The Role of Personality and Attitudes in Predicting Risky Driving Behavior

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Abstract

Increasing support for the relationship between road traffic violations and accident liability led to research focusing on the determinants of risky driving. In psychology, more recently, a new approach, which is integrating traditional personality trait approach and social cognition approach, has been applied to understand the mechanisms underlying people’s risk-taking behavior in traffic. Following such approach, this study was aimed at measuring personality traits, specific attitudes toward traffic safety, and self-reported risk-taking in traffic and at investigating relationship among them. The study was based on a self-completion questionnaire web-survey carried out among 186 students at University of Oslo. The participants completed measures of attitude (consisted of attitude toward fun-riding, speeding, and traffic flow vs. rule obedience), personality (included normlessness, impulsive sensation seeking, and aggression-hostility), and driving behavior questionnaire (consisted of Highway Code violation, aggressive violation, and error). The results of a structural equation modeling suggested that the relation between the personality traits and risky driving behavior was mediated through attitudes specific to traffic safety. Together with attitudes toward traffic safety, gender and exposure were found to be good predictors of risky driving behavior. Methodological limitations and implications of the study were also discussed.
1. Introduction

According to the World Health Organization’s 2002 Report, in higher-income countries, road traffic accidents are among the top ten leading causes of disease burden as measured in DALYs (disability-adjusted life years). In 2005 there were 38,253 people killed and approximately 1.86 million people injured as a result of motor-vehicle crashes in the United States (National Highway Traffic Safety Administration [NHTSA], 2005). Road traffic injuries in the 52 countries of the WHO European Region represent a major public health problem. Each year an estimated 127 thousand people are killed (about 10% of global road traffic death) and about 2.4 million are injured on roads in Europe. As a result, the cost of road traffic injuries in Europe are estimated to reach € 180 billion per year in the countries of the European Union, twice the annual budget for all its activities, and to account for about 2% of the gross domestic product in several countries. Road traffic injuries are the leading cause of death among young people in the Region and are predicted to increase in several countries as they become more highly motorized. This huge health burden adds to other adverse transport-related health effects, such as those resulting from air pollution, global warming, noise, increasingly sedentary lifestyle and disruption of communities (Racioppi, Eriksson, Tingvall, & Villaveces, 2004).

Different approaches of empirical and theoretical explanations of involvement in traffic accidents have been taken to understand the nature of traffic accident, and to reduce road traffic incidents. Accumulating research evidence showed risky driving is an important contributor to traffic accidents (Iversen, 2004; Jonah, 1986; Lawton, Parker, Stradling, & Manstead, 1997b; Parker, Reason, Manstead, & Stradling, 1995a). In his review of the literature, Jonah (1986) illustrated a link between various risky driving behaviors and traffic accidents. Parker et al. (1995a) identified three types of driving behaviors, i.e. errors, lapses and violations, and examined the relationship between driving behavior and accident involvement. They found that violations, i.e. behaviors that involve deliberate deviations from safe driving practice, correlate with both past and future accident rates. By contrast, the self-reported tendency to make errors or to have lapses did not predict accident rates. Violations
were found to be a statistically significant, positive predictor of accident involvement, even after the effects of exposure, age and gender had been partialled out. More recently, Iversen (2004) found that people who had been involved in at least one car crash over the last one-year period engaged in more speeding, drink-driving, and reckless driving, as well as lower use of seat belts, over the same period. Many different factors have been implicated as determinants of risky driving. The following review identifies the most prominent possible predictors of risky driving. Given the recent emphasis on motivation as a factor in risky driving (Parker, Manstead, Stradling, Reason, & Baxter, 1992b; Parker et al. 1995a; Ulleberg & Rundmo, 2003), several risk-taking attitudes, beliefs, and personality traits are particularly relevant.

1.1 Age differences in risky driving and crash involvement

Age differences in risky driving practices, crash involvement, injuries, and traffic death are well documented. The NHTSA’s (1995) literature review stated that, “the fatality and injury rates for youth remain markedly above other age groups” (p.54), with teenagers and youths in their early 20s, especially young males, having the highest crash involvement rate of any age group. Crash rates for newly licensed females, of various ages, also showed that the risk of a crash decreased with increasing age. Norris, Matthews, & Riad (2000) noted that younger age is one of the predictors of future motor vehicle accidents (MVAs), with younger adults (ages 19 to 39) being twice as likely to have an accident than older adults (ages 56 to 88). The middle-age range (40 to 55 years) had a crash rate that was between these two extremes. Elander, West and French (1993) noted that the observation of younger drivers having an increased crash involvement is indeed a robust finding, with studies consistently underlining the younger driver’s greater risk at being involved in a traffic accident. Lawton et al (1997b) investigated overall age effects, finding that young drivers reported committing more violations than older drivers. Furthermore, Lawton et al observed that age and violations were independently significant predictors of accident rate, with younger drivers and those with higher violations showing a tendency to be involved in more accidents. The study observed that age is a significant predictor of violation score, even though this relationship is partially mediated by social deviance. Additionally, Lawton et al found that being young was associated with a higher accident rate, both independently and via the tendency to
commit violations. They therefore suggested that there is something about being young in itself that increases the likelihood of an accident, independent of the younger drivers’ tendency to commit violations.

1.2 Gender differences in risky driving and crash involvement

The literature also shows that males are more likely than females to commit driving violations, to speed, and also to be involved in a traffic accident. Waller, Elliot, Shope, Raghunathan, & Little (2001) found that men had about twice the risk of committing an offence, in any given year, when compared to women. They also reported that men had an overall higher risk of crashing, and their first crash occurred sooner than females. The proportion of crashes at-fault also decreased more than twice as fast for women, as for men, with increasing length of licensure. Furthermore, the NHTSA (1995) documented that males have higher crash fatality rates than females for every age group, per 100,000 populations. In addition, among the 16 to 20 age groups and the 21 to 24 age groups, the male population-based fatality rates were observed to be more than twice as high as those rates for females. However, there was less disparity observed between genders for injury rates, with females of ages 16 to 20 actually showing a slightly higher injury rate than their male counterparts. Lawton et al (1997b) considered the effects of gender on driving violations, as well as the tendency to be involved in traffic accidents. Findings demonstrated that males tend to commit more violations than females and therefore have more accidents as a result. Tendency to commit violations was independently associated with both gender and with accident involvement. However, results also showed that, once the effects of violation score were removed from the equation, gender was no longer found to be independently predictive of accidents. Such a pattern of relationships led the authors to suggest that the effect of gender on accident involvement was mediated by the tendency to commit violations.

1.3 The role of experience and exposure in risky driving and crash involvement

Driving skill, experience and exposure to traffic also have been found to be related to violating behavior and motor vehicle accidents (MVAs). Driving is a skill-based, rule-governed, expressive activity (Stradling and Meadows, 2000). Mastering
the vehicle maneuvering skill is the very first step to become a driver, and skill component of driving improves as on road driving experience increases. Lack of experience and insufficient cognitive and motor skills may cause unintentional errors while driving, which in turn combine with other factors, may result accidents in traffic. Waller et al (2001) considered the effects of experience, finding that length of licensure was related to decreased crash risk, and especially a decrease in at fault crashes. The odds of having one or more crashes one or more crashes in a year declined about 17% per year of licensing, controlling for age at time of licensure, gender, and pre-license offences. Mayhew, Simpson, & Pak (2003) found a striking 41 percent drop in crash rates per 10,000 novice drivers over the first seven months of licensing. Furthermore, this effect was most pronounced for the youngest drivers, with 16 year olds showing a 56% drop and 17 year olds showing a 30% drop in crash rates. Like the Waller et al.’s study, this study showed that the largest decline in crash rates occur over the first few months of licensing, and especially for the youngest drivers, were for the types of crashes where the young driver was at-fault, such as single vehicle or run of the road crashes. The rapid fall in crash rates soon after licensing suggests that the problem for newly licensed drivers is more about their noviceness and lack of experience than factors relating to their age. Despite the obvious part that age-related factors play significant role, at least over the first few years from legal licensing, experience-related factors appear to play a considerably larger role in the high initial crash rates found for novice drivers. Whereas driving experience appears to decrease risk for MVHs, other factors, such as amount of travel per year, patterns of travel, and time of travel, complicate the relationship between age, experience, and crash risk. It is impossible to become a proficient driver without spending time driving, and the only way for a new driver to gain experience is to get on-the-road experience. But further one drives, the greater are one’s chances of being involved in an accident. It is found that driving experience and exposure are often confounded (Jonah, 1986). Studies investigating the relationship between self-reported overall mileage and crash involvement reported correlation coefficients ranging from .12 to .35 (French et al., in press; Loo, 1978; Quimby, Maycock, Carter, Dixon, & Wall, 1986; Quimby & Watts, 1981; all in Elander et al., 1993).

1.4 The role of personality traits in risky driving and crash involvement

1.4.1 Sensation Seeking (SS)
Sensation Seeking has been linked to a range of different risk taking behaviors including driving practices such as speeding and drink driving (Arnett, 1990). According to Zuckerman (1994), Sensation Seeking (SS) “is a trait defined by the seeking of varied, novel, complex, and intense sensations and experiences and the willingness to take physical, social, legal, and financial risks for the sake of such experiences” (p. 27). Jonah’s (1997) extensive review found that, of the 40 studies investigated, only 4 did not find significant positive relationships between Sensation Seeking (SS) and some aspect of risky driving. Jonah observed stronger relationships with either observed or reported driving behavior, rather than with traffic violations or collision involvement. All 15 studies investigating SS and ‘other risky driving behaviors’ (other than drink driving) evidenced an association of high SS with higher risky driving tendencies. Of the 12 studies considering SS and collision involvement, 7 studies observed significant differences between high and low SS on collision involvement, and another study reported a greater number of collisions with high SS. Furthermore, of the 11 studies examining SS and traffic violations, 6 studies reported more violations with increasing SS scores, and 3 studies identified clusters including drivers with high SS scores and violations. Overall, Jonah evidenced that high Sensation Seekers were more likely to experience collisions and violations than low Sensation Seekers, and high Sensation Seekers were also more likely to perceive less danger in risky driving. Consideration of drink driving as an index of risky driving showed that, of the 18 studies within Jonah’s review, all but 5 either found that, as SS score increased, reported ‘driving while impaired’ (DWI) also increased, or, reported / convicted DWIs had higher SS scores. Jonah observed that collision involvement has been less strongly associated with SS, suggesting that this may be due to a lack of variance in the collision measure (in that collisions are relatively rare events), and also because being involved in a collision does not necessarily mean that the driver behaved incorrectly.

