Influencing subgroups of young drivers and their passengers.

Motivational influences of personality traits on risk-taking attitudes and driving behaviour.

Pål Ulleberg

Dr.polit.-avhandling 2002

Psykologisk institutt

Fakultet for samfunnsvitenskap og teknologiledelse

Norges tekninsk-naturvitenskapelige universitet, NTNU

Trondheim

ISBN-nummer 82-471-5131-6

Contents

Preface and acknowledgements

The present thesis consists of five papers; one introductory paper and four empirical papers. The purpose of the introductory paper is to place the four empirical papers within a common theoretical and methodological framework, as well as discussing the results of the four empirical papers in relation to each other. The structure of the thesis implies that some parts of the papers, especially the methods section, will be similar in all of the papers.

There are several persons to whom I would like to express my gratitude. First, I would like to express my thanks to my mentor, professor Torbjørn Rundmo, who introduced me to the research project this thesis is based upon. I also thank him for his support and the discussions we have had throughout my work with this thesis.

I would also like to thank the Norwegian Public Roads Authorities (Statens Vegvesen) for making the distribution and collection of the questionnaires possible. In particular, I wish to thank the following members of the "18-40" project group for their invaluable help: Per Gjerde, Erik Hartmann, Rolf Robertsen and Bård Morten Johansen.

I would also like to express my gratitude to my current employer, the Institute of Transport Economics (TØI) in Oslo, for providing me the time needed to conclude the last part of the thesis. Without this kind of support, it would have taken me considerably longer time to finish the thesis. In particular, I wish to thank Knut Østmoe and Marika Kolbenstvedt for their supportive attitude. I would also like to thank my friends and colleagues at the Department of Safety and Environment at TØI, especially Truls Vaa and Aslak Fyhri, for their helpful comments concerning the introductory paper of the thesis.

I also thank my parents Halfdan and Berit Marie and my brother Hans Petter for their moral support and their encouragement. Their positive attitude towards research has been a major source of inspiration for me. Finally, I would like to express my deepest gratitude to my wonderful cohabitant Anne Lise for her support and encouragement. The quality of the thesis would not have been the same without her constructive comments and suggestions.

Overview of the papers included in the thesis:

Paper I: Risk-taking attitudes among young drivers: the psychometric qualities and dimensionality of an instrument to measure young drivers' risk-taking attitudes
Scandinavian Journal of Psychology, 2002, 43, 197-209

Paper II: Personality, attitudes and risk perception as predictors of risky driving behaviour among young drivers
Safety Science, in press

Paper III: Personality subtypes of young drivers. Relationship to risk-taking preferences, accident involvement, and response to a traffic safety campaign
Transportation Research Part F: Traffic Psychology and Behaviour,2001, 4, 279-297.

Paper IV: Social influence from the back-seat:
Factors related to adolescent passengers' willingness to address unsafe drivers
Transportation Research Part F: Traffic Psychology and Behaviour, submitted

Summary

In Norway, as well as in many other countries, traffic accidents are one of the greatest threats against adolescents' health. Young Norwegian drivers are found to have 10-15 times as high a risk of being involved in traffic accidents compared to other drivers, and more than every forth Norwegian driver who is involved in traffic accidents resulting in physical injuries is 24 years of age or younger. The high accident rate indicates that traffic safety promotion may be of particular relevance to young drivers.

One way of influencing safer driving practices is through the use of public road safety campaigns. The effect of such campaigns has, however, been questioned. Several literature reviews have concluded that the majority of traffic safety campaigns aimed at influencing drivers' attitudes or behaviour have failed to document any effects on the number of accidents. The supposed influence of attitudes on driving behaviour has also been questioned. On the other hand, a meta-analysis carried out recently suggests that campaigns be the most efficient measure to improve safety on the roads. This suggests that road safety campaigns still may be a useful mean for promoting road safety.

There may be several reasons for the campaigns' apparent lack of success, as well as the uncertain relation between attitudes, driving behaviour and traffic accidents. This thesis aims at giving a more thoroughly insight into the dimensionality of adolescents attitudes to traffic safety, as well as the association between attitudes and driving behaviour. The motivations underlying attitudes and behaviour are also studied in terms of the correspondence between personality traits and young drivers' safety orientation in traffic. Finally, the role of adolescent passengers as "guardian angels" is addressed.

The present thesis consists of four studies. The first study aims at developing a reliable and valid measure of adolescents' risk-taking attitudes and how such a measure relates to driving behaviour and accident involvement. The second study investigates how personality dispositions are related to adolescents' safety orientation in traffic. The third study aims at identifying reliable and valid subtypes of young drivers on the basis of personality characteristics. The fourth study has a different point of departure, focusing on the role of adolescent passengers rather than the drivers. This last study examines factors that may enhance or prevent adolescent passengers to promote safe driving among their peer drivers.

The results of study 1 demonstrated that adolescents' attitudes towards risk-taking in traffic were multidimensional. The reported attitudes on the dimensions demonstrated that adolescents think differently concerning these aspects of traffic safety. On some dimensions, most adolescents report quite ideal attitudes concerning safety, on other dimensions the picture is the opposite. The attitude dimensions identified were related to both risk-taking behaviour in traffic and accident involvement. However, the influence of the various dimensions on behaviour differed in magnitude. This implies that some dimensions were more important predictors of behaviour than others. Thus, the attitude dimensions with the highest correspondence with self-reported behaviour could be given special attention when traffic safety programs are carried out.

The results of study 2 suggested that the relation between the personality traits and driving violations was mediated through attitudes. On this basis it was concluded that personality traits primarily influence risky driving behaviour indirectly through affecting the attitudinal determinants of the behaviour. This suggests that deeper-lying motivations represented as personality traits is reflected in adolescents' attitudes towards traffic safety. A practical implication of the results would be to acknowledge the importance of personality traits in traffic safety campaigns. Consequently, the messages of attitude campaigns could be tailored according to certain personality characteristic, in order to appeal to high-risk drivers. However, if risk-taking attitudes are partly a consequence of permanent motivational factors, this implies that drivers' risk-taking attitudes may be difficult to change trough traditional mass-media campaigns.

Study 3 identified six subtypes of young drivers on the basis of a cluster analysis of personality measures. The subtypes were found to differ on self-reported risky driving behaviour, attitudes towards traffic safety, risk perception, estimation of own driving skills, and accident involvement. Two of the subtypes were identified as high-risk groups in traffic. The subtypes were also found to differ on how they evaluated and responded to a traffic safety campaign. The results indicated that the campaign seemed to appeal most to the low-risk subtypes and least to the high-risk subtypes. Gender differences within each subtype were also found on the different traffic related measures, as well as on response to the campaign. It is concluded that young drivers should not be treated as a homogenous group pertaining to road safety.

