Predicting Traffic Accident Rates: Human Values Add Predictive Power to Age and Gender

Ivars Austers[1], Viesturs Renge and Inese Muzikante

Department of Psychology, University of Latvia

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[1] Corresponding author. Address: Department of Psychology, University of Latvia, Jurmalas gatve 74/76, Riga LV-1083, Latvia. Tel.: +371 67034018; Fax: +371 67034020.
E-mail address: ivars.austers@lu.lv

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Introduction

It has been well-documented by researchers in traffic psychology that age and gender can help in the prediction of accident rates - males and younger drivers tend to be involved in more accidents (e.g., Krahe, 2005; Krahe and Fenske, 2002; Stradling and Parker, 1997). There are a number of studies showing that driving style and a tendency towards specific deviations from safe driving patterns is inherited from parents – children display the same driving style as their parents (Bianchi and Summala, 2004; Taubman-Ben-Ari et al., 2005). This may provide support for arguments that there are other culturally shared motivational forces in addition to the family, that shape driving behavior. Our proposal in the present paper is that human values carry significant power in explanations of deviations from safe driving patterns. The role of values in this context has been studied on a cultural (i.e. country) level (Özkan and Lajunen, 2007). There have also been studies, which relate values to driving behaviour in general, e.g. values have been used in explaining socially responsible car usage. It has been shown that egocentric values are positively related to socially problematic usage of transport, while altruistic and biospheric values related negatively (de Groot and Steg, 2007). To our knowledge, there have been two studies of a smaller scale thus far, where individual values were treated as predictor variables in explaining traffic accidents (Muzikante and Renge, 2008; Renge et al., 2008). However, these two studies were primarily focused on other research issues besides values and were done with relatively small samples of drivers. In the present study our aim was to test whether human values, in addition to age and gender, carry incremental validity in explaining traffic accidents.

Recent studies in psychology generally use value theory as developed by Shalom Schwartz (Bardi and Schwartz, 2003; Schwartz, 1992) where human values are defined as a set of abstract beliefs related to desired human goals. The survey in 67 countries (Schwartz et al., 2001) showed that values carry a universal structure, characteristic of all people, but there may be differences in the hierarchy of these values. People may differ markedly depending on the significance they ascribe to each of the ten basic value types, yet the basic structure of the value types and motivational concerns they represent (i.e., conflict and compatibility of the values) remain the same independently of the culture that the people represent (Schwartz, 1992).

(Insert Figure 1 about here)

All the ten value types form two concurrent dimensions. The first dimension, “Openness to Change/Conservation”, consists of stimulation, hedonism and self-direction versus security, traditions and conformity in values. The first two values stress independence in actions, thoughts and feelings, openness to new experiences, whereas the last two – self-restriction, orderliness and resistance to change. The second dimension is “Self-Enhancement/Self-Transcendence” – power, hedonism and achievement versus universalism and benevolence. “Openness to Change” and “Self-Enhancement” emphasize the realization of one’s own interests, while “Self-Transcendence” and “Conservation” – care about the interests and welfare of others. If one acts to fulfil any value, it may lead to psychological, practical, or social consequences which may not always be in accord with the fulfilment of another value, i.e. they may be in conflict (Schwartz, 1992). Conflict between two concurrent values is generally solved in favour of the value which is most significant at the given moment.

A significant question in the values studies is whether values influence behaviour? Doubts about the existence of such an influence has been among the reasons why historically relatively little attention has been paid to the study of values. There have been studies showing that there is only a moderate or sometimes even a weak relationship between individual values and different types of social behaviour (Feather and O'Brien, 1987; Henry, 1976; Leung et al., 1995). However, more recent studies (Verplanken and Holland, 2002; Lönnqvist et al., 2006) have tried to determine the conditions which allow values to predict behaviour. According to Verplanken, only the so called central values will be able to influence behaviour (Verplanken and Holland, 2002). Values will achieve a central status when they are a part of an individual's self- identity. For instance, in a case of "value centrality", a person identifying him or herself as an environmental activist will be using values that form part of his or her identity. Verplanken's research demonstrated that values will predict behaviour if they are cognitively activated and central to a person. Cognitive activation of values takes place when these values become salient under the focus of attention, for example, in a discussion of the violation of traffic rules in the light of the importance of driving safety. Values also may be activated by a confrontational situation. For example, a driver of a sports car has to make a choice – whether to demonstrate the maximum speed of a car to his or her friends or to drive in a way that ensures the safety of the friends and all others involved in traffic; stimulation and security values will be in conflict here (Verplanken and Holland, 2002). Research has also demonstrated that if high importance is attached to conformity values, this will lead an individual to behave according to social norms, but those for whom conformity is less important have a tendency to care more about their individual values (Lönnqvist et al., 2006).