1.4.2 Impulsiveness

Another personality trait has been identified by numerous researchers as a risk factor in driving is impulsiveness – a tendency to act on the spur of the moment, often without giving due consideration to the possible (usually negative) consequence of
such action (Beirness, 1993). Pelz and Schuman (1968) and Schuman, Pelz, Ehrlich, & Selzer (1967; both in Beirness, 1993) reported that high scores on a measure of ‘impulse expression’ (anger, driving for relief, daredevil driving, taking chances with friends, prefers speed not safety in cars, risky driving practices) were positively related to violations and accidents in a sample of young, unmarried, male drivers. Schmidt, Perlin, Townes, Fisher, & Shaffer (1972; in Beirness, 1993) corroborated this with evidence of a generally elevated level of impulsive behavior among drivers killed in single-vehicle collisions. Mayer and Treat (1977; in Beirness, 1993) identified impulsiveness as a characteristic that distinguished college-age drivers who reported involvement in three or more crashes from a control group.

One would expect that absence of forethought in the initiation of the behavior, i.e. impulsiveness will result lack of thoroughness in decision-making. And research consistently shows that hastily made decisions are associated with an increased risk of crash involvement. Parker, West, Stradling & Manstead (1995b) underlined that one would expect that a lack of thoroughness in decision-making would contribute to accident risk, if, for example, a driver pulls out into traffic before looking carefully or considering the consequences of the conditions. West, Elander, & French (1992a; in Elander et al., 1993) reported that individuals who frequently made decisions without carefully considering the costs and benefits displayed a higher crash risk. Elander et al. (1993) further noted that this relationship has consistently been found to be independent of age, gender, and mileage.

Zuckerman (1979) indicates that while sensation seeking and impulsiveness share some degree of commonality, they are not completely overlapping constructs. Whereas sensation seeking involves a tendency to engage in high-risk behaviors for the rewarding aspects of the behavior – the thrill, excitement, or stimulation – impulsiveness involves an absence of forethought in the initiation of the behavior. But, when impulsivity is combined with sensation seeking, the resulting behaviors involve a higher probability of being at risk for harm than when sensation seeking alone influences the behaviors (Zuckerman and Kuhlman, 2000). Thus, it will give new knowledge on the role of permanent underlying motivation on risk taking behavior of individuals, if these two personality traits can be combined and examined in relation to risky driving behavior.
1.4.3 Aggression-Hostility

The research has also identified aggression / hostility as factors of personality affecting crash involvement. There are strong research evidences suggesting that risky and problem drivers tend to exhibit excessive hostility or aggressive tendencies, and that aggressive drivers tend to be involved in more traffic accidents. As the result of extensive interviews with ten high-accident and ten low-accident subjects, Conger et al. (1959; in Beirness, 1993) concluded that one factor accounting for crash involvement was a reduced capacity to manage or control hostility. Zelhart (1972; in Beirness, 1993) observed that the greatest numbers of traffic accidents were reported by a subgroup characterized by aggressive and unsocialized tendencies. Tsuang, Boor, and Fleming (1985; in the NHTSA, 1995) also conducted an extensive review of the literature, and also asserted that those involved in crashes generally displayed less control of hostility and anger. In several studies, D. M. Donovan and colleagues have found aggressiveness to be related to risky driving and accidents, and they suggest that together with sensation seeking trait, aggressiveness form part of the motivational basis for reckless driving. Based on their findings they have argued that risky driving is often and expression of anger and hostility (Donovan, Umlauf, & Salzberg, 1988; in Arnett, Offer & Fine, 1997). Norris et al. (2000) conducted a prospective study to investigate the characterological risk factors for motor vehicle accidents (MVHs) and found that high hostility, in combination with poor self-esteem, was one predictor of future MVAs. The authors found that the drivers with this combination of characteristics were strikingly more likely to be in an accident than drivers who had neither characteristic.

1.4.4 Social Deviance

Research also found a strong relationship between social deviance and traffic violations, accident involvement, accident repeaters, drink driving, and aggression. It appears that various forms of driving behavior such as committing driving violations, driving whilst intoxicated (DWI), speeding, tailgating, running red-lights and generally displaying risky behavior in traffic can be said as manifestations of social deviance. Lawton et al. (1997b) investigated the relationship between mild social deviance, violations and accident rates. Findings showed that social deviance was a
significant predictor of both violation score and of accident rate. Furthermore, social deviance remained a significant predictor of accident rate, even when violations were controlled for. However, social deviance was not independently associated with accident rates, once the effects of violations and age were taken out of the equation. Meadows, Stradling & Lawson (1998) found scores on the extreme social deviance factor and the violation factor significantly and independently predicted accident involvement. Their findings also revealed that extreme social deviance was a strong predictor of violation factor score. Similar to Lawton et al.’s study, social deviance still remained a significant predictor, even when the effect of violation score was controlled for.

However, it is important to note that studies concerning the role of personality traits in risky driving practices and crash involvement have not controlled for exposure, and the relationship between personality traits and risky driving behavior or crashes could therefore be confounded (spuriously inflated) due to this. That is, it could be e.g. persons scoring high on sensation-seeking drive more than those scoring low on this trait, and therefore have more crashes simply because they drive more. The same goes for the relationship between attitudes, violations and crashes, which is reviewed below – these studies rarely control for exposure.

1.5 Driver attitudes and beliefs in relation to risky driving and crash involvement

As mentioned earlier, three basic types of driving behavior were identified as lapses, errors and violations (Parker et al., 1995a). Research investigating relationship between these three types of driving behavior and traffic accidents evidenced that not lapses or errors, but driving violations, which are defined as deliberate deviations from those practices believed necessary to maintain the safe operation of a potentially

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1 The studies finding no relationship with errors and crashes are however based upon self-report of different driver errors. The validity of self-reports of errors is questionable, as errors are believed to be unintentional, and it is not likely that a person remembers how often he or she e.g. misjudges the speed of an oncoming car or put on the wiper instead of the indicator unless this ends up in a critical situation. The previously mentioned large risk reduction-taking place during the first few months after licensing suggest that this is not be a result violations, and must therefore be ascribed to some skill acquisition. This is particularly true since both Lajunen & Summala (1995) and Bjørnskau & Sagberg (2005) have found that the frequency of violation increases as the accident risk decreases during the first year of holding a driver license. However, both studies found that accident risk decreases as driving skills increases. Thus, the lack of driving skills (which includes committing errors) is most probably a contributing factor to crashes for the most inexperienced drivers.
hazardous system (Reason, Manstead, Stradling, Baxter & Campbell, 1990), go with crash involvement (Stradling and Meadows, 2000). And typically, it is those drivers who score high on violations, not those who score high on errors or lapses, who are statistically more likely to have been accident-involved as drivers in the past (Parker et al., 1995a), and to be accident involved (again) in the future (Parker et al., 1995b), both in active and passive crashes (Stradling and Meadows, 2000). That is, high violators are not only more likely to run into others or run off the road, but to put themselves in situations where others run into them. Thus, another explanation of individuals’ traffic accident involvement may lie under the understanding of their tendency to commit violations.

Deliberate deviations from safety rules in traffic, i.e., violations and their relation to traffic accidents and crashes can be understood within the framework of social cognition approach. One such approach – The Theory of Planned Behavior (Ajzen, 1988) propose that attitudes toward health-relevant behaviors are key determinants of intentions to engage in the behavior, which, in turn, cause performance of the behavior. An attitude may be defined as a psychological tendency expressed by evaluating a specific object with some degree of favor or disfavor (Eagly & Chaiken, 1993). Relevant attitudes arise from beliefs about the outcomes of the behavior coupled with evaluation of those outcomes. For example, a belief that speeding increases the chance of crashing, along with a negative evaluation of crashing, would amount to a negative attitude toward speeding. A belief that speeding increases the chance of arriving at an appointment on time, along with a positive evaluation of arriving at an appointment on time, would amount to a positive attitude toward speeding. Several studies have illustrated the importance of investigating driver attitudes and beliefs in relation to risky driving, violations, and crash involvement (Parker et al., 1995a; Ulleberg & Rundmo, 2003).

Macmillan (1975; in Novaco, 1989) investigated ‘competitive’ and ‘aggressive’ driver attitudes, finding that males, across all age groups, who were categorized as ‘competitive’, had significantly higher convictions for motoring offences and higher numbers of accidents. Similarly, those with ‘aggressive’ attitude towards driving also displayed significantly higher numbers of accidents and convictions for motoring offences. Parker, Manstead, Stradling, & Reason (1992a) observed that younger
drivers endorsed positive aspects of speeding and dangerous driving more strongly than did older drivers. It has previously been noted that young drivers also show more risk-taking behavior in traffic (Jonah, 1986), such as younger drivers are more likely to speed than older drivers are, but this study also underlines a difference, in attitudes towards speeding, between younger and older drivers. Rothenatter (2000; in Lancaster and Ward, 2002), however, corroborated this finding by considering attitudes towards high and low-risk violations, and observed that those drivers who regularly commit traffic violations, such as speeding, have a positive attitude towards committing these violations. Stradling (2000; in Lancaster and Ward, 2002) also investigated attitude and skill, but from a different angle, considering the effects on crash likelihood. Results showed that a driver’s violations score was a much better predictor of crash involvement than their error or lapse score. The author therefore suggested that, above a certain minimum level of competence at vehicle handling and road reading, it is drivers with inappropriate attitude, rather than poor skill, who are more likely to crash. Furthermore, this was argued to apply to both active and passive crashes.