Study 4 showed that there were several factors influencing adolescents' willingness to address risky driving. Females were in general most likely to report that they spoke out to the driver when feeling unsafe in the car. Males seemed to perceive more negative consequences of addressing unsafe drives, to be less confident in their ability to influence an unsafe driver, to be more likely to accept risk taking from other drivers, and perceive less risk than females. In turn, these beliefs affected the likelihood of confronting an unsafe driver. The results also demonstrated that a relatively large proportion of the adolescents thought that it is acceptable to ride with an unsafe driver. This kind of belief lessened the likelihood of addressing unsafe driving, as well as being most prominent among passengers who ride with friends with risky driving habits.

Possible implications of the results of the four studies for both driver-focused and peer-focused interventions aimed at promoting road safety are discussed.

1. Introduction

1.1 Background and aims of the thesis

In Norway, as well as in many other countries, traffic accidents are one of the greatest threats against adolescents' health. Young Norwegian drivers are found to have a 10-15 times higher risk of being involved in traffic accidents as compared to other drivers (Fridstrøm, 1996). More than every forth Norwegian driver who is involved in traffic accidents resulting in physical injuries is 24 years of age or younger. Not only are adolescents themselves injured or killed in traffic, they are also disproportionately often involved as drivers in accidents in which others are killed or injured (Brown, Sanders & Schonberg, 1986). The high accident rate indicates that traffic safety promotion may be of particular relevance to young drivers.

It is commonly acknowledged that human factors may contribute to accident involvement in traffic (Grayson & Maycock, 1988). Based on a study of more than 2000 traffic accidents, Sabey and Taylor (1980) concluded that human factors were contributing elements in 95 % of the accidents. In particular, driving behaviour was identified as the most central of these factors. Similar conclusions have been reached in other studies (Treat, Tumbas, McDonald et al., 1977). Thus, efforts made to promote safer driving practices may be one important mean of reducing traffic accidents. Such efforts is especially relevant in Norway, since the road authorities recently implemented the Vision-Zero policy, meaning that no persons should be killed or seriously injured in traffic by the year 2030.

One way of influencing safer driving practices is through the use of public road safety campaigns. The public campaign has during the last 30 years been one of the most popular ways of promoting safe driving. Publicity campaign aimed at promoting traffic safety can be said to have started at the end of the 60s in Europe. At that time, the number of traffic accidents had increased by an accelerating number[1], and authorities acknowledged that their efforts made to promote traffic safety had to be renewed. According to Barjonet (1997), this resulted in a change from administrating road safety through laws and police surveillance towards efforts made to promote safer driving practices among all road users. The role of

[1] 429 persons were killed in traffic accidents in Norway in 1961. In 1970, the number of persons killed in traffic accidents had risen to 570 persons. This number has been reduced to 274 killed persons in traffic in 2001 (Statistics Norway, 2002).

psychologists, which previously had been restricted to the selection of professional road or rail drivers by the use of psychometric tests, was now extended to cover all road users. The primary aim was to persuade drivers to drive more safely and to use safety equipment (such as using the seat belt) through mass media advertisements. In particular, social psychology was brought into road safety work in order to design and prepare campaigns. The majority of these campaigns sought to influence safety related attitudes in order to decrease the number of accidents. This was based upon the assumption that a change in attitudes would cause a corresponding change in behaviour.

The effect of such campaigns has, however, been questioned. Several literature reviews have concluded that the majority of traffic safety campaigns aimed at influencing attitudes have failed to document any effects on the number of accidents (Elvik, Mysen & Vaa , 1997; OECD, 1994, see Aarø & Rise, 1996, for a review). The supposed influence of attitudes on driving behaviour has also been questioned (Assum, Midtland & Opdal, 1993). On the other hand, a meta-analysis carried out recently suggests that campaigns in general, including those aimed at influencing attitudes, may be the most efficient measure to improve safety on the roads (Delhomme, Vaa, Meyer, Gordon, Goldenbeld, Järmark et al., 1999).

There may be several reasons for the attitude campaigns' apparent lack of success, as well as the uncertain relation between attitudes, driving behaviour and traffic accidents. One reason may be that the campaigns usually have aimed at influencing attitudes in general, and not the specific attitudes most likely to influence driving behaviour. Another reason may be the rather weak methodology applied when the relation between attitudes and driving behaviour is studied. For instance, several studies have applied attitude measures with unknown psychometric properties, causing the relationship between attitudes and behaviour to be underestimated (Wilde, 1993). Obviously, this imposes a limitation to the validity of the conclusions made from these studies. The use of a reliable and valid measurement of attitudes could therefore be advantageous in several ways. First, it may help to understand the impact of attitudes on driving behaviour and accident involvement. Second, it may help road safety authorities to target the specific attitudes most likely to influence driving behaviour and accident involvement. The first aim of the present thesis is therefore *to develop a reliable and valid measure of adolescents' risk-taking attitudes and how such a measure relates to driving behaviour and accident involvement*.

The process of motivating people to change their attitudes and behaviour is, however, more complicated than merely telling people what to do or how to think. Understanding how adolescents who engage in risky driving think, behave, and feel is clearly advantageous in this context – knowledge of this type can give authorities a better position to design safety campaigns that appeal most to their target audience. It may thus be of importance to examine whether certain personality characteristics, meaning stable patterns of feelings, thoughts and behaviour (Tellegen, 1991), are related to young drivers safety orientation in traffic. Taking such dispositions into account may result in a more efficient measure of communicating the message to the target audience of safety campaigns, as well as changing their attitudes and behaviour. A second aim of the present thesis is therefore *to investigate how personality dispositions are related to adolescents' safety orientation in traffic.*

It is important to note that although young drivers as a group are more likely to be involved in accidents, this does not mean that all young drivers are equivalent. Several studies indicate that subgroups of drivers may be more at risk than others (Deery & Fildes, 1999, Gregersen & Berg, 1994). If personality dispositions are related to traffic safety orientation, one way of identifying such subgroups could be on the basis of certain combinations of personality traits. The third aim of the present thesis is *to identify reliable and valid subtypes of young drivers on the basis of personality characteristics*. If there are differences in safety orientation among such subtypes, it is possible to define the groups on which to focus and give practical suggestions on how to target these groups.

Road safety campaigns usually aims at influencing the individual driver. Although positive social influence from peers has been found to be effective in health promotion programs (Posavac, Kattapong & Dew, 1999), such strategies are rarely employed when traffic safety campaigns are carried out. Such measures may however be especially relevant for young drivers, since their accidents risk tends to increase when they are accompanied by passengers of their own age (Drummond & Triggs, 1991; Williams & Wells, 1995; Doherty, Andrey & MacGregor, 1998; Chen, Baker, Braver & Li, 2000). Thus, highlighting the role of other socially influential persons involved in the driving situation may be beneficial in order to promote safe driving. This is related to the final aim of this thesis, which is *to identify factors that may enhance or prevent adolescent passengers to exert positive peer influence in the driving situation*.

As implied in the above presentation, the present thesis considers human factors to be a central cause of traffic accidents. However, the importance of human factors, as well as what kind of human factors are the important contributing causes to traffic accidents, has been and still is disputed. The next section aims at presenting the most central theories pertaining to traffic accident causation and driving behaviour.