According to the classification proposed by the Manchester group of researchers (Reason et al., 1990; Parker et al., 1995) all the possible deviations in driving will fall into one of three types: *Violations*, *Errors* and *Lapses*. *Violations* are intended deviations from the rules of safe driving (e.g. "Deliberately disregard the speed limits late at night"), *Errors* are unsuccessful efforts to reach a chosen goal (e.g. "Misjudge the speed of an oncoming vehicle"), but *Lapses* are minor deviations on the way to the chosen goal. Since *Violations* are intentional actions, they are related to social and motivational factors; whereas *Errors* and *Lapses* depend on a driver's informational processing. For the assessment of these factors, a Driver Behaviour Questionnaire (DBQ) was developed. The local versions of a DBQ are being used in different countries (e.g., Åberg and Rimmö, 1998; Obriot-Claudel and Gabaude, 2004). Several studies have demonstrated that males are more prone to *Violations*, but females – to *Lapses*; also in addition, *Violations* decrease with the driver age, but not *Errors*. Of the three types of deviant driving, conscious *Violations* have the closest relationship to traffic accidents (e.g., Lajunen et al., 2004; Mesken et al., 2002; Parker et al., 1995; Reason et al., 1990; Underwood et al., 1997).

We made the following predictions concerning the relationship of aberrant driving and accident rate based on the importance of individual values. First, based on previous studies (Muzikante and Renge, 2008; Renge et al., 2008), we expected that individual values would not predict the number of accidents directly, that values would predict the extent to which drivers engage in *Violations*. Values were expected to influence the accident rate indirectly via *Violations*. Besides gender (males) and age (younger drivers) being more prone to *Violations,* we also expected that values would add a predictive power to age and gender. Specifically – "Self-Enhancement" values were expected to positively relate to *Violations*, while "Conservation" and "Self-Transcendence" values were expected to relate negatively to *Violations*. We did not formulate a specific prediction with respect to "Openness to Change" values.

Method

Participants

There were 530 participants in the study. The mean age of the respondents was 29.71 (SD = 8.36, the range 18 to 60. 46% were females). Forty percent of the participants were involved in accidents in the last three years.

Measures

Individual values. For the assessment of individual values, the Latvian version of the Portrait Values Questionnaire (PVQ; Schwartz et al., 2001) was used. We computed four index variables corresponding to the four dimensions of the values system, namely, “Self-Transcendence”, “Self-Enhancement”, “Openness to Change”, and “Conservation”. The reliability of all the four indexes was satisfactory (Cronbach’s alphas ranged from .54 to .68).

Risky driving. The Latvian version of the Driver Behaviour Questionnaire was used in this study. It was created using items from the original (Reason et al., 1990) and Swedish versions (Åberg and Rimmö, 1998). The Questionnaire consists of 29 items related to different driving situations), (1 – never, 6 – nearly always). The reliability (measured by Cronbach’s alpha) of the separate scales of DBQ for separate scales was reasonable high: .79 for *Violations* .69 for *Errors*, and .70 for *Lapses*.

The respondents were also asked to indicate the frequency of involvement in road traffic accidents (during the last three years) and their age and gender.

Procedure

We used an internet based version of the questionnaire (posted at a portal dedicated to automobiles and driving), which was filled out by 545 respondents. A data analysis was performed on a set of 530 questionnaires, since 15 questionnaires lacked a significant amount of information.

Results

Correlations among the major variables (including age and gender) are represented in Table 1. Age significantly correlated with *Violations*, *Errors*, and accident involvement. Gender significantly correlated with *Violations*, *Lapses*, and the number of accidents in which one has been involved. Males were more prone to report *Violations* and accidents, while women were more prone to report *Lapses*. Age was related to accidents in a negative correlation.