On the other hand, research investigating the relationship between attitude and risky driving behavior emphasizes the importance of investigating attitudes and beliefs that are specific to each individual risky driving behavior, rather than general road safety attitudes and beliefs. For example, in a longitudinal study examining self-reported risky driving and traffic safety attitudes, Iversen (2004) found that drivers with more positive attitudes toward rule violations and speeding were more frequently observed to engage in risky driving behavior. Fernandes, Job, & Hatfield (2007) corroborated this finding by observing that attitudes and beliefs strongly predicted risky driving, even after controlling for the effects of age, gender, and personality factors. In particular, those attitudes and beliefs specific to individual behaviors appear to be the most prominent factors.

Risky driving is a major determinant of drivers’ involvement in traffic accidents. While people may engage in risky driving and involve in traffic accidents for any of the reasons outlined previously, most of the research only investigate one constellation of factors, such as the role of personality traits, without examining other possible contributing factors, such as attitudes. More recently, a new approach
integrating the personality trait approach and the social cognition approach is forging. According to this approach, factors related to individual, social and cognitive variables all have influence on driving behavior. Risky driving behaviors and accident involvement among drivers, therefore, can be best understood if contribution of such factors examined together, not separately. Using similar approach just mentioned, the present study sought to identify the predictors of risk-taking behavior in traffic. In particular, the study investigated the relationships between personality traits, attitudes specific to traffic, demographic factors as well as experience and exposure, and risky driving behavior.

2. Method

2.1 Participants

An invitation letter to driver’s license holders who would be interested in taking part in a web-survey was sent out via student e-mail list serves at University of Oslo. A total of 206 volunteers filled out the questionnaire following URL link given in the invitation letter. Of these, six indicated not having driver’s license were not included in data analysis, another 14 were omitted from the analysis because their scores on social desirability items (scores ≥ 2 [positive respond on two out of three items]) in the questionnaire suggested a strong tendency toward socially desirable responding. In result, 186 respondents’ answers were regarded as valid, and used in further statistics. Among 186 respondents, 140 (75.3%) were females, 46 (24.7%) were males. The mean age of respondents was 27 years, and the age ranged from 19 to 53 years (SD = 5.97).

In the general instructions, respondents were asked to answer all the questions, read the questions carefully and answer honestly or choose the one fit best. Participants were also informed about their right of withdrawal at any time, and about confidence and anonymity of their answers.
2.2 Measures

Through a review of the literature it is found that demographic factors (such as age and gender), exposure factors, personality factors (such as sensation seeking, impulsiveness, social deviance and aggression-hostility), driving experience, and attitudes related to driving, are strongly correlated with risk taking behavior in traffic. In present study, a web-survey questionnaire consisted of questionnaires on above variables together with driving behavior questionnaire was deployed.

2.2.1 Attitude Scale

Risk-taking attitudes and beliefs, i.e. preferences toward risk-taking in traffic, have been found to correlate with risky driving behavior, intention to commit driving violations, and involvement in traffic accidents. Using both exploratory and confirmatory factor analysis, Ulleberg & Rundmo (2002) identified 11 dimensions of risk-taking attitudes related to driving. They applied both parametric as well as non-parametric methods to test the homogeneity of items within each attitude dimension, and reliability and validity of the dimension were found satisfactory. The attitude dimensions were significantly correlated with self-reported driving behavior, as well as accident frequency. Among 11 attitude subscales, three subscales, i.e. “speeding”, “traffic flow vs. rule obedience”, and “funriding” had the highest Cronbach’s alpha, the highest partial correlations with risk-taking behavior and accident involvement, and the highest standard regression coefficients when predicting risk taking behavior from attitudes, compared to other subscales of the attitude.

In present study, respondents’ risk-taking attitude related to driving was measured using nine items from those three attitude scales, i.e. “speeding”, “traffic flow vs. rule obedience”, and “funriding”, from Ulleberg & Rundmo (2002)’s study. In the original scales “traffic flow vs. rule obedience” was consisted of 9 items; “speeding” was consisted of 5 items; and “fun riding” was consisted of 3 items. In present study, in order to make the web questionnaire short, only 4 items from ‘traffic flow vs. rule obedience’ scale, 3 items from ‘speeding’ scale, and 2 items form ‘fun riding’ scale were utilized to elicit respondents’ attitude toward traffic safety. The items are listed in the Appendix. All items were answered on five point Likert scales.
ranging from “strongly agree = 1” to “strongly disagree = 5”. A total score on each scale was constructed by adding scores on each item, and high total score indicated a positive attitude towards traffic safety, meaning low preference for risk-taking in traffic.

2.2.2 Normlessness Scale

Normlessness (i.e. the belief that socially unapproved behaviors are required to achieve certain goals), which is a measure of social deviance, was measured using Kohn & Schooler’s (1983) normlessness scale. Ulleberg & Rundmo (2003) had reported Cronbach’s alpha coefficients of 4-item normlessness scale as 0.714 for Norwegian sample. In present study, it was decided to drop one item, which has the lowest standardized path from concept to indicator, form the original scale consists of four items. Therefore, only three items that were taken from Kohn & Schooler’s (1983) normlessness scale were included to measure the trait – social deviance. These three items are listed in the Appendix. All items were answered on five point Likert scales ranging from “strongly agree = 5” to “strongly disagree = 1”. A total Normlessness score was computed by adding scores on each item.

2.2.3 Impulsive Sensation Seeking Scale

The trait of Impulsive Sensation Seeking, which involves a tendency to act quickly without planning and a general need for novelty, thrills and excitement, are usually operationalized using 19-item Impulsive Sensation Seeking Scale (ImpSS) of Zuckerman-Kuhlman Personality Questionnaire (ZKPQ) (Zuckerman, 2002). The format of the complete ZKPQ contains five subscales (i.e. Impulsive Sensation Seeking (ImpSS), Sociability (Sy), Neuroticism-Anxiety (N-Anx), Aggression-Hostility (Agg-Host), and Activity (Act)) consisted of 89 true-false statements, and another 10 infrequency items to detect careless responding. The 19-item Impulsive Sensation Seeking Scale (ImpSS) reflects a need for change and novelty, a preference for uncertainty (risk) in social relationships and environments, and a tendency to forgo planning coupled with acting on impulse with a little concern for consequences. In order to avoid possible contamination, this scale does not contain any items that specifically mention activities such as drinking, drugs, sex, or risky sports
The reliability of the ZKPQ has been described as “fairly robust” (Zuckerman, 2002, p.393). Cronbach’s coefficient alpha for all scales ranged between .70 and .80. The test and retest reliability for the ImpSS scale was .80. Research in several areas (i.e., psychopathy, drug abuse, and general risk taking) found good convergent and discriminant validity. Also, there was a high degree of convergence between ZKPQ factors and other measures of personality, such as the Revised NEO Personality Inventory, the Eysenck Personality Questionnaire-Revised, and the Temperament and Character Inventory. In addition, the ZKPQ scales have been translated into several other languages (e.g., Chinese, German, Japanese, and Spanish), and all show similar factor and internal scale reliability. This stability suggests a cross-cultural generality of the personality constructs involved (Zuckerman, 2002).

Recently, Aluja et al. (2006) developed a shortened version of the ZKPQ with robust structure and acceptable psychometric properties in four languages: English (United States), French (Switzerland), German (Germany), and Spanish (Spain). Using several criteria derived from exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), including modification index and standardized regression weights, 10 items form each of the original subscales were selected to form a cross-cultural shortened form of the Zuckerman-Kuhlman Personality Questionnaire (ZKPQ-50-cc) adapted to English, French, German, and Spanish languages. Correlations in their total sample between the scores obtained with the original ZKPQ and the ZKPQ-50-cc were 0.90, 0.87, 0.94, 0.95 and 0.92 for the N-Anx, ImpSS, Sy, Agg-Host, and Act scales, respectively. Thus, the scores obtained with the 50-item instrument are quiet comparable to those obtained with longer version. All scales have satisfactory alpha coefficients above 0.70 in each country, except for the Agg-Host scale in Germany, Spain and Switzerland, and the Sy scale in Germany. However, these latter alpha coefficients were only slightly lower (0.60 – 0.68). Cronbach’s alpha coefficients of ImpSS scale were 0.72, 0.73, 0.73, and 0.74 for American, German, Spanish, and Swiss samples, respectively (see Aluja et al., 2006).
In present study 10-item Impulsive Sensation Seeking Scale of ZKPQ-50-cc was included to measure both impulsiveness and sensation seeking. The items are listed in the Appendix. Since all these 10 items are True or False statements (i.e. respondents answer as True when they agree with the statement, or they answer as False if they don’t agree with the statement), a total score for Impulsive Sensation Seeking Scale was computed on the basis of the number of true statements within the scale.

2.2.4 Aggression-Hostility Scale

The trait of Aggression-Hostility, which involves a tendency toward rude or anti-social behavior; a readiness to be verbally aggressive, are usually operationalized using 17-item Aggression-Hostility Scale (Agg-Host) of Zuckerman-Kuhlman Personality Questionnaire (ZKPQ) (Zuckerman, 2002). The 17-item of scale reflects rudeness, vengefulness and impatience with others, a “hot temper” and negatively reactive, confrontational non-verbal behavior. The test and retest reliability for the original Agg-Host scale was .78 (Zuckerman, 2002).