1.2 Theories of accident causation and driving behaviour

1.2.1 Accident proneness

The concept of *accident proneness* is based on the observation that some individuals consistently have more accidents than others. The concept can be traced back to Greenwood and Woods (1919, in McKenna, 1983), who studied accident involvement among female workers in an ammunition factory. They found that only a small number of the workers accounted for most of the accidents, a tendency they believed to be stable over time. The concept of accident proneness has been subjected to controversy, both concerning the usefulness of the concept, as well as the explanations proposed of why some people are more involved in accidents than other (McKenna, 1983). The aim is not to present this controversy, but rather to focus on findings relevant for involvement in traffic accidents.

Based on the concept of accident proneness, one can expect that only a small number of drivers are responsible for most of the traffic accidents occurring. This notion was first presented by Farmer and Chamber (1939), who suggested that some drivers were more accident prone than others due to certain personal characteristics. Rawson (1944) presented a similar view, but went a step further claiming that accident proneness in traffic could be explained on the basis of Sigmund Freud's psychoanalytical theory. According to this perspective, errors resulting in accident involvement are subconsciously motivated in order to punish ourselves as a consequence of feeling guilty. Rawson (1944) based his rather speculative view on the finding that the truck drivers who were most involved in traffic accidents also had the most personal accidents.

Tillman and Hobbs (1949) also found some evidence for accident proneness in a study of taxi drivers, but explained this tendency as a result of mild social deviance. They based this explanation on results finding that drivers with most

accidents also were more likely to have been in contact with juvenile courts, social services, public health and credit bureaux compared to drivers with fewer accidents. They attributed the tendency to be accident prone to a general characteristic of being socially maladjusted and stated the well-known phrase “a man lives as he drives”. Thus, driving was regarded as a manifestation of living.

Most evidence for stable individual differences in traffic accident rates comes from a longitudinal study conducted by Häkkinen (1979). Häkkinen used an extensive test battery of psychological tests and tested 66 bus and streetcar drivers in Helsinki repeatedly over a period of 10-27 years. The results indicated a high consistency of accident involvement between the initial testing and 10-27 years later ($r = .66$). Häkkinen also found that high accident drivers differed from low accident drivers on several of the tests applied. Still, Häkkinen, concluded that no specific personality type predisposes for accident involvement. Häkkinen believed accident proneness to be a meaningful concept, although he did not emphasise personality characteristics as causal factors to the same extent as previous supporters of the theory of accident proneness.

Others have, however, been more critical to the meaningfulness of the concept accident proneness. Forbes (1939, in Elvik, 1991) demonstrated that drivers who were involved in several accidents during one period, not necessarily were involved another period. For instance, the 1.3 % of the drivers that accounted for 22.8 % of the total number of traffic accidents in the period of 1931-1933, did only account for 3.8 % of the accidents in the period of 1934-36. The reason for certain individuals appearing to be accident-prone as a result of coincidence also is in agreement with elementary statistical reasoning. Differences in low frequency events such as accident involvement should be expected, even though all drivers have the same probability of being involved in an accident. Hence, much of the variation in accident frequency can be explained by random variation. To exclude certain persons form driving would therefore not necessary decrease the number of accidents occurring.

On the other hand, Elander, West and French (1993) have suggested that part of the difficulty in finding stable individual differences in accident involvement may be due to methodological factors. Using the correlation coefficient to determine the stability of low frequency events such as accidents leads to an underestimation of the stability of accident involvement. West, Elander and French (1992) exemplify this by using odds ratios instead of correlations as a measure of stability in accident

involvement. For instance, the correlation for accident involvement between two periods was as low as 0.12. However, the odds ratio showed that a drivers who had an accident in one year, was twice as likely to have an accident the following two years compared to a driver who did not have an accident in the first year.

The theory of accident proneness in its most extreme form, meaning that only a small amount of drivers are responsible for most accidents, is today regarded as inadequate by most researchers. Still, many researchers accept the notion that stable individual differences may be one of several causes contributing to accident involvement. McKenna (1983) has suggested replacing the concept accident proneness with the term "differential accident involvement". This view acknowledges that there exist individual differences in accident involvement, but do not attribute these differences to a general inherited predisposition towards accidents as proposed by the earliest supporters of accident proneness. According to McKenna (1983), the central aim should rather be to consider the possibility of predicting and distinguishing those who are involved in accidents and those who are not on the basis of various psychological tests.

1.2.2 In-depth studies

In the 1950, the focus was shifted from accident proneness towards *in-depth studies* aiming to reconstruct each accident in detail in order to detect the causes of the accident – every factor that may have contributed to the accidents was sought identified (see OEDC, 1988, for a review). The general conclusion of these studies was that the human factor in most cases contributed to accidents. However, it was difficult to conclude which specific human factor that caused accidents. The general conclusion was that human factors were the causes of the majority of traffic accidents, but that no single human factor could be identified as more important than others (Elvik, 1991).

1.2.3 Information processing models and system theory – the driver as a victim

The development of models of human information processing in the 1950's can be said to have exerted a great influence on the causes thought to contribute to traffic accident involvement. Such models emphasises that information processing is conducted through a sequence of stages, which include attention, perception, decision and response (see e.g. Broadbent, 1958). Each of these stages is associated with a limited capacity for processing information. When driving, the driver has to

continuously process new information and uses this to make appropriate decisions. Limitations in the information processing capabilities of the driver are thus likely to influence the driver's capability to attend to, perceive, make decisions, and respond to new traffic situations. (Shinar, 1978). The failure in the processing of information (e.g. inattention, misperception, and slow reaction time) may cause unintended errors and thereby contribute to accident involvement. Several studies have supported this assumption (for reviews, see Ranney, 1996; Shinar, 1978).

The consequences of the limited information processing capabilities have been considered in the system theoretical approach to accident causation. During the 60's, this approach emerged as a dominant explanation of traffic accident causation. According to system theory (Marek & Sten, 1977), accidents are viewed as a failure of the traffic system rather than the failure of the driver. One of the fundamental assumptions in system theory is that the demands of the traffic systems to a considerable extent influence the behaviour of the driver. The traffic system may be too complex for the limited capacity of human information processing to cope with, causing the driver to fail in detecting potential dangerous situations. According to the theory, redesigning the traffic environment is a more efficient way to reduce the accident frequency than denying an individual a driver license due to certain personality characteristics (as proposed by some supporters of the concept of accident proneness).

System theory also acknowledges that the human factor is an important element contributing to accidents, but this is only one of the elements that may influence accident involvement. The traffic system is seen as consisting of three main elements; the road user (the human factor), the vehicle (type of car, safety equipment), and the traffic situation (characteristics of the road). System theory focuses on the interaction between these three elements, and not so much the unique contribution of each. The aim of system theory is thus to capture and reflect the complexity of the situations in which accidents occur rather than reducing the problem of accidents into unique factors. Statements such as "80 per cent of all accidents are caused by human error" are thus regarded as simplistic, failing to accept that several factors may interact with each other.