(Insert Table 1 about here)

A hierarchical regression analysis was conducted to determine the incremental validity of values over and above age and gender in predicting *Violations*. Table 2 shows the results of regression analysis. As can be seen, values are significant predictors of *Violations* over and above age and gender. Adding values in Step 2 increments explained the variation of *Violations* by 9% in whole age, while gender and values explains the 22% of variation in *Violations*. As we hypothesized, “Self-Enhancement” values positively predicted *Violations* and “Conservation” values negatively predicted *Violations*. “Self-Transcendence” values along with “Openness to Change” values do not predict *Violations* at all.

(Insert Table 2 about here)

To test the model of the relationship of individual values to *Violations* and drivers’ accident involvement, we conducted Path Analysis by a series of regression analyses. Table 2 presents the first regression analysis and Figure 2 illustrates all the significant paths (only statistically significant standardized regression coefficients are presented) determined by the analysis.

(Insert Figure 2 about here)

Those findings were in line with the predictions. On the other hand, “Openness to Change” and “Self Transcendence” values had no influence on *Violations*. In addition, there were no direct influences of values on involvement in accidents. However, *Violations* predicted the number of accidents (standardized regression coefficient = .14).

Discussion

One of the first studies at the very beginnings of traffic psychology which related personality factors to the risk of traffic accidents – the famous research about taxi drivers – found that mild social deviance was related to involvement in traffic accidents (Tillman & Hobbs, 1949, cited in Lawton et al., 1997). Due to this study the well-known expression: ‘We drive as we live’ was coined. Later studies have confirmed this relationship (Lawton et al., 1997; Underwood et al., 1997; West et al., 1993).

Values influence our lives in many ways, as one may conclude from the results of the present study; they also influence our driving style. The predictions of our study were supported to a large extent. We found that “Self-Enhancement” values positively predicted traffic safety Violations and “Conservation” values predicted traffic *Violations* negatively. However, the model did not show a direct influence of those variables on the accident rate. The only predictor of the accident rate was traffic *Violations*, suggesting that *Violations* mediate the relationship between the culturally embedded variables and aberrant driving behaviour.

The finding that “Self-Enhancement” values correlate with driving *Violations* is consistent with the results of research done by Bond and his colleagues (Bond et al., 2004). It was found that "Self-Enhancement" values correlate with competition and wishful thinking. Wishful thinking is related to risky driving and traffic accidents (Kontogiannis, 2006) and competition as a strategy is a fairly aggressive way of conflict resolution. Aggressiveness in turn, is related to traffic accidents (e.g., Lajunen and Parker, 2001; Van Rooy et al., 2006). The negative relationship between "Conservation" values and *Violations* corresponded to the results in a cross-cultural study at a country level where a negative correlation between "Conservation" and traffic safety had been found (Özkan and Lajunen, 2007).

Our results are inconsistent with a previous study's results to some extent. In Bond's et al. (2004) study, "Openness to Change" values were negatively related to wishful thinking but in our study they had a positive correlation with driving *Violations* and traffic accident involvement. However, they did not appear as a significant independent variable in the final path analysis model.

All in all, the findings demonstrate that the idea of combing age, gender and values is also fruitful in studying aberrant driving behaviour. So, from this we conclude that individual values do not predict the frequency of involvement in traffic accidents per se. Value dimensions of "Conservation" and "Self Enhancement" are significant predictors of the traffic accident rate in addition to age and gender. whereas, the frequency of *Violation*s predicts the involvement in traffic accidents. Our conclusion is that *Violations* act as a mediating variable between personality related variables (individual values, age and gender) and involvement in traffic accidents.

The data in the present study do not provide a full understanding of the mechanisms underlying the demonstrated relationship and the role of *Violations* as a mediating variable. It is possible that studies so far have not considered the idea of value self-centrality (Verplanken and Holland, 2002) in the due account.

References

Åberg, L. and Rimmö, P.-A. (1998), 'Dimensions of Aberrant Driver Behaviour', *Ergonomics,* 41: 39 –56.

Bardi, A. and Schwartz, S. H. (2003), 'Values and Behaviour: Strength and Structure of Relations', *Personality and Social Psychology Bulletin,* 29: 1207 – 20.