In present study, 10-item Aggression-Hostility Scale from ZKPQ-50-cc was included to measure trait - Aggression-Hostility. These 10 items were also True or False statements. Aluja et al. (2006) had reported Cronbach’s alpha coefficients of 10-item Agg-Host Scale as 0.72, 0.60, 0.66, and 0.68 for American, German, Spanish, and Swiss samples, respectively. The items are listed in the Appendix. There are three items within the scale that were reverse coded in order to eliminate response bias and careless replying. So, when computing total score for Aggression-Hostility scale, answers on these three items were reversed and then total score for the scale was computed.

In addition, three infrequency items were taken from the 10-item Infrequency scale of the original ZKPQ, in order to detect careless responding among participants. These three items were also True or False statements, and total score was computed on the basis of the number of true statements. These three items are listed together with Impulsive Sensation Seeking items and Aggression-Hostility items in the Appendix.
2.2.5 The Modified Driver Behavior Questionnaire

The Modified Driver Behavior Questionnaire (DBQ) developed by Stradling & Meadows (2000), was based on previous researches in the area of human risk behavior in traffic. Based on his model of human error, Reason et al. (1990) divided human risk behavior to errors and violations, and developed a survey instrument, Driver Behavior Questionnaire (DBQ), to measure these concepts in driver behavior. They defined errors as ‘the failure of planned actions to achieve their intended consequences’ and violations as ‘deliberate deviations from those practices believed necessary to maintain the safe operation of a potentially hazardous system’. Unlike errors, violations were seen as deliberate behaviors, although both errors and violations are potentially dangerous and could lead to a crash. Using the Driver Behavior Questionnaire, Parker et al. (1995a) investigated the relationship between errors, violations, and accident involvement in a study of 1600 drivers. It was found that accident involvement was predicted by self-reported tendency to commit violations, but was not significantly associated with the tendency to make errors. Subsequently, Lawton, Parker, Stradling, Manstead (1997a) extended the violations scale by adding new items. Factor analysis of this extended violation scale distinguished two classes of violation – highway code violations such as speeding and running red lights that was deliberate deviations from safe driving without a specifically aggressive aim, and more directly interpersonally aggressive violations such as sounding one’s horn or giving chase to another driver when angered.

The Modified Driver Behavior Questionnaire (DBQ) is consisted of three scales, named highway code violation (HCV), aggressive violation (AV) and errors (E), consisted of 8, 4, and 8 items, respectively. In present study, behavioral scale consisting of all 8 items of HCV, all 4 items of AV, and only 3 Error items were included to measure self-reported acts of risk-taking in traffic. The items are listed in the Appendix. On a 5-point scales with endpoints “never = 0” and “very often = 4”, the respondents were asked to indicate how often they performed each of the 15 different acts of risk-taking. A total score on each scale was constructed by adding the item scores within each scale. A total violation score were computed by adding high way code violation score and aggressive violation score, and high score indicated a high degree of risky driving performance.
2.2.6 Informational Survey

In the final section of the web-survey questionnaire, respondents were asked about their age, gender, what kind of drivers license they have (No driving license, Driving license for car, Driving license for motorcycle, Driving license for both car and motorcycle), how long they have had drivers license, how often they drive (Everyday, Many times in a week, One time in a week or less, and Never), and annual mileage they drive (Ca…Km).

2.3 Procedure

As the targeted respondents of the study were Norwegians, except the attitude scales (which were taken directly from original Norwegian scales) all other scales and informative items were translated from English into Norwegian. Then the web-survey questionnaire, as sequence, consisted of attitude scales, personality scales, behavior scales, and informational survey was developed using Nettskjema at UiO which allows users to create their own forms for surveys or other data collection, and invite people to respond the forms. Administrative unit of the Department of Psychology of UiO approved the use of student e-mail list serves to invite students participating the survey.

An invitation letter asking driver’s license holders who would be interested in taking part in a web-survey was sent out via student e-mail list serves on November 01, 2007. In the invitation letter, the general purpose of the study was briefly explained as to investigate the relationship between personality, attitude and behavior in traffic. Participants were told that it would take about 20 minutes to fill out the questionnaire. It was also informed that participation in the survey was voluntary and anonymous. The URL to the web-survey page was given together with e-mail addresses of contact persons if there were any questions regarding the survey and study.

Upon deciding to participate in the study, each volunteer followed the URL and was directed to the web-survey page. On top of the web-survey page, detailed information outlining the nature of the study and instructions of the survey were
given. Participants were told that the survey consisted of several parts, some parts about themselves, some parts about their opinion toward traffic safety, and some other parts about the behaviors they performed in traffic. And Participants were asked to read each questions carefully, and answer as best as they could. Participants were also told that there were no wrong or right answers for the questions, and they were asked to rate, choose or give honestly the answer that best describes them. Participants were informed their rights of withdraw or not to answer the questions in the survey at any time if they feel uncomfortable with any of the items in the survey. And again participants were reassured about the anonymity and confidentiality of participation in the study. In addition, at the beginning of each part there was specific instruction of how to complete.

The web-survey was open from November 01, 2007 to February 08, 2008. A total number of 206 volunteers filled out the web-survey questionnaire before the closing date. No compensation was offered to volunteers for participation in this research study. The data file was downloaded as SPSS file directly form Nettskjema for further data analysis.

2.4 Statistical analysis

The purpose of this study was to investigate the relationships between personality traits, attitudes specific to traffic safety, demographic factors as well as experience and exposure, and risk-taking behavior in the traffic. To this end, the project involved a non-experimental design, predicting the occurrence of risky driving behavior from demographic, experience, exposure, personality, and attitudinal measures.

Descriptive statistics were used to highlight sample characteristics. In order to examine possible gender differences on attitude, personality and driving behavior measures, the mean score of men and women were compared using t-tests. Cohen’s d (Cohn, 1988) was estimated to give an indication of how large the gender differences were on the related measures. The d-value is an indication of effect size, in this case the effect of gender on the various attitudes, personality traits and driving behavior.
According to Cohen (Cohn, 1988), a d-value of 0.20 or below is regarded as a small effect, 0.50 a medium effect, and 0.80 or above a large effect.

Cronbach’s alpha coefficient was applied to evaluate the internal consistency of the personality measures, the attitude scales and the risky driving behavior measure. A value of .7 – .8 is considered as acceptable value for Cronbach’s α, and values substantially lower indicate an unreliable scale. However, it is suggested that when dealing with psychological constructs, value below even .7 can be expected because of diversity of the construct being measured (Kline, 1999; in Field, 2005).

The relationship between gender, experience, exposure, personality, attitudes and risky driving behavior were estimated using structural equation modeling. The covariance matrix of the variables was analyzed by means of the Amos 7.0 Program. Missing cases were deleted listwise. Parameters were estimated using Maximum Likelihood (ML) estimation method. Various fit indices were used to assess the fit of the model to the observed data: the goodness-of-fit index (GFI), the adjusted goodness-of-fit index (AGFI), the comparative fit index (CFI), and the root mean square error of approximation (RMSEA). Traditionally, a GFI, an AGFI, and a CFI above 0.90 have been an agreed cut-off criteria, indicating a close fit between the model and the data (Hu and Bentler, 1995; in Ulleberg and Rundmo, 2003). Moreover, an RMSEA of 0.08 or less also indicate a good fit (Browne and Cudeck, 1993; in Ulleberg and Rundmo, 2003).

3. Research Ethics

Participants of this study were recruited through e-mail invitation. Brief information on the survey, anonymity and confidentiality of the survey together with its web linkage were given in the same e-mail. Participants could be able to decide whether to participate or not before, or after they were guided to the web page where the nature, purpose, procedure, requirements, and confidentiality of the study were given in detail.
Since participants of the survey were recruited through e-mail, and they were volunteers to participate, they could just open the web page, and get detailed information on the survey at introduction part of it. In the questionnaire, there was no information was asked regarding personal identity such as name, and there were generally no sensitive or privacy related questions. Nevertheless, if participants felt some questions were not appropriate to answer, they had the right not to answer or draw out as they were told in the very first part of the survey page. Only a code number were used to identify data. All of the answers of the participants were kept confidential, and only were used for this study. So, all participants and their answers were kept as anonymous.

4. Results

Prior to analysis, attitude toward traffic flow vs. rule obedience, attitude toward speeding, attitude toward funriding, normlessness, impulsive sensation seeking, aggression-hostility, high way code violation, aggressive violation, gender, age, driving experience, and exposure items were examined through various SPSS programs for accuracy of data entry, missing values, and fit between their distributions and the assumptions of multivariate analysis. It was found that annual mileage, which was one of the items intended to measure driving exposure, had large number of missing values and discrete distribution, therefore how often the respondents drove their motor vehicle was applied as a measure of exposure instead of annual mileage. For remaining measures and items, there were no missing values. Distribution of them, i.e. skewness and kurtosis, were inspected through histograms, and it was suggested no transformations were necessarily needed. There were cases with outliers but not extreme outliers, and it was decided to keep them in the dataset.

4.1 Scale reliability and construction

Internal consistency for all measures in the study was estimated through
Cronbach’s alpha coefficient. It was found that Cronbach’s alpha for aggressive violation scale increased from .467 to .505 when one of the four items in the original scale was dropped {Become angered by another driver and give chase with the intention of giving him/her a piece of your mind}. Factor analysis for violation items, i.e. highway code violation items and aggressive violation items, also revealed that this particular item was singled out in the factor structure. Thus it was decided not to include this item in further analysis.