One of the advantages of the system theoretical approach to traffic safety, is that it introduces a holistic view of the contributing causes of accidents. This is by no doubt a more profitable point of departure than merely focusing on the individual

drivers as the cause of accidents, or seeking for the most important cause of accidents, as aimed by the in-depth study approach.

One major problem of system theory is that the driver is treated as a more or less passive responder to the traffic environment. There is, however, overwhelming evidence pointing towards the drivers as an active responder to the traffic environment. Several measures introduced to lower the demands of the traffic system to the drivers, such as anti-lock brake systems (ABS), road lightning of previously dark roads, and light instead of dark road surface, have not lead to fewer accidents, as predicted by system theory (see Elvik, Mysen & Vaa, 1997 for a review). Instead, drivers tend to adapt their behaviour in traffic towards taking more risks than before (e.g. increasing the speed they drive) when the demands of the traffic system are lowered. This tendency of behavioural adaptation was acknowledged by Gibson and Crooks as early as in 1938. They found that when provided with vehicles with more efficient breaks, drivers tended to delay breaking accordingly. Moreover, Smeed (1949) emphasised that the provision of better roads merely enables motorists to drive faster, which in the next turn will result in the same number of accidents as previously. A more recent example is the introduction of (ABS). In a longitudinal study of taxi drivers in Munich, taxi drivers with ABS-brakes drove more carelessly, overestimated the effectiveness of the brake system, and felt more secure compared to taxi drivers who drove vehicles without this brake system (Ashenbrenner, Biehl & Wurm, 1987). Moreover, a study conducted by Daimler Benz A.G. (1986, in Trimpop, 1994) concluded that cars with the ABS system were three times more involved in accidents where they hit other cars from behind than cars without this system.

On the other hand, measures aimed at lowering the demands of the traffic system on the driver on locations where accidents tend to accumulate (so called “black spot treatment”) have succeeded, as predicted by system theory (Elvik, 1997). Such measures may include improved road geometry or placing traffic lights on road crossings. These results suggest that the system theory may be a valuable approach in reducing the number of traffic accidents. Still, the process of behavioural adoption indicates that system theory has it’s limitations.

1.2.4 Motivational models of driving behaviour – accidents as a results of a failure to regulate own driving appropriately

The process of behavioural adoption can be said to have inspired the development of several models of driving behaviour where the driver is seen as an active creator of the traffic environment rather than a passive responder. The aim is not to present a thoroughly description for all of these models. The aim of the current section is to present the most central motivational models, in order to describe the different factors hypothesised to affect driving behaviour. Note that several of these models are still being developed and improved by their authors.

Taylor (1964) was one of the first theorists who acknowledged that driving is more than a passive response to the traffic situation. Taylor suggested that the level of emotional tension or level of anxiety the driver wishes to tolerate motivates driving behaviour. The driver is thought to adjust his level of risk taking while driving in order to keep his emotional responses at a constant level. Taylor (1964) based his hypothesis on a study of subjects who drove a car on three specific routes under varying conditions in a city while their galvanic skin response (GSR) was monitored. The GSR remained stable during the entire trip, even though the drivers changed their behaviour while driving.

In the mid-seventies Näätänen and Summala (1974, 1976) introduced their zero-risk theory of driving behaviour. The point of departure in their theory was that the driver's motivations and intentions largely had been ignored in road safety work. Central in their theory is the concept "subjective risk monitor". The subjective risk monitor is thought to become activated and generate different degrees of subjective risk or fear depending on the risk experienced in the traffic situation. Näätänen and Summala thus emphasises emotions as one of the central motivators of driving behaviour. The driver is normally thought to be motivated to escape or avoid this (unpleasant) experience of risk in order to feel no risk, for instance by reducing speed while driving on an icy road. Hence, the theory is labelled zero-risk. Drivers thus (actively) adapt to the complexity of the traffic situation by adjusting the manner in which they drive. Accidents happen, in part, because drivers fail to adapt their driving adequately to the level of complexity in the traffic situation. Näätänen and Summala (1974, 1976) also acknowledge that certain drivers, particularly young drivers, are motivated by so called "extra motives", for instance to seek risks in traffic due to the excitement it causes or a need for impressing peers.

Contrary to the zero-risk theory, the risk homeostasis theory (Wilde, 1982) is based on a driver's presumed motivation to seek some level of optimal or accepted risk (i.e. target risk), which guide his or her behaviour. This target risk depends upon the driver's knowledge of the accident rate. Whenever there is a discrepancy between the target risk and the risk experienced, this will lead behavioural changes to reduce this discrepancy. This process of risk evaluation is according to the risk homeostasis theory (RHT) a rationally founded cost-benefit evaluation of various action alternatives while driving. When introducing a new safety measure, e.g. ABS, the driver will adjust his or her behaviour in order to seek the level of optimal risk. In this case to delay braking, increase speed or follow the car in front more closely. Thus, accidents happen because the driver is willing to tolerate a target level of risk. Another difference between Wilde's RHT and the models proposed by Taylor (1964) and Näätänen and Summala (1974, 1976) is that emotions are given less or no importance by Wilde (1982).

The three models described above rely heavily on the driver's experience of risk, or the avoidance of risk, as the main motivator behind driving behaviour, which in the next turn may result in accident involvement. All models, especially the zero-risk theory and the RHT, predicts that measures aimed at reducing the complexity of the traffic situations and the introduction of new safety devices will not necessarily reduce traffic accidents because drivers tend to adapt to the traffic situation by taking more risks than before the measures were introduced. Although the zero-risk theory and RHT provide explanations of the process of risk compensation, they have been criticised for failing to generate any testable hypothesis (Ranney, 1996).

Similarly to the zero-risk theory, the risk-avoidance model of Fuller (1984) considers that the driver is motivated to avoid an experience of risk and fear while driving. Fuller's model (1984) is based on the assumption that making progress towards a destination and avoiding hazards are the two predominant driver motivations. According to the model, drivers spend most of the time avoiding obstacles and potential accident hazards in order to avoid a feeling of risk or fear. Repeated exposure to obstacles while driving is our basis for learning how to identify risks on the road. Fuller (1984) emphases that actions in traffic are most of the time performed automatically, and not a result of conscious, deliberate decision processes. Thus, risk taking in traffic may not always be a result of conscious decision-making, but rather a result of the individual's conditioning history. For instance, a driver may choose not to reduce his or her speed before a road crossing,

because no cars are approaching from the right (thus a lack of a stimuli that otherwise would have elicited a reduction of speed).