Bianchi, A. and Summala, H. (2004), 'The 'Genetics' of Driving Behaviour: Parent Driving Style Predicts Their Children's Driving Style', *Accident Analysis & Prevention,* 36: 4, 655 – 9.

Bond, M. H. et al. (2004), 'Combining Social Axioms with Values in Predicting Social Behaviours', *European Journal of Personality,* 18: 177 – 91.

Feather, N. T. and O'Brien, G. E. (1987), 'Looking for Employment: An Expectancy-Valence Analysis of Job-Seeking Behaviour among Young People', *British Journal of Psychology,* 78: 251 – 71.

de Groot, J. I. M. and Steg, L. (2007), 'Values, Beliefs and Environmental Behaviour: Validation of an Instrument to Measure Egoistic, Altruistic and Biospheric Value Orientations in Five Countries', *Journal of Cross Cultural Psychology,* 38: 318 – 32.

Henry, W. A. (1976), 'Cultural Values do Correlate with Consumer Behavior', *Journal of Marketing Research,* 13: 121–7.

Krahe, B. (2005), 'Predictors of Women`s Aggressive Driving Behavior', *Aggressive Behavior,* 31: 537 – 46.

Krahe, B. and Fenske, I. (2002), 'Predicting Aggressive Driving Behavior: The Role of Macho Personality, Age, and Power of Car', *Aggressive Behavior,* 28: 21 – 9.

Kontogiannis, T. (2006), ‘Patterns of Driver Stress and Coping Strategies in a Greek Sample and Their Relationship to Aberrant Behaviors and Traffic Accidents’, *Accident Analysis and Prevention,* 38: 5, 913 – 24.

Lajunen, T. and Parker, D. (2001), ‘Are Aggressive People Aggressive Drivers? A Study of the Relationship between Self-Reported General Aggressiveness, Driver Anger and Aggressive Driving’, *Accident Analysis and Prevention*, 33: 243–55.

Lajunen, T. et al. (2004), ‘The Manchester Driver Behaviour Questionnaire: A Cross-Cultural Study’, *Accident Analysis and Prevention*, 36: 231 – 8.

Lawton, R. et al. (1997), ‘Predicting Road Traffic Accidents: The Role of Social Deviance and Violations’, *British Journal of Psychology*, 88: 2, 249 – 62.

Leung, K. et al. (1995), ‘How to Explain Cross-Cultural Differences: Values, Valences, and Expectancies?’, *Asian Journal of Psychology,* 1: 70–5.

Lönnqvist, J.- E. et al. (2006), ‘Conformism Moderates the Relations between Values, Anticipated Regret, and Behavior’, *Personality and Social Psychology Bulletin,* 32: 1469 – 81.

Mesken, J. et al. (2002), ‘Interpersonal Violations, Speeding Violations and Their Relation to Accident Involvement in Finland’, *Ergonomics,* 45: 7, 469 – 83.

Muzikante, I. and Renge, V. (2008), ‘Autovadītāju Individualo Vertibu Saistiba ar Riskantu Brauksanu’[Drivers’ Individual Values and Risky Driving], *LU Rakstu Krajums. Psihologija*, 742: 39 – 55, (Riga: Akademiskais apgads).

Obriot-Claudel, F. and Gabaude, C. (2004), ‘The Driver Behaviour Questionnaire: A French Study Applied to Elderly Drivers’, Paper presented at the 3rd International Conference on Traffic and Transport Psychology, Nottingham, UK. <www.psychology.nottingham.ac.uk/IAAPdiv13/ICTTP2004papers2/Individual%20Differences/Obriot.pdf> , accessed May 21, 2007.

Özkan, T. and Lajunen, T. (2007), ‘The Role of Personality, Culture, and Economy in Unintentional Fatalities: An Aggregated Level Analysis’, *Personality and Individual Differences,* 43: 519 – 30.

Parker, D. et al. (1995), ‘Behavioural Characteristics and Involvement in Different Types of Traffic Accident’, *Accident Analysis and Prevention,* 27: 571 – 81.

Reason, J. T. et al. (1990), ‘Errors and Violations on the Road: A Real Distinction?’, *Ergonomics,* 33: 1315 – 32.

Renge, V. et al. (2008), ‘Combining Social Axioms with Personality Measures and Self-Reported Driving Behaviour in Predicting Traffic Accidents’, *International Journal of Psychology*, 43: 3-4, 586.