The number of items, mean scores, and internal consistency for measures are listed in table 1. With the exception of the attitude toward speeding scale (\(\alpha = 0.567\)), the aggression-hostility scale (\(\alpha = 0.567\)), the aggressive violations scale (\(\alpha = 0.505\)) and the error scale (\(\alpha = 0.435\)), internal consistency were not high but acceptable for attitude toward funriding scale, attitude toward traffic flow vs. rule obedience scale, normlessness scale, impulsive sensation seeking scale and high way code violations scale, ranging from 0.614 to 0.717. It should be noted that results involving scales with poor internal consistency should be interpreted with caution. The overall low alpha coefficients of these scales were probably due to the fact that most of the scales in this study were shortened form of original scales and the value of \(\alpha\) depends upon the number of items on the scale. In addition, ImpSS scale and Agg-Host scale are consisted of true/false statements. Thus, fewer items in the scales and dichotomous answer options in some scales led low value of alpha coefficients in this study.

4.2 Gender differences on the various measures

Table 2 shows gender difference on the various measures related to attitudes, personality and driving behaviors. Significant gender differences were found on attitude toward speeding and on Highway Code violations. There were no significant gender differences among personality variables. The mean scores on attitude towards speeding subscales for men and women indicated that most of the respondents disapprove breaking traffic rules and speeding, and significant gender difference (\(d = 0.35\)) indicated that males held positive attitude towards speeding compared to female counterparts. Both males and females reported relatively low level of high way code violations, particularly the female respondents. A sizeable gender difference (\(d =

22
-0.47) indicated that males reported they more often commit high way code violations than females did. It is however, important to note that there were relatively large individual differences in the reported violation frequency.

Table 1. Number of items, mean scores and Cronbach’s alpha for measures.

<table>
<thead>
<tr>
<th>Measures</th>
<th>Number of Items</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Cronbach’s alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Attitude scales</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Funriding</td>
<td>2</td>
<td>7.63a</td>
<td>1.672</td>
<td>0.687</td>
</tr>
<tr>
<td>Traffic flow vs. rule obedience</td>
<td>4</td>
<td>13.72a</td>
<td>2.868</td>
<td>0.694</td>
</tr>
<tr>
<td>Speeding</td>
<td>3</td>
<td>10.78a</td>
<td>2.021</td>
<td>0.567</td>
</tr>
<tr>
<td><strong>Personality variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normlessness</td>
<td>3</td>
<td>7.49b</td>
<td>2.121</td>
<td>0.682</td>
</tr>
<tr>
<td>Impulsive sensation seeking</td>
<td>10</td>
<td>4.29c</td>
<td>2.144</td>
<td>0.614</td>
</tr>
<tr>
<td>Aggression-Hostility</td>
<td>10</td>
<td>3.84c</td>
<td>2.107</td>
<td>0.567</td>
</tr>
<tr>
<td><strong>Risky driving behavior in traffic</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High way code violations (HCV)</td>
<td>8</td>
<td>6.97d</td>
<td>3.780</td>
<td>0.717</td>
</tr>
<tr>
<td>Aggressive violations (AV)</td>
<td>3</td>
<td>2.19d</td>
<td>1.602</td>
<td>0.505</td>
</tr>
<tr>
<td>Errors (E)</td>
<td>3</td>
<td>2.30d</td>
<td>1.345</td>
<td>0.435</td>
</tr>
</tbody>
</table>

*a Range: (1 – 5) x No of items. High scores indicate positive attitude toward traffic safety.
*b Range: (1 – 5) x No of items. High scores indicate high on this trait.
*c Range: (0 – 1) x No of items. High scores indicate high on these traits
*d Range: (0 – 4) x No of items. High scores indicate a high degree of HCV/AV/E.

4.3 Correlations among variables

In order to investigate factors that may explain risk-taking behavior in traffic, as a first step, correlation analysis was performed to describe the strength and direction of the relationships between variables. Table 3 shows the correlations between the variables. To simplify the correlation matrix, latent variable scores were
Table 2. Gender differences on attitude, personality and driving related measures.

<table>
<thead>
<tr>
<th>Measures</th>
<th>Number of items</th>
<th>Women – mean score (SD) n = 140</th>
<th>Men – mean score (SD) n = 46</th>
<th>t-value (diff. men-women)</th>
<th>Effect size (d-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Attitude scales</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Funriding</td>
<td>2</td>
<td>7.75 (1.67)</td>
<td>7.28 (1.64)</td>
<td>1.65</td>
<td>0.28</td>
</tr>
<tr>
<td>Traffic flow vs. rule obedience</td>
<td>4</td>
<td>13.78 (2.75)</td>
<td>13.52 (3.22)</td>
<td>0.53</td>
<td>0.09</td>
</tr>
<tr>
<td>Speeding</td>
<td>3</td>
<td>10.96 (1.97)</td>
<td>10.24 (2.09)</td>
<td>2.11*</td>
<td>0.35</td>
</tr>
<tr>
<td><strong>Personality variables</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Normlessness</td>
<td>3</td>
<td>7.53 (2.03)</td>
<td>7.39 (2.40)</td>
<td>0.38</td>
<td>0.06</td>
</tr>
<tr>
<td>Impulsive sensation seeking</td>
<td>10</td>
<td>4.21 (2.13)</td>
<td>4.52 (2.20)</td>
<td>-0.84</td>
<td>-0.14</td>
</tr>
<tr>
<td>Aggression-Hostility</td>
<td>10</td>
<td>4.01 (2.15)</td>
<td>3.33 (1.91)</td>
<td>1.92</td>
<td>0.34</td>
</tr>
<tr>
<td><strong>Risky driving behavior in traffic</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High way code violations (HCV)</td>
<td>8</td>
<td>6.52 (3.59)</td>
<td>8.33 (4.06)</td>
<td>-2.86**</td>
<td>-0.47</td>
</tr>
<tr>
<td>Aggressive violations (AV)</td>
<td>3</td>
<td>2.14 (1.58)</td>
<td>2.35 (1.69)</td>
<td>-0.75</td>
<td>-0.13</td>
</tr>
<tr>
<td>Error (E)</td>
<td>3</td>
<td>2.35 (1.35)</td>
<td>2.13 (1.34)</td>
<td>0.96</td>
<td>0.16</td>
</tr>
</tbody>
</table>

*P < .05  **P ≤ .005
computed for attitude toward traffic safety and risk taking behavior. As shown in the table 3, gender were significantly correlated with risk-taking behavior in traffic, males reported more risk-taking compared to females. Experience (measured as total years of driving license holding) was significantly correlated with age and exposure (measured as driving frequency). Pearson product-moment coefficient for age and experience was 0.948, and this correlation indicates multicollinearity could be a problem if these two variables are included in further analysis at the same time.

Exposure and three personality measures were significantly correlated with attitudes toward traffic safety and risky driving behavior. Individuals drove more frequently tended to have negative attitude towards traffic safety, as well as reporting more risky driving behavior in traffic. Individuals who scored high on normlessness, impulsive sensation seeking and aggression-hostility demonstrated a negative attitude towards traffic safety, and reported more risk-taking in traffic. And these three personality traits significantly correlated with each other.

Attitude towards traffic safety was significantly correlated with risk-taking behavior (both HCV and AV) in traffic. In particular, individuals with a positive attitude towards traffic safety were less likely to report risky driving behavior, as indicated by the large negative correlation between the variables (r = -0.589). Errors were not correlated significantly with any personality traits and attitudes. The lack of correlation between errors and traffic violations (both HCV and AV) also indicated they are different concepts.

4.4 Model development

Figure 1 shows the hypothesized structural model, illustrating factors influence people’s risk-taking behavior in traffic. The model includes two hypothesized factors: Attitude towards traffic safety (with attitudes toward funriding, speeding, and traffic flow vs. rule obedience, as indicators) and Risky driving behavior (with Highway Code violations and aggressive violations as indicators). The hypothesized causal relationship between the different variables can be described as follows. Personality variables were hypothesized to covary (hence the two-headed arrow), and to have indirect effects on risky driving behavior through influencing
Table 3: Correlations between gender, age, experience, exposure, personality traits, attitude toward traffic safety and self-reported risk behavior. N = 186

<table>
<thead>
<tr>
<th></th>
<th>1</th>
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<th>5</th>
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<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Gender</td>
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<td>(Male = 1; Female = 0)</td>
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<td>2. Age</td>
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<td></td>
<td></td>
<td></td>
<td>.048</td>
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<tr>
<td>3. Experience</td>
<td>.043</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
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<tr>
<td>(Years with driving license)</td>
<td></td>
<td>.948**</td>
<td></td>
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<td></td>
<td></td>
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<td></td>
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<tr>
<td>4. Exposure</td>
<td>.083</td>
<td>.328</td>
<td>.352**</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>(Driving frequency)</td>
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<td></td>
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<tr>
<td>5. Normlessness</td>
<td>-.028</td>
<td>-.129</td>
<td>-.111</td>
<td>.079</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>6. Impulsive Sensation-Seeking</td>
<td>.062</td>
<td>-.019</td>
<td>-.001</td>
<td>.082</td>
<td>.327**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Aggression-Hostility</td>
<td>-.140</td>
<td>-.047</td>
<td>-.037</td>
<td>.063</td>
<td>.286**</td>
<td>.214**</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>8. Attitude towards traffic safety</td>
<td>-.117</td>
<td>.106</td>
<td>.061</td>
<td>-.192**</td>
<td>-.454**</td>
<td>-.340**</td>
<td>-.251**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Highway Code Violations (HCV)</td>
<td>.207**</td>
<td>.093</td>
<td>.149</td>
<td>.403**</td>
<td>.311**</td>
<td>.307**</td>
<td>.276**</td>
<td>-.598**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Aggressive Violations (AV)</td>
<td>.055</td>
<td>.085</td>
<td>.118</td>
<td>.343**</td>
<td>.178**</td>
<td>.190**</td>
<td>.370**</td>
<td>-.361**</td>
<td>.528**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Risk-taking behavior in traffic (Violations = HCV+AV)</td>
<td>.180</td>
<td>.101</td>
<td>.156</td>
<td>.430**</td>
<td>.303**</td>
<td>.304**</td>
<td>.339**</td>
<td>-.589**</td>
<td>.959**</td>
<td>.746**</td>
<td></td>
</tr>
<tr>
<td>12. Errors (E)</td>
<td>-.071</td>
<td>-.009</td>
<td>-.014</td>
<td>.000</td>
<td>.149</td>
<td>.066</td>
<td>.082</td>
<td>-.157</td>
<td>.076</td>
<td>.134</td>
<td>.104</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2-tailed)
attitude towards traffic safety. In the next turn, together with other measured variables, such as gender, exposure and experience, attitude towards traffic safety were hypothesized to predict risky driving behavior. Several questions are of interest: (1) Does this model fit the data? (2) Does the attitude towards traffic safety mediate the relationship between various personality traits and risky driving behavior? (3) Do gender, exposure, experience and attitude towards traffic safety predict risky driving behavior?