Recent approaches have also to a large extent acknowledged emotions as motivators behind driving behaviour. For instance, Rothengatter (1988) stresses that the pleasure of driving and the speed choice of others also play a major role in speed choice. Trimpop (1994) extended Wilde's (1982) risk homeostasis theory to include emotional factors as motivators of a person's risk behaviour in traffic, as well as in other areas of risk taking. Moreover, Røysamb (1997) suggests that each individual establish his or her own driving speed based on an optimal interface between emotions such as fear, calmness, excitement, boredom, etc. Røysamb (1997) based this conclusion on a study finding non-speeders tending to avoid speeding because this is perceived as frightening. They also lacked positive emotional reason for speeding. On the other hand, speeders seemed to lack this kind of fear and avoid non-speeding because this may cause low arousal emotions such as boredom and sadness. Speeders were found to be motivated on the basis of the positive emotions speeding causes, such as excitement, avoiding boredom etc.

The most recent, but not yet fully developed approach, is presented by Vaa, Berge, Glad and Sagberg (2000). These authors stress that previous research has not generated a comprehensive model of driving behaviour, and the authors are as a result of this in the phase of developing such a model. A central concept in their model is the "target feeling", meaning that drivers seek to obtain the best feeling while driving, a feeling that is hypothesised to be different among drivers.

Other models of behaviour not specifically developed to account for driving behaviour has also been applied as explanation of driving behaviour and accident involvement. The Theory of Reasoned Action (TRA) does to a larger extend stress the importance of attitudinal and social factors as predictors of driving behaviour (Ajzen & Fishbein, 1980). According to this model, a person's intention to perform a behaviour, which in the next turn influences behaviour, is determined by the person's attitudes towards the behaviour and by the subjective norm. The subjective norm is considered to be the person's beliefs about what other referents expect him or her to do, weighted by the person's motivation to comply with these referents. Ajzen (1988, 1991) later extended this model to include perceived behavioural control, meaning the extent a person believes the behaviour in question is under volitional control, as an additional determinant of behaviour. This model was named the theory of planned behaviour (TPB).

Although the TRA or TPB were not specifically developed to account for driving behaviour, they have frequently been applied for this purpose (see e.g., Parker, Manstead, Stradling, Reason & Baxter, 1992; Parker, Manstead and Stradling, 1995; Parker, Lajunen and Stradling, 1998; Rutter, Quine and Chesham, 1995). Attitudes towards traffic safety have been found to correlate with aggressive driving behaviour, fast driving, and self-reported accident involvement (Parker & Manstead, 1996; Parker, Lajunen & Strandling, 1998; West and Hall, 1997). Moreover, substantial correlation between the social norm component and driving after consuming alcohol (Åberg, 1993) and decisions to commit traffic violations have also been found (Parker, Manstead, Reason et al., 1992). Similarly to Wilde's RHT, the TRA and TPB suppose that driving behaviour is to a large extent based on rational evaluations of various action alternatives while driving.

To sum up, the motivational models of driving behaviour presented here provide different explanations for what determines driving behaviour and causes accidents compared to models based on human information processing. The latter sees the driver as a passive responder to the traffic situation, where cognitive overload may result in accident involvement (Ranney, 1996). In contrast, motivational models rather focus on the driver as a active decision-maker in traffic situations who adapt his or her behaviour in order to avoid risk or to choose the amount of risk accepted. Both main types of models have, however, presented convincing evidence for some predictive validity on driving behaviour and accident involvement. Are these two main types of models, cognitive models and motivational models, incommensurable or can they complement each other? The answer may lie in separating driving behaviour into different components.

1.2.5 Hierarchical model of driving behaviour and the distinction between errors and violations

Several theorists have classified driving behaviour as a hierarchy (Mikkonen & Keskinen,1988, in Laapotti et al., 2001; Rasmussen, 1984, van der Molen & Bötticher, 1988). The advantage of hierarchical models is that they to a certain extent integrate both cognitive as well as motivational factors as determinants of driving behaviour and accident causation.

Although there are several differences between hierarchical models of driving behaviour, they all roughly separate between three levels of driving behaviour (Laapotti et al.2001). The lowest level is an *operational*, vehicle manoeuvring

level. This involves concrete operations such as braking, changing gear, turn on indicators etc. Inexperienced drivers typically have most of the their mental capacity directed towards such actions. As such skills become more familiar and automatised, this allows mental capacity to be freed and more resources are directed towards levels higher up in the hierarchy. The next level, the *tactical* level, involves decisions of how traffic situations are mastered, for instance to overtake a car in front. The highest level, the *strategic* level, concerns higher-level decision making, such as planning where and when to drive. Most of such decisions are made before the driver is in the car[2]. Thus, the higher up in the behavioural hierarchy, the more conscious decision making is involved.

Driving behaviour and decisions typical for all three levels may result in accidents, but the causes underlying such behaviours are thought to be different. According to Reason, Manstead, Stradling, Baxter and Campell (1990), driving behaviour resulting in accidents should be divided into two main components; *errors* and *violations*.

This distinction is regarded as important because different psychological factors are thought to underlie these components of driving behaviour. *Errors* are defined as the failure of planned actions in order to achieve their intended consequences. Errors can be divided into two subtypes: mistakes, which refer to misinterpretation of information, and slips/lapses that concerns divergence of planned actions from some satisfactory path towards a desired goal. Norman (1983, in Reason et al., 1990) has clarified this distinction: If the intention is not appropriate (e.g. to brake in a situation when it is more appropriate to accelerate), this is a mistake. If the action is not what was intended (e.g. hitting the brake when the intention is to accelerate), this is a slip/lapse. It is important to note that both subtypes of driving errors are thought to be unintended. They are hypothesised to origin from deficiencies in judgmental and /or inferential processes. Thus, cognitive and motor skills are thought to influence this kind of erroneous behaviour in traffic. These kinds of erroneous behavioural acts correspond to behaviour typically involved in the operational and tactical level of the driving behaviour hierarchy (Reason et al., 1990).

[2] It should be noted that Keskinen (1996, in Laapotti et al., 2001) has suggested to add a forth level in the hierarchical model; “goals for life and skills for driving”. This level is thought to connect driving behaviour with human behaviour in general.

On the other hand, *violations* concern intentional/deliberate acts of risk-taking in traffic. Such behaviour may include intentionally risky acts such as speeding, ignoring a red light, or showing of skills to others. According to Reason et al. (1990), violations are influenced by social and motivational factors, such as norms, driving in accordance with a valued social image, or a wish for rapid progress in traffic. Acts of violations are also thought to be more dominant in the higher levels of the driving behaviour hierarchy.

Other theorists also acknowledge the separation between driving errors and violations. Näätänen and Summala (1974, 1976) separate between cognitive skills and motivation pertaining to driving behaviour. The skill component of driving behaviour refers to the driver's cognitive and motor skills, which represents the driver's maximum performance and capabilities while driving. The driver's skills do, however, not necessarily predict accident involvement. The driver's motives are, on the other hand, a more suited measure pertaining to accident involvement. Motives are thought to represent the driver's motivation and permanent personality traits and attitudes towards safety. Contrary to skills, motives determine what drivers chose to do with their skills. The distinction between errors and violations also corresponds to Evans' (1991) separation between driver performance and driving behaviour, as well as Elander, West and French's (1993) separation between driving skills and driving style.