Schwartz, S. H. (1992), ‘Universals in the Content and Structure of Values: Theory and Empirical Tests in 20 Countries’, in M. Zanna (ed.), *Advances in Experimental Social Psychology,* 25: 1 – 65. (New York: Academic Press).

Schwartz, S. H. et al. (2001), ‘Extending the Cross-Cultural Validity of the Theory of Basic Human Values with a Different Method of Measurement’, *Journal of Cross-Cultural Psychology*, 32: 519 – 42.

Stradling, S. G. and Parker, D. (1997), ‘Extending the Theory of Planned Behaviour: The Role of Personal Norm, Instrumental Beliefs and Affective Beliefs in Predicting Driving Violations’, in T. Rothengatter and E. C. Vaya (eds.), *Traffic and Transport Psychology: Theory and Application*, (Amsterdam: Pergamon).

Taubman-Ben-Ari, O. et al. (2005), ‘From Parents to Children – Similarity in Parents and Offspring Driving Styles’, *Transportation Research Part F: Traffic Psychology and Behaviour*, 8:1, 19 – 29.

Underwood, G. et al. (1997), 'Estimating Accident Liability', in T. Rothengatter and E. C. Vaya (eds.).

Van Rooy D. L. et al. (2006), 'Convergent, Discriminant, and Predictive Validity of Agressive Driving Inventories: They Drive as They Live', *Aggressive Behavior*, 32: 89 – 98.

Verplanken, B. and Holland, R.W. (2002), 'Motivated Decision Making: Effects of Activation and Self-Centrality of Values on Choices and Behavior', *Journal of Personality and Social Psychology*, 82:3, 434 – 47.

West, R. et al. (1993), 'Mild Social Deviance, Type-A Behaviour Pattern and Decision-Making Style as Predictors of Self-Reported Driving Style and Traffic Accident Risk', *British Journal of Psychology*, 84: 207 – 19.