As a preliminary check of the identifiability of the model, the numbers of data points and parameters to be estimated were counted. With 11 variables there were \( \frac{11 \times (11+1)}{2} = 66 \) data points. The hypothesized model contained 26 parameters to be estimated (10 regression coefficients, 3 covariances, 13 variances); therefore, the model was overidentified and tested with 40 degrees of freedom. To set the scales of the factors, the path predicting attitude towards traffic flow vs. rule obedience from attitude towards traffic safety and the path predicting highway code violations from Risky driving behavior were fixed to 1.

The hypothesized model showed a marginal fit to the data in terms of the Maximum Likelihood \( \chi^2 \) test statistics, \( \chi^2 (40, N = 186) = 102.611 \ p < .001, \ GFI = 0.910, \ AGFI = 0.851, \ CFI = 0.862, \ RMSEA = 0.092. \) In order to improve model fit, several modifications were carried out. The largest improvement in model fit would be obtained by allowing “Experience” and “Exposure” to correlate as suggested in modification indices. This modification was complemented, since it was evaluated as theoretically meaningful – it is reasonable to believe that those more experienced drive more frequently, and those drive frequently usually have drivers’ license for considerable amount of time. This modification resulted in a Chi-square value of 78.076 (39, \( N = 186 \) \( p < .001, \ GFI = 0.929, \ AGFI = 0.879, \ CFI = 0.914, \ RMSEA = 0.074. \)

The second modification concerned a direct path from the trait – “Aggression-Hostility”, to “Aggressive violations”. This path was evaluated as theoretically meaningful, since aggressive and hostile individuals tend to perform aggressive violations more often. This modification further reduced the Chi-square value to 64.663(38, \( N = 186 \) \( p < .01 \ [p = 0.004]. \) The measure of model fit suggested that the
Figure 1  Hypothesized SEM model.
modified model showed a moderate fit to the data, GFI = 0.941, AGFI = 0.898, CFI = 0.941, RMSEA = 0.062.

The third suggested modification concerned a direct path from “Exposure” to “Attitude towards traffic safety”. This path was also evaluated as theoretically meaningful – it may be that individuals drive more frequently also holds negative attitudes toward traffic safety. The path was added and the model re-estimated. In result, the measures of the model suggested that the model fitted the data well, $\chi^2$ (37, $N = 186$) = 57.802 $p < .05$ \([p = 0.016]\), GFI = 0.949, AGFI = 0.908, CFI = 0.954, RMSEA = 0.055.

The further suggestion in the modification indices concerned the correlation between “Gender” and personality trait-“Aggression-Hostility”. As shown in table 3, compared to other personality traits, there was nonsignificant but considerable gender difference on this trait; nevertheless it was regarded as meaningful to allow the correlation. This modification was completed, and it resulted in a Chi square (36, $N = 186$) of 53.626 $p < .05$ \([p = 0.030]\), and model fit indices of GFI = 0.953, AGFI = 0.913, CFI = 0.961, RMSEA = 0.051.

Figure 2 shows the final tested model, with standardized path coefficients. Only significant paths (\(* p < .05 \quad ** p < .01 \quad *** p < .001\)) are shown in the figure, exempting the nonsignificant path from experience to risky driving behavior. The structural model explained 68% of the total variance in risk-taking behavior. Attitude towards traffic safety, exposure, aggression-hostility, and gender were the variables with direct effects on risk-taking behavior. As indicated by the size of the standardized path coefficient ($\beta = -.70$), there was a considerable effect of risk-taking attitudes on risk-taking behavior. Thus, the more positive attitudes towards traffic safety the respondents stated, the less risky driving behavior they reported. The relationship between exposure and risky driving behavior demonstrates that individuals who drive more often usually take more risk in traffic, and commit more violations. The significant direct path from aggression-hostility to aggressive violations suggests that individuals scoring high on aggression-hostility reported committing more aggressive violations in traffic as compared to those low on this trait.
Figure 2: The structural model illustrating factors hypothesized to affect risky driving behavior.
Experience measured as years of driving license holding, was not related to risky driving behavior in the structural model. This suggests that experience does not play an important role in traffic risk-taking when the effects of the other variables in the model are statistically controlled for.

As shown in the model, a total of 35% of the variance in attitude towards traffic safety were explained by the different personality traits plus exposure. The lack of direct effects of the personality traits on risk-taking behavior implies that personality traits primarily had indirect effects on the risk-taking behavior through affecting attitude towards traffic safety. In order to determine the total effects of those variables on risky driving behavior, both direct and indirect effects were estimated (Table 4).

Table 4: Direct, indirect and total effects of the variables on risk-taking behavior in traffic. Standardized coefficients.

<table>
<thead>
<tr>
<th>Gender (females = 0 males = 1)</th>
<th>Experience</th>
<th>Exposure</th>
<th>Aggression-Hostility</th>
<th>Impulsive Sensation Seeking</th>
<th>Normlessness</th>
<th>Attitude towards traffic safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct effect</td>
<td>.140</td>
<td>.104</td>
<td>.252</td>
<td>-</td>
<td>-</td>
<td>-.701</td>
</tr>
<tr>
<td>Indirect effect</td>
<td>-</td>
<td>-</td>
<td>.134</td>
<td>.108</td>
<td>.145</td>
<td>.267</td>
</tr>
</tbody>
</table>
| Total effect                   | .140       | .104     | .386                 | .108                      | .145         | .267                           | - .701

Table 4 demonstrates that exposure had both indirect effect and direct effect on how often the respondents commit risky driving behavior. The quiet considerable standardized coefficient (β = .252) signifies that individuals who drive more frequently committed driving violations more often than individuals who drive less frequently. The indirect effect was caused by frequent drivers holding negative attitudes toward traffic safety, and finding it acceptable to break some traffic rules. In turn, these negative attitudes and beliefs affected the frequency of committing risky driving.

Table 4 shows the personality variables had primarily indirect effects on how often the respondents committed risk-taking behavior in traffic. As illustrated in
The indirect effects took place through influencing attitude towards traffic safety. The indirect effects suggested that respondents with high scores on aggression-hostility, impulsive sensation seeking and normlessness were more likely to perform risky driving behavior than those scoring low on these traits. Normlessness seemed to be of greater importance in this context, as shown by the size of its standardized total effects, signifying that respondents with high scores on normlessness were most likely to commit violations in traffic. On the other hand, aggression-hostility turned, however, out to be the weak predictor of the risk-taking behavior in traffic. However, it is worth to note that aggression-hostility had direct effect upon aggressive violations that was one of the indicators of risky driving behavior. Thus, the standardized coefficient for aggression-hostility in table 4 is a bit misleading because the direct effect of aggression-hostility on aggressive violations was hidden. The direct effect of aggression-hostility on aggressive violations indicates that individuals with high scores on aggression-hostility were more likely perform aggressive behaviors in traffic.

Gender, exposure and attitude toward traffic safety had direct effect upon risky driving behavior. The negative sign and large size of the standardized coefficient of attitude toward traffic safety signify that respondents who hold negative attitudes toward traffic safety were most likely to report risky driving behavior than those holding positive attitude towards traffic safety. The direct effect of gender upon risky driving behavior indicates that males reported risky driving behavior more often than females did. Exposure had both direct and indirect effect on risky driving behavior. Experience showed nonsignificant direct effect on risky driving behavior, and it was the weakest predictor among all variables.

5. Discussion

Before discussing the findings of this study it is worth reflecting on its possible methodological weaknesses. First, measures used in present study are shortened form of original scales. Besides, impulsive sensation seeking scale, aggression-hostility scale and the modified driving behavior questionnaire were
probably the first time translated into Norwegian and tested in Norwegian population. Therefore, reliability and validity of the measures used in this study might be questioned. While it would be unequivocally preferable to use original full version scales in a research, the short version can reduce the administration time for the scales at little cost in terms of reduced reliability. An additional potential weakness concerning measures in this study in terms of reliability is that impulsive sensation seeking and aggression-hostility were measured using dichotomous options. However, it is not surprising to find relatively low reliability of psychological tests, such as intelligence and personality traits measures, in studies.

Second, the respondents were internet-recruited volunteers from registering students in the University of Oslo. As a nonrandom sampling, the true impact of using volunteer students as participants is difficult to assess. Meanwhile, their characteristics may not be true of many people in the general population, and external validity of the research may suffer from this. In fact, traditional subject pools also have problems with sampling, and the usage of Internet based survey provides another opportunity to reach potential participants efficiently and economically.