It should be noted that Reason et al.'s (1990) separation between violation and error factors of driving behaviour has also been confirmed in studies of Swedish drivers conducted by Åberg and Rimmö (1998) and Rimmö and Åberg (1999). These studies have, however, found empirical support for separating the slips and lapses factor into two new factors, inattention errors and inexperience errors. The authors consequently suggested splitting driving behaviour into four factors, *violations* (e.g., exceeding the speed limit), *mistakes* (e.g., misjudgement of the gap when overtaking), *inattention errors* (e.g., failure to observe traffic signs and signals), and *inexperience errors* (e.g., preparing to reverse while using a forward gear).

To sum up, it seems to be consensus towards separating between deliberate violations and unintentional errors. There is, however, some disagreement whether one should separate between two or three main types of driving errors.

Errors and violations in traffic may influence accident involvement differently. Based on a review of several studies of the effect of individual differences in road accident risk, Elander, West and French (1993) concluded that driving style (violations) such as fast driving and willingness to commit driving violations could be explained by motivational factors such as personality, antisocial motivation, norms, and driving related attitudes. Driving skills (errors) where, on the other hand, more attributable to limitations in cognitive abilities such as hazard perception and switching attention. Parker, Manstead and Stradling (1995) have also reached a similar conclusion. In line with Reason et al. (1990), Parker, Manstead and Stradling (1995) separated risky driving behaviour into three components on the basis of a factor analysis; slips, mistakes, and violations. While slips and mistakes were found to originate from faulty information processing, violations were explained by intentional disobedience of traffic rules. Interestingly, they found a clear link between the self-reported tendency to commit violations and accident involvement. This link was not found for driving errors and lapses. Accordingly, they concluded that driving errors originating from insufficient information processing is relatively unimportant cause of accident involvement. On the other hand, intentional violations are important in this context. A similar conclusion was also reached in a study conducted by Lawton, Parker, Stradling and Manstead (1997).

Still, other studies have concluded that insufficient information processing is an important factor contributing to traffic accidents (Karttunen & Häkkinen, 1986; see Ranney, 1996 for a review). Moreover, Rimmö and Åberg (1999) have found that both the "violation" and the "mistakes" factor both are related to traffic accident involvement.

As implied above, driving errors and driving violations seems to be influenced by different factors. It is acknowledged that both types of behaviour may contribute to accident involvement Risk behaviour classified as driving errors will not, however, be focused in the present thesis. The reason is that driving errors is mainly thought to be unintentional, and assumed to arise from deficits in the driver's information processing skills and motor skills. Such skills represents drivers' maximum level of performance, but not necessarily how the driver will act in traffic. On the other hand, driving violations are thought to be the result of intentional risk taking, representing what the driver actually does with his or her skills in traffic situations. The motivation underlying such actions is usually the target of road safety campaigns. Such motives will be the focus of the present thesis.

1.3 Young drivers, risk taking and accident involvement

Young drivers are at particular risk of being involved in traffic accidents (Arnett, 1990; Evans, Wasielewski & Von-Buseck, 1982; Fridstrøm, 1996). Several explanations have been proposed to explain why (see Gregersen & Bjurulf, 1996; for a review). These can roughly be divided into skill-based and motivational factors, each relating to the different components of driving behaviour, errors and violations, as well as the different levels in the hierarchy of driving behaviour.

The first explanation focuses skill-based factors, which concern young drivers' lack of experience and insufficient cognitive and motor skills. This may cause unintentional errors when driving, which may result in accidents. The importance of such factors is supported by studies finding a relatively large reduction in the accident risk of young drivers (usually a reduction of 50 %) during the first year they possess a driving licence (Maycock, Lockwood & Lester, 1991; Sagberg, 1997). Moreover, young drivers tend to have a persistent bias in perception of risk and evaluation of their own driving skills. Compared to other age groups, they are found to be more likely to underestimate the probability of the specific risks caused by traffic situations (Brown & Groeger, 1988; Deery, 1999), and to have a propensity to perceive themselves as invulnerable to negative outcomes (Millstein, 1993). They also prone to fail to perceive the hazards in traffic (Deery, 1999; Groeger & Brown, 1989; Milech, Glencross & Hartley, 1989), and overestimate their own driving skills (Moe, 1986).

The second explanation emphasises motivational factors as main reasons behind young drivers' accidents. According to this view, the reason why the accident rate decreases by age is because the drivers gradually become more socially and emotionally mature, as well as becoming more responsible when ageing. This effect of age is thought to be reflected in safer driving. Support for this assumption is found in studies showing that young drivers tend to be more prone to deliberate risk taking in traffic than others. Specifically, they are more likely to drive faster (Jonah, 1986), follow too closely (Baxter, Manstead, Stradling et al., 1990), overtake dangerously, and run on yellow lights (Koneci, Ebbesen & Koneci, 1976) compared to other drivers (see also Summala, 1987). Moreover, Reason et al. (1990) have found that the tendency to commit driving violations declines with age, whereas the propensity to commit driving errors does not.

These results indicate that motivational influences may be particularly dominant for young drivers. Jessor (1987) has proposed that adolescents' risky driving style is motivated on the basis of a general propensity towards deliberately engaging in high-risk behaviour, meaning a risky lifestyle. This is supported by studies finding that risky driving tend to covary with other forms of deliberate risk-taking, such as problem drinking, marijuana use, and delinquency (Jessor, 1987; Beirness & Simpson, 1988). Moreover, Jonah (1986) has hypothesised that adolescents' risky driving may serve as a means for expressing independence, defying authority, impressing peers, and satisfying a need for excitement.

Related to Reason et al.'s (1990) distinction between errors and violations, the approach focusing on skill-based factors can be seen as an explanation of accident involvement caused by driving errors, which are thought to be unintended and occur in the lower levels of the driving behaviour hierarchy. The approach focusing on motivational factors is more suited to explain accident involvement due to deliberate risk taking in traffic (i.e. driving violations), which mainly is thought to occur in the higher level of the driving behaviour hierarchy. Thus, this distinction of driving behaviour can unite the different causal explanations of young drivers' accident involvement[3]. Since the present thesis concentrate on deliberate risk-taking in traffic, motivational factors will be focused.

1.3.1 The role of young males in traffic

Young male drivers are found to be more involved in traffic accidents than young females (Arnett, 1990). This difference seems, however, to diminish with age (Laapotti et al., 2001; Maycock, Lockwood & Lester, 1991; McKenna, Waylen & Burkes, 1998). As a group, young male drivers also demonstrate more deliberate risk taking in traffic compared to female drivers of the same age (Harré, Field & Kirkwood, 1996; Jessor, 1987; Parker, Manstead, Stradling et al., 1992; Åberg & Rimmö, 1998). The reasons for these gender differences are probably several.

