org/10.1177/0022022190213003>
- Triandis, H. C., & Gelfand, M. J. (1998). Converging Measurement of Horizontal and Vertical Individualism and Collectivism. *Journal of Personality and Social Psychology*, 74(1), 118–128.
- Tschanz, B. T., Morf, C. C., & Turner, C. W. (1998). Gender differences in the structure of narcissism: A multi-sample analysis of the Narcissistic Personality Inventory. *Sex Roles*, 38(9–10), 863–870. <https://doi.org/10.1023/A:1018833400411>

- Turner, J. C., Hogg, M. A., Oakes, P. J., Reicher, S. D., & Wetherell, M. (1987). *Rediscovering the Social Group: A self-categorization Theory*. Oxford: Basil Blackwell.
- Tyler, T. R. (1990). *Why people obey the law*. New Haven: Yale University Press.
- Tyler, T. R. (2006). Psychological Perspectives on legitimacy and legitimation. *Annual Review of Psychology*, 57, 375–400.
<https://doi.org/10.1146/annurev.psych.57.102904.190038>
- Ulleberg, P., & Rundmo, T. (2003). Personality, attitudes and risk perception as predictors of risky driving behaviour among young drivers. *Safety Science*, 41(5), 427–443.
[https://doi.org/10.1016/S0925-7535\(01\)00077-7](https://doi.org/10.1016/S0925-7535(01)00077-7)
- Van Kleef, G. A., Homan, A. C., Finkenauer, C., Gündemir, S., & Stamkou, E. (2011). Breaking the Rules to Rise to Power: How Norm Violators Gain Power in the Eyes of Others. *Social Psychological and Personality Science*, 2(5), 500–507.
<https://doi.org/10.1177/1948550611398416>
- Vingilis, E. R., & Mann, R. E. (1986). Towards an interactionist approach to drinking — driving behaviour: implications for prevention and research. *Health Education Research*, 1(4), 273–288. <https://doi.org/10.1093/her/1.4.273>
- Von Hirsch, A., Bottoms, A. E., Burney, E., & Wikstrom, P. O. (2000). *Criminal deterrence and sentence severity*. Oxford: Hart Publishing.
- Walter, L., Broughton, J., & Knowles, J. (2011). The effects of increased police enforcement along a route in London. *Accident Analysis & Prevention*, 43(3), 1219–1227.
<https://doi.org/10.1016/j.aap.2011.01.003>
- Watkins, M. W. (2006). Determining Parallel Analysis Criteria. *Journal of Modern Applied Statistical Methods*, 5(2), 344–346. <https://doi.org/10.4324/9780203390719>

- Wiesenthal, D. L., Hennessy, D., & Gibson, P. M. (2000). The Driving Vengeance Questionnaire (DVQ): the development of a scale to measure deviant drivers' attitudes. *Violence and Victims*, 5(2), 115–136.
- World Health Organization. (2015). *Global status report on road safety*. Geneva, Switzerland: WHO Press. Retrieved from http://www.who.int/violence_injury_prevention/road_safety_status/2015/en/
- Zhao, N., Mehler, B., Reimer, B., D'Ambrosio, L. A., Mehler, A., & Coughlin, J. F. (2012). An investigation of the relationship between the driving behavior questionnaire and objective measures of highway driving behavior. *Transportation Research Part F: Traffic Psychology and Behaviour*, 15(6), 676–685.
<https://doi.org/10.1016/j.trf.2012.08.001>