Third, the data reported here were based solely on self-reports. As always with self-reports of behavior, social desirability might have biased the data. It can be claimed that some respondents may have embellished their answers or been economical with the truth. It should be noted, however, that respondents were assured about anonymity (they did not provide their names) and confidentiality, and they volunteered to participate the study. Hence, the participants did not have any benefits to be gained by lying. Moreover, present study controlled for such biases in responding by using infrequency items in the questionnaire. Another controversy concerning self-report measures is whether it can give an objective representation of actual behavior. Self-reports may not represent genuine actual behavior, but may nevertheless provide a good indication of it. For example, West, French, Kemp & Elander (1993b, in Lawton et al., 1997b) reported a correlation of .65 between observed driving speed and responses on the driving speed subscale of their Driving Style Questionnaire. The use of self-reports has also several advantages compared to the alternatives of direct observation or simulation. Both alternative methods will inevitably place individuals under observation that may cause substantial changes in
actual behavior, while self-reports provide summary of information in a variety of natural situations. And, both alternative methods are expensive and time consuming.

Despite aforementioned methodological limitations, findings in this study are encouraging. The results showed that there were strong gender effects on attitude towards speeding and on highway code violations. Females were in general most likely to hold negative attitude towards speeding, and to commit traffic violations less often than males. These results are in line with previous studies finding relatively large gender differences in traffic safety orientation (Lawton et al., 1997a,b; Ulleberg & Rundmo, 2002; Waller, Elliot et al., 2001). Compared to Ulleberg & Rundmo (2002)’s study, present study only find significant gender difference on attitude towards speeding, the other two measures of attitudes toward traffic safety, however, didn’t show significant gender difference as they did in Ulleberg & Rundmo’s study. These maybe due to the fact that present study only had a small sample size of 186 respondents, and number of female respondents and male respondents were not even. It could be expected that there would be gender differences on both highway code violations and aggressive violations. But, in present study only significant gender difference on highway code violation was found. Relatively low aggressive violations and nonsignificant gender difference suggested that, compared to highway code violations, aggressive violations are not widely spread in Norwegian roadways.

Age demonstrated very high correlation with experience ($r = 0.948$) that was measured as years of drivers’ license holding. This is expected as older drivers usually have got their drivers’ license for quiet long time than younger drivers. This high correlation between age and experience also indicated in further statistical analysis only one of them could be used in order to avoid multicollinearity, and it was decided to keep experience as variable in followed analysis. But, all other measures used in present study were lack of significant correlation with age. According to previous studies, younger drivers are more likely to exhibit the risk taking factors of personality (Zuckerman, 1979; Jonah, 1997), and more likely to commit driving violations than their older counterparts (Lawton et al., 1997a; NHTA, 1995; Reason et al., 1990). Present study failed to find such relationship between age and risk taking factors of personality, attitudes toward traffic safety and violations. A possible explanation is that, in present study, respondents were not split into age groups to find
out possible age effects upon personality, attitudes and risk-taking behavior. It might be possible to find effects of age on other variables by comparing different age groups, not just using age as a continuous variable.

The results also showed that the relationship between personality traits, attitudes toward traffic safety and risky driving behavior was present also when exposure was controlled for. One possible explanation is that frequent drivers expose themselves to hazardous traffic systems more often, and increasing driving experience and exposure to traffic increases the sense of subjective control and decreases the sense of subjective risk while decreasing concern for safety aspects (Lajunen & Summala, 1995). Therefore, frequent drivers might be found holding unfavorable attitudes toward traffic safety, and committing violations more often than less frequent drivers. The measure of exposure (how often a person drive) could have been more precise. In fact, annual mileage is a more precise measure of exposure, but in the present study the respondents were not able to report this. The relations between personality traits, attitudes toward traffic safety, and risk-taking behavior (violations) need to be examined more carefully and in depth. It was found that personality traits significantly correlated with both attitudes toward traffic safety and risk-taking behavior (violations), and it was also noticed that there was significant and quiet large correlation between attitudes toward traffic safety and risk-taking behavior (violations). According to Ajzen (1988, p.103), “Some personality dimensions may be considered dispositions to hold certain beliefs rather than dispositions to act in certain ways.” Personality traits used in present study, i.e. impulsive sensation seeking, aggression-hostility and normlessness, appear to fall into this category of traits. The Theory of Planned Behavior (Ajzen, 1988) proposes that attitudes toward health-relevant behaviors are key determinants of intentions to engage in the behavior, which, in turn, cause performance of the behavior. Also in the Theory of Planned Behavior, it was postulated that attitude toward a behavior is determined by salient beliefs about that behavior, termed behavioral beliefs (Ajzen, 1988). Thus, it is plausible to assume that some personality traits predispose an individual to hold certain salient behavioral beliefs, and that beliefs, in turn, affect attitude toward behavior that is thought to be one determinant of the behavior, i.e. personality traits might have effects on a behavior through their effects on attitude toward that behavior.
Present study also examined errors in traffic in relation to personality, attitudes towards traffic safety, risk-taking behavior (violations) in traffic and other factors. The results showed that errors were not gender specific, i.e. present study didn’t find significant gender differences on making errors while driving, nor correlated significantly with age, experience, exposure, any personality traits, attitude or violations. The results here signify that errors in traffic have nothing to do with individual dispositions and attitude toward traffic safety. And it is possible that errors occur regardless a person holding positive or negative attitude toward traffic safety, and it is rare that a person deliberately make errors in traffic. The results also suggested that errors and violations are different concepts. They share little in common as indicated the correlations between them. The results are in line with previous research (Reason et al., 1990; Parker et al., 1995a) findings that errors and violations are different types of aberrant driving behavior. Parker et al. (1995a) examined the relationship between driving behavior and accident involvement. They found that violations, not errors, correlate with both past and future accident rates. From this point, it seems feasible to assume that violating behavior in traffic go with crashes, therefore investigating violations and their predictors could lead to identification of possible factors having effects on occurrence of traffic accidence. On the other hand, compared to violations, traffic accidents are rare events making them difficult to assess and report. Hence, present study made a post-hoc assumption that predictors of violating behavior in traffic are also the predictors of accident risk in traffic, and only further investigated the relationship between assumed predictors and violating behaviors in traffic.

Relying on above-supposed relationship between personality trait, attitude and behavior, present study suggested a model intended to predict risky-driving behavior from personality traits, attitudes toward traffic safety, and other additional factors. After several modifications, the model showed good fit with the data collected. The results showed that personality traits primarily have indirect effects on risk-taking behavior through their influence on attitude toward traffic safety. The results also suggested that exposure (driving frequency) and gender, together with attitudes specific to traffic safety, are important predictors of risky driving behavior. In addition, strong effect of aggression-hostility on aggressive violation was found. In present study, experience did not show significant association with risky-driving
behavior, suggesting that experience is a weak predictor of risky driving behavior. However, this may be due to the fact that experience was only measured using one item, i.e. years of drivers’ license holding. Ideally a more comprehensive measure should have been applied to reveal the impact of experience on risky driving behavior.

The patterns of findings are in line with previous studies on the relationship between personality, driver attitudes, and risky behavior (Fernandes et al., 2007; Iversen, 2004; Parker et al., 1995a; Ulleberg & Rundmo, 2002), and underscore the importance of identifying potential hazardous personality characteristics in attempts to change attitudes and behaviors related to traffic. For example, Iversen (2004) found that drivers with more positive attitudes toward rule violations and speeding were more frequently observed to engage in risky driving behavior; Ulleberg & Rundmo (2002) found high scores on sensation seeking, normlessness and aggression were associated with both risk-taking attitudes, and risky driving behavior. Ulleberg & Rundmo further suggested that personality primarily influence behavior through affecting the behavior’s attitudinal determinants.

A plausible explanation for the effects of personality traits on risk-taking attitudes and risky driving behavior is that impulsive sensation seekers are expected to seek excitement and stimulation in traffic, and to act on the spur of the moment, often without giving due consideration to the possible consequences, which is, in turn, reflected in holding positive attitudes toward traffic violations, and in intention to engage risky driving behavior at the sake of thrill. When it comes to normlessness, individuals scoring high on this trait are assumed to believe it is acceptable to do whatever he/she can get away with, and to have low barriers towards socially unapproved behavior. Such a belief may reflect itself in negative attitudes toward traffic safety, and socially deviant (normless) individuals can be expected to perform traffic violations more often. Individuals scoring high on aggression-hostility are usually characterized as verbally aggressive, rude, antisocial, vengeful, hot tempered and impatient. These may manifest themselves in individuals’ defying authoritative regulations such as traffic rules through both holding negative attitudes toward traffic safety and inclining to commit traffic violations, especially aggressive violations more often. Furthermore, the indirect effect of the personality traits on risk-taking behavior suggested a causal relationship, where the personality traits are thought of as
exogenous variables influencing attitudes, which in turn affect behavior. Personality traits have been found to be relatively stable over time, and there is also evidence for them having biological basis (Zuckerman, 1983). Thus, it is theoretically meaningful to treat the personality traits as exogenous variables.

Attitude towards traffic safety was found to have the largest direct effect on risky driving behavior in the structural model. The attitude measures seemed to mediate the relationship between personality traits and behavior. However, personality traits and exposure accounted for only 35 percent of variance in the attitude measures, indicating that the attitude measures also had an independent effect on risk taking behavior. Meanwhile, gender and exposure also had direct effects on risky driving behavior, and the model explained 68% of the variance in the behavior. In this way, gender, exposure and risk-taking attitudes can be said to predict risky driving behavior. But, it should be noticed that participants answered attitude measures before answering behavior measures in present study. And it might be that participants were slightly changed their reported behaviors in order to keep their attitudes and behaviors in line. In fact, if the behavior measures were answered first, and then the attitude measures, it would also cause problem because people are inclined to justify their previous actions in their attitudes (Heider, 1958, in Ulleberg & Rundmo, 2003). Nevertheless, the predictive value of attitude, not general attitudes but specific attitudes, in relation to the behavior is well documented (Iversen, 2004; Ulleberg & Rundmo, 2002). On this basis, one may expect attitudes specific to traffic safety to be correlated with the violating behavior, and to be one of the predicting factors of the risky behavior.