One reason may be male identity building. Papadakis and Moore (1991) have suggested that trying out manoeuvres beyond their skills (speeding etc.) may be an

[3] It is, however, important to note that not all researchers acknowledge that both explanations may be relevant for understanding young drivers' elevated accident risk. According to Groeger and Brown (1989), the source of young drivers problems on the road is due to their lack of driving experience, not a tendency towards risk-taking caused by youthfulness and personality deficiencies.

aid for young men in the building of their identities. This may be especially relevant in cultures where risk is a part of the construction of manliness. Similarly, Keskinen (1996, cited in Laapotti et al., 2001) have propose that drivers usually get their driver license at an age where adult identity still is under construction, and that feedback and appreciation have high importance at this age. Young drivers, particularly males, may therefore attempt to impress their peer passengers by driving recklessly. This assumption is supported by Harré et al. (1996), who found that young males reported that they were more likely to conform to the perceived unsafe driving norms of their friends than young females were. Moreover, Näätänen and Summala (1976) have found that young men's assessment of a person's driving skills is not so much related to safe driving as the willingness to drive fast and overtake. Näätänen and Summala (1976) believe that these tendencies may provide an outlet for so called "extra motives" while driving, such as showing off one's driving skills to one's peers or one's girlfriend.

A related explanation may be differences in gender role expectations. Simon and Corbett (1996) have proposed that women's traditional gender-role is non-competitive and passive, and that they are expected to avoid risks, while men are encouraged to express competitiveness, anger, and to take risks. According to this view, this causes young men to be less safety oriented in traffic and more frequently engage in risk-taking activities as compared to young females. It is, however, important to note that gender role expectations of this type are found to be most dominant in masculine cultures, such as in USA and Germany (Hofstede, 1991, 1998). Explanations based on gender role differences may not apply to the same extent in cultures scoring high on femininity[4], such as in Scandinavian countries. Cross-cultural differences in young drivers' risk taking behaviour have also been found in studies using computer simulations of driving tasks (Sivak, Soler & Trankle, 1989a; Sivak, Soler, Trankle & Spagnhol, 1989). However, males were still found to take more risks compared to females with the same cultural background.

[4] Hofstede's (1991) cultural dimension of masculinity/femininity indicates the degree to which a culture values behaviours such as assertiveness, achievement, acquisition of wealth or caring for others, social supports and the quality of life. According to Hofstede (1991), people scoring high on masculinity believe in achievement and ambition, in ostentatious manliness, with very specific behaviours and products associated with male behaviour. In contrast, feminine cultures believe less in external achievements and/or manliness, and more in quality of life such as helping others and sympathy for the unfortunate. Feminine cultures also prefer equality between male and female and less prescriptive role behaviours associated with each gender.

Others attribute gender differences in risk-taking to biological factors such as increased hormonal activity during adolescence (see e.g. Buchanan, Eccles & Becker, 1992 for a review). Especially, the production of the hormone testosterone is particularly high among males at this age, which is thought to reflect itself in greater engagement in risk taking activities.

The studies mentioned in section 1.3 indicate that motives and intentions play an important role in young drivers' risk taking in traffic. They also indicate that such motivations in combinations with lack of experience and poor driving skills most probably contribute to young drivers' accidents. After all, few drivers are believed to intentionally seek to be involved in an accident, although deliberate risk taking increases this probability. The present thesis will especially focus on the importance of motivations and intentions as represented by risk-taking attitudes and personality traits. In addition, it is acknowledged that the driver may be influenced by factors other than those intrinsic to the driver, such as peer pressure. The reasons for emphasising these are presented in the next sections.

1.3.2 Driver attitudes and their influence on risky driving behaviour and accident involvement

An attitude may be defined as a psychological tendency expressed by evaluating a specific object with some degree of favour or disfavour (Eagly & Chaiken, 1993). Attitudes are of interest because they are thought to reflect underlying motivations, which subsequently may affect behaviour in traffic. This assumption is supported by several studies finding a relation between risk-taking behaviour in traffic and driving related attitudes (see e.g., Parker, Manstead, Stradling, Reason & Baxter, 1992; Parker, Manstead & Stradling, 1995; Parker, Lajunen & Stradling, 1998; Rutter, Quine & Chesham, 1995, Åberg, 1999). An effective strategy to increase road safety may thus be to change the attitudes that influence adolescent driving behaviour. According to cognitive dissonance theory (Festinger, 1957), changing the beliefs that underpin behaviour can lead to behavioural change. This assumption has later been integrated in the Theory of Reasoned Action /Planned Behaviour (Ajzen & Fishbein; 1980, Ajzen, 1988) and health behaviour models such as the Health Belief Model (Rosenstock, 1974). From these theories one can expect that a change in certain attitudes may reduce the probability of accidents.

The somewhat vague definition of an attitude presented here suggests that attitudes related to traffic safety are extensive, and may cover different aspects or

dimensions of traffic safety. This supposed heterogeneity of traffic safety attitudes should be considered when studying the relation between attitudes and behaviour in traffic. For instance, some attitudes/beliefs may be more important predictors of risk behaviour than others. If so, the attitudes with the highest correspondence with risky behaviour could be given special attention in safety programs. Safety campaigns aimed at influencing attitudes do, however, usually aim at influencing traffic safety attitudes in general, and tend not to focus on the specific attitudes most likely to influence risk-taking behaviour. This may also be an additional explanation of why several attitude campaigns seem to be unsuccessful in changing behaviour in traffic.

One reason for the lack of targeting specific attitudes may be that there have been few studies aimed at developing driver attitude scales. One exemption is a study by Malfetti, Rose, DeKorp and Basch (1989), who conducted an extensive work regarding adolescents' risk-taking attitudes related to driving. Their Young Driver Attitude Scale (YDAS) was based on a literature review and interviews with groups of adolescents, concerning teenager's risk- taking attitudes. Their work resulted in a 70 item attitude scale measuring 7 attitude dimensions. These included attitudes towards speeding, safe driving, riding with an unsafe driver (i.e. willingness to drive with a driver who violate the traffic rules), concern for others, concern for oneself, drinking and driving, and safety belts. In addition to these dimensions, other studies have found attitudes towards rule violations and belief in accident causation to be significant predictors of risk-taking behaviour in traffic (Parker & Manstead, 1996; Rundmo, 1992, 1996). The studies mentioned above suggest that attitudes towards traffic safety are multidimensional, suggesting that people evaluate various aspects of traffic safety differently. A central aim of the present thesis is therefore *to examine the possible multidimensionality of adolescents' attitudes towards traffic safety*. A related aim is to study the impact such attitude dimensions has on driving behaviour and accident involvement.

It is not only important to know which specific attitudes to target, but also to understand the functions such attitudes may serve when aiming to change these. As indicated previously, attitudes may be expressions of some deeper-lying motivations. According to functional theorists, attitudes are held because they serve different functions to the individual (see. e.g. Katz, 1960; Shavitt, 1989; Snyder & Cantor, 1999; Lavine & Snyder, 2000). These can roughly be divided into five main types of functions: to gain accurate knowledge of the social world (knowledge function), to protect against internal conflicts and external dangers

(ego defensive function), to maximise rewards and minimise punishment (instrumental function), for self-expression and maintenance of self-identity (value-expressive function), and to behave in a socially appropriate manner (social-adjustive function).