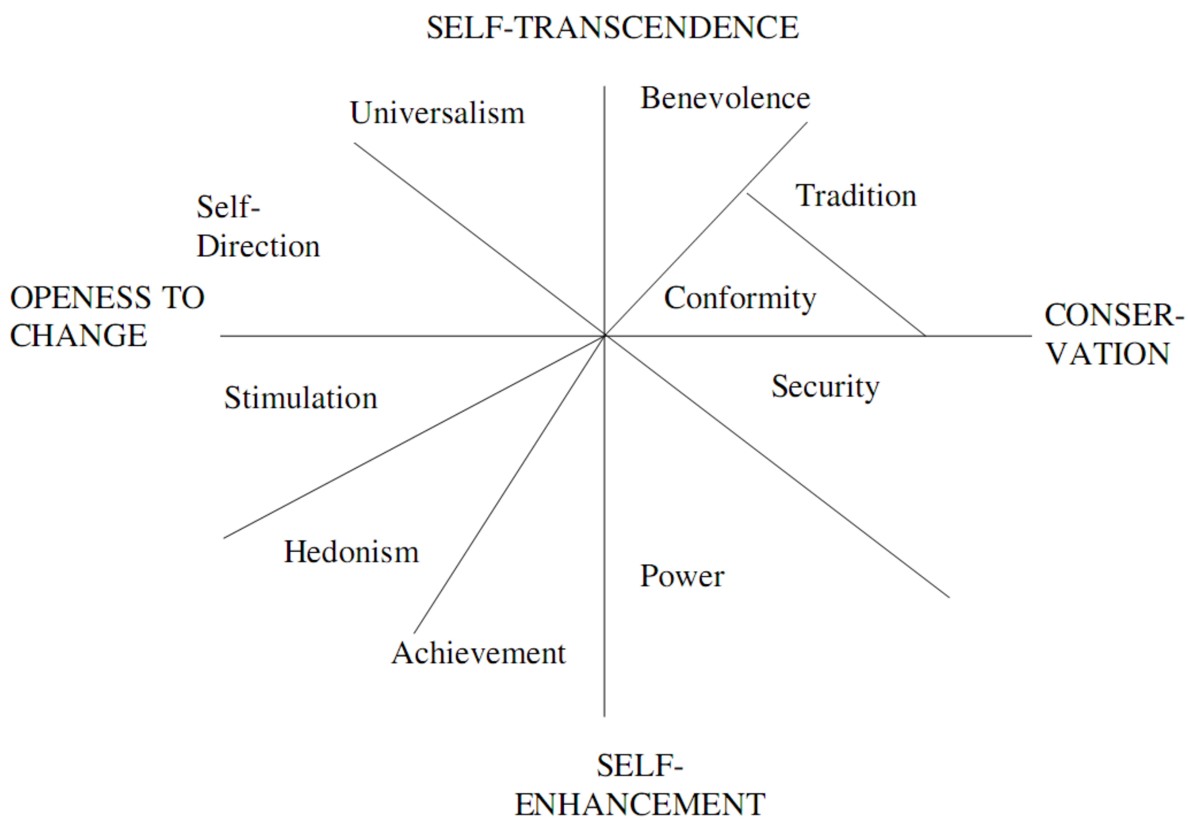


Figure 1. Circular value structure. The values from the opposite sides of the circle are in conflict, while the adjacent values are similar in their content and motivational goals (Schwartz, 1992).

Table1. Means, standard deviations and Pearson correlations among variables.

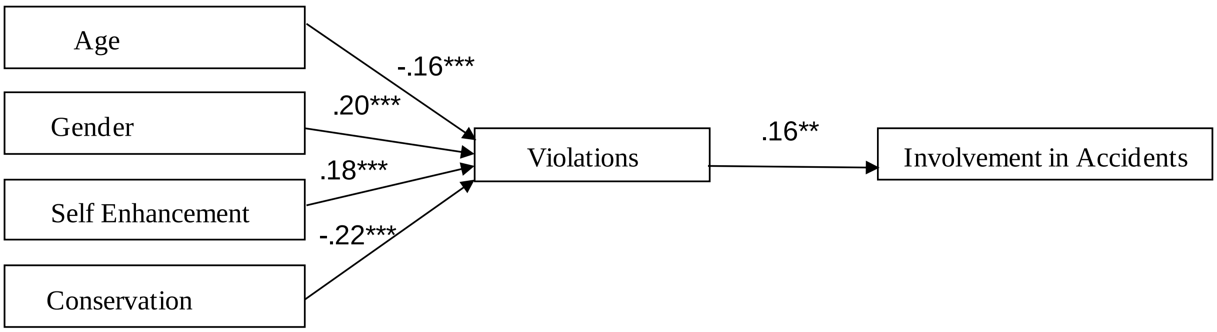
	M	*SD*	*Gender*	*Age*	*Violations*	*Errors*	*Lapses*	*Accident involvement*
Violations(DBQ)	2.76	0.78	.24**	- .28**	-	-	-	-
Errors (DBQ)	1.72	0.47	.03	- .20**	.43**	-	-	-
Lapses (DBQ)	2.01	0.54	- .22**	- .01	.24**	.50**	-	-
Accident involvement	0.39	0.49	.18**	- .09*	.14**	.08	.03	-
Self - Enhancement	3.68	1.05	- .01	-.25**	.25**	.15**	.14**	.04
Openness to Change	3.99	0.99	.03	- .12*	.17**	.06	.03	.12*
Self - Transcendence	4.14	0.91	- .16**	.17**	- .20**	- .17**	- .01	.03
Conservation	3.86	0.97	- .13**	.21**	- .31**	- .20**	- .01	-.04

* $p < .05$, ** $p < .01$

Table 2. Summary of hierarchical regression analysis of age, gender and values on violations.

Independent variables	***B***	***SE B***	***β***	***R²***	**Δ*R²***	***F change***
Step 1				.13	.13	38,78***
Age	- 0.02	0.01	- .27***			
Gender	0.35	0.06	.23***			
Step 2				.22	.09	15,23***
Age	- 0.01	0.01	- .16***			
Gender	0.30	0.06	.20***			
Self - Enhancement	0.13	0.03	.18***			
Openness to Change	0.06	0.03	.07			
Self - Transcendence	- 0.04	0.04	- .05			
Conservation	- 0.17	0.04	- .22***			

***$p < .001$



** p < .01, ***p < .001

Figure 2. Computed model linking human values to number of accidents via Violations.

Coefficients are standardized regression weights.