The present study has several implications. First of all, this study corroborated previous researches emphasizing the importance of investigating personality traits and specific attitudes in relation to the risk-taking behavior in traffic. The findings that personality traits have influence upon risky driving through attitudes toward traffic safety indicate road safety campaigns and intervention programs should take into account personality risk factors. However, it is not realistic to change the personality of drivers. A more meaningful way would be to target specific attitudes toward safety. For example, by promoting driving as transportation, not the way of seeking excitement and thrill, in a general traffic safety campaign, the impacts of sensation
seeking may be reduced. And, findings also indicate that one way of reducing violations is to reduce driving frequency, which may not be a practical position. From other research (e.g. Lajunen & Summala, 1995) we know that safety motives decreases as a function of annual mileage (exposure). In addition, the findings of this study suggest that safety motives or attitudes have large effects on risky driving (violations). Therefore, it is still possible to reduce the impact of exposure on risk-taking behavior through affecting safety motives of drivers, i.e. affecting attitudes, beliefs and values. Another implication of present study is that, in this study, the impulsive sensation seeking scale and aggression-hostility scale of the ZKPQ-50-cc were translated into Norwegian and tested in Norwegian sample. Thus, this study made a remarkable contribution to cross-cultural validations of the ZKPQ-50-cc.

The present study due to its small sample size and sample characteristics together with methodological limitations and selected variables may not represent the whole picture. It is conceivable that other factors may also relevant to the risk-taking behavior in traffic. And the post-hoc assumptions that violations predict traffic accident involvement and predictors of the violating behavior are also predictors of traffic accidents need to be investigated. Hence, a future study investigating full range of possible predictor factors of risk-taking in traffic with large sample size, and follow up examinations of traffic accident risk would give clearer picture.
6. References


Beirness, D.J. (1993). Do we really drive as we live? The role of personality factors in road crashes. *Alcohol, Drugs, and Driving, 9*, 129-143.


**Appendix**

*Attitude Scale*


<table>
<thead>
<tr>
<th>Når du kjører bil, hører fart og spenning sammen. (Fun riding)</th>
<th>Svært enig</th>
<th>Enig</th>
<th>Både/og</th>
<th>Uenig</th>
<th>Svært uenig</th>
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<thead>
<tr>
<th>Noen ganger er det nødvendig å tøye reglene for at trafikken skal gli. (Trf flow/rule)</th>
<th>Svært enig</th>
<th>Enig</th>
<th>Både/og</th>
<th>Uenig</th>
<th>Svært uenig</th>
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<thead>
<tr>
<th>Hvis du er en god sjåfør, er det er helt OK å kjøre litt fort. (Speeding)</th>
<th>Svært enig</th>
<th>Enig</th>
<th>Både/og</th>
<th>Uenig</th>
<th>Svært uenig</th>
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<tr>
<th>Det er bedre å kjøre smidig enn alltid å kjøre lovlig. (Trf flow/rule)</th>
<th>Svært enig</th>
<th>Enig</th>
<th>Både/og</th>
<th>Uenig</th>
<th>Svært uenig</th>
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<tr>
<th>Det er helt OK å råkjøre så fremt trafikkforholdene gjør det mulig. (Speeding)</th>
<th>Svært enig</th>
<th>Enig</th>
<th>Både/og</th>
<th>Uenig</th>
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<tr>
<th>Bilkjøring er mye mer enn bare transport, det er også fart og moro. (Fun riding)</th>
<th>Svært enig</th>
<th>Enig</th>
<th>Både/og</th>
<th>Uenig</th>
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<tr>
<th>I blant er det nødvendig å ta sjanser i trafikken. (Trf flow/rule)</th>
<th>Svært enig</th>
<th>Enig</th>
<th>Både/og</th>
<th>Uenig</th>
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<tr>
<th>Å kjøre 5 til 10 kilometer over fartsgrensa er helt OK fordi alle andre også gjør det. (Speeding)</th>
<th>Svært enig</th>
<th>Enig</th>
<th>Både/og</th>
<th>Uenig</th>
<th>Svært uenig</th>
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<tr>
<th>Av og til er det nødvendig å bryte noen trafikkregler for å komme seg tidsnok frem. (Trf flow/rule)</th>
<th>Svært enig</th>
<th>Enig</th>
<th>Både/og</th>
<th>Uenig</th>
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**Normlessness Scale**


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<thead>
<tr>
<th>Svært enig</th>
<th>Enig</th>
<th>Både/og</th>
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Det er helt i orden å gjøre som du vil så lenge du ikke havner i vanskeligheter. □ □ □ □ □

Det er helt OK å omgå lover og regler så lenge du ikke direkte bryter dem. □ □ □ □ □

Hvis noe fungerer, er det mindre viktig om det er rett eller galt. □ □ □ □ □

**Impulsive Sensation Seeking Scale (ImpSS) & Aggression-Hostility Scale (Agg-Host)**

[from ZKPQ-50-cc with infrequency items (Inf)]


<table>
<thead>
<tr>
<th>Riktig</th>
<th>Galt</th>
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</table>

Jeg gjør ofte ting på impuls. (ImpSS) □ □

Når jeg blir sint, sier jeg stygge ting. (Agg-Hos) □ □

Noen ganger liker jeg å gjøre ting som er litt skremmende. (ImpSS) □ □

Det er naturlig for meg å banne når jeg blir sint. (Agg-Hos) □ □

Jeg liker fester med ”fullt kjør”. (ImpSS) □ □

Jeg har nesten aldri lyst til å slå eller fike til noen. (Agg-Hos)* □ □

Jeg har alltid fortalt sannheten. (Inf) □ □
Jeg kunne godt tenke meg å reise på ferie uten noen fast plan, reiserute eller tidsskjema. (ImpSS)

Hvis noen fornærmer meg, prøver jeg å ikke bry meg om det. (Agg-Hos)*

Jeg liker å være i situasjoner der man ikke kan forutse utfallet. (ImpSS)

Hvis noen irriterer meg, så nøler jeg ikke med å fortelle det til dem. (Agg-Hos)

Jeg er villig til å forsøke alt én gang. (ImpSS)

Når noen er uenig med meg, klarer jeg ikke å la være å komme i krangel med dem. (Agg-Hos)

Jeg vinner alltid i spill. (Inf)

Jeg foretrekker venner som er spennende og som kan gjøre uventede ting. (ImpSS)

Jeg har et sterkt temperament. (Agg-Hos)

Jeg ville like å leve et liv der man er på farten og reiser mye, med mye forandringer og spenning. (ImpSS)

Jeg klarer ikke unngå å være ”en smule” uhøflig ovenfor folk som jeg ikke liker. (Agg-Hos)

Jeg blir ofte så grepet av nye og spennende ting og ideer at jeg ikke tenker på mulige problemer i det hele tatt. (ImpSS)

Jeg er alltid tålmodig ovenfor andre, selv om de er irriterende. (Agg-Hos)*

Noen ganger liker jeg å gjøre “sinnssyke” ting bare for moro skyld. (ImpSS)

Jeg har aldri mistet noe. (Inf)

Når noen skrier til meg, skrier jeg tilbake. (Agg-Hos)

(* reverse coded)
**The modified Driver Behavior Questionnaire**

Angi for hver situasjon hvor ofte du som bilfører opplever dem. Vi forventer ikke presise svar, men din oppfatning av hvor ofte de skjer med deg. Sett ett kryss i ruten som passer best.

<table>
<thead>
<tr>
<th>Hvor ofte forekommer det at du:</th>
<th>Svært ofte</th>
<th>Ofte</th>
<th>Av og til</th>
<th>Sjelden</th>
<th>Aldri</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kjører bevisst over fartsgrensen på motorvei (HCV)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Misliker visse typer bilførere og viser din irritasjon med alle midler du kan. (AV)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Kjører bevisst over fartsgrensen i tettbygde strøk. (HCV)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Undervurderer farten på møtende kjøretøy i forbindelse med forbikjøring. (E)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gir mye gass ut i fra lyskryss for å kjøre forbi en bil i kjørefeltet ved siden av deg. (HCV)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Oppdager for sent at fotgjengere krysser veien du svinger inn på. (E)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kjører svært nær bilen foran for å få føreren til å kjøre fortere eller kjøre til siden. (HCV)</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Bruker bilhornet for å vise at du er irritert på en annen bilist. (AV)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Kjører bevisst mot rød lys i lyskryss. (HCV)</td>
<td></td>
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<tr>
<td>Kjører bevisst for langt ut i veikryss slik at den som har forkjørsrett må stoppe og slippe deg frem. (AV)</td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Holder deg i et kjørefelt som du vet er stengt lengre framme for så å presse deg over i annet kjørefelt i siste liten. (HCV)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Ungår så vidt kollisjon i kryss fordi du ikke var oppmerksom på vikepliktsskilt eller stoppskilt. (E)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Blir utålmodig av en treg bilist i venstre kjørefelt og kjører forbi på innsiden. (HCV)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>*Blir opprørt av en annen bilførers atferd og kjører etter ham/henne for å si fra. (AV)</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kjører bil når du er usikker på om du har litt promille. (HCV)</td>
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</tr>
</tbody>
</table>

(* item removed)
Personopplysninger

Kjønn: □ Mann □ Kvinne

Alder: ________

Har du førerkort? □ Nei □ Ja, for personbil
□ Ja, for motorsykkel □ Ja, både for personbil og motorsykkel

Hvis ja, Hvor lenge (antall år) har du hatt førerkort for bil/MC? ________

Hvor ofte kjører du selv bil/motorsykkel? □ Hverdag □ Flere ganger i uka
□ En gang i uka □ Aldri
eller mindre

Omtrent hvor mye kjører du i løpet av ett år? Ca________km