Young drivers' attitudes towards traffic safety may serve several of these functions. An example is the functions served by expressing a favourable attitude towards speeding. Some drivers may be motivated to get ahead quickly in traffic, and the attitude may thus serve an instrumental function. Others may be motivated on basis of ego-defensive and value-expressing functions of attitudes. For instance, young drivers may express favourable attitudes towards speeding in order to express values like independence and rebelliousness. Similarly, young drivers whishing to impress their peers or girlfriend may express favourable attitudes towards speeding in order to present themselves in a socially appropriate manner.

The importance of knowing the functional basis for attitudes when attempting to change attitudes can be demonstrated by evidence supporting the functional matching effect. This effect implies that people will be more persuaded by arguments that address the functional basis for their attitudes than by equally strong arguments addressing different functions (Katz, 1960). Evidence for this effect has been found in several studies (see e.g. DeBono, 1987; DeBono & Harnish, 1988; Lavine, Burgess, Snyder, Transue, Sullivan, Haney & Wagner, 1999; Prentice, 1987).

Smith, Bruner and White (1956) also assume that attitudes have a functional basis, but believe attitudes and opinions to be an integral aspect of personality, reflecting the underlying personality of the individual. In contrast to the narrow functions proposed by Katz (1960), they suggest that attitudes have wider functions by serving deeper lying needs, and that several aspects of the person may systematically relate to the attitude. For instance, a person's attitude towards taking concern for others in traffic may express the ability to take others' view and altruism. Furthermore, one may expect that a person's expression of a positive attitude towards for instance dangerous overtakings may be a reflection of personal characteristics such as impulsiveness, impatience, and low concern for others. The relation between personality traits and attitudes, as well as the implication for traffic safety promotion, will be elaborated more thoroughly in the next section.

1.3.3 The influence of personality traits on accident involvement and driving behaviour

Personality traits can be defined as dimensions of individual differences in the tendency to show consistent patterns of thoughts, feelings and behaviour (McCrae & Costa, 1995; Tellegen, 1991). In contrast to an attitude, traits are not evaluative, and are not referring to specific objects. Thus, traits are thought to be more stable and more general as compared to attitudes.

As implied by the definition, personality traits are thought to influence behaviour. Cattell (1950) has stated one of the most deterministic views pertaining to the influence of personality traits on behaviour. According to Cattell, personality permits the prediction of what a person will do in a given situation, as well as what a person will do across situations. The strongest critics of the trait approach have taken the opposite view, emphasising that human behaviour is largely dependent upon the situation rather than individual differences. Mischel (1968) has been the theorist most frequently associated with this situationalistic position, referring to studies finding that only 5-10 % of the variance in specific behaviours is attributable to individual differences.

Although traits have low predictive value of single situations, Epstein (1977) has shown that traits show high correspondence with aggregate measures of behaviour (see also Eysenck, 1991). Interestingly, Mischel later became more favourable to the role of personality traits in relation to behaviour. Based on an empirical study, Wright and Mischel (1987) concluded that both individual differences in personality together with situational variables influence behaviour. They found an interaction effect between the two. As a result, they proposed an interactionistic view, meaning that both the person and the situation influences behaviour. Several studies have reached the same conclusion (see e.g. Matthews & Deary, 1998, for a review). This has resulted in the interactionistic view becoming widely accepted among personality and social psychologists.

Further evidence for the meaningfulness of personality traits is found in longitudinal studies, which have demonstrated that personality traits are stable over time (Costa & McCrae, 1992a, 1994; Schuerger, Zarrella & Hotz, 1989). Moreover, some evidence for cross-cultural generalisation are also found (Eysenck & Eysenck, 1982; McCrae, Zonderman, Bond, Costa & Paunonen, 1996)

The role of personality traits in traffic accidents has been central in explanations emphasising accident proneness (Farmer & Chambers, 1939; Tillman & Hobbs, 1949). The notion that *one* general personality trait is the cause of drivers' accident involvement has, however, been rejected. Still, the influence of personality on driving behaviour and accident involvement is not totally abandoned. A range of studies have found personality traits to be weakly, but consistently associated with accident involvement in traffic (see e.g Beirness, 1993 for a review). There is, however, reason to believe that the role of personality traits pertaining to accident involvement in traffic may be underestimated. As implied by Everitt (1977), general measures such as personality traits are assumed to be weak predictors of a single event measure such as a traffic accident. This difficulty is further augmented due to the fact that traffic accidents are relatively rare, and influenced by numerous other factors than the driver's behaviour in traffic (see, e.g. Fridstrøm, Ifver, Ingebrigtsen, Kulmala & Thomsen, 1995). This notion is supported by several studies finding a weak relation between the personality trait *sensation seeking* and traffic accident involvement, but a relatively strong relation between this personality trait and the propensity to commit driving violations (Jonah, 1997).

Sensation seeking can be said to be the personality trait most frequently studied in relation to driving behaviour and traffic accident involvement. Sensation seeking is defined as a need to experience novelty, excitement, and dangers (Zuckerman, 1979)[5]. Several researchers have suggested that risky driving is motivated on the basis of the sensation-seeking thrill this causes for some individuals (Arnett, 1990, 1991; Jonah, 1997). This assumption has been confirmed in several studies finding sensation seeking to been associated with a risky lifestyle and risky driving (see, e.g. Arnett, 1990, 1991, 1996; Wilson & Jonah, 1988; Yu & Williford, 1993; Jonah, 1997). The motivational influence of sensation seeking on risky driving behaviour is further supported by findings demonstrating that sensation seeking explains a large part of the variation in the propensity to commit driving violations, but accounts for very little of the variance in the tendency to commit driving errors (Rimmö & Åberg, 1999).

A range of other personality factors are also related to risky driving and crash involvement. The most prominent ones are mild social deviance, hostility,

[5] Zuckerman (1979) has divided the trait sensation seeking into four dimensions: Thrill and Adventure Seeking (seeking dangers), Excitement Seeking (seeking unusual sensations), Disinhibition (mild social deviance), and Boredom Susceptibility (intolerance for repetitive experiences).

aggression, impulsiveness, emotional liability, locus of control , and antisocial motivation (Arthur, Barrett & Alexander, 1991; Hilakivi, Veilahti, Asplung, Sinivuo, Laitinen & Koskenvuo, 1987; Lawton, Parker, Stradling & Manstead, 1997; West & Hall, 1997; Underwood, et al., 1999; see, Beirness, 1993; Elander, West & French, 1993 for a review). These traits have, however, not been so much in focus as compared to sensation seeking, and their impact on driving behaviour and accident involvement are usually studied separately. This indicates that research focusing on the combination of such traits can be advantageous in order to understand the role of permanent underlying motivation (i.e. personality traits) to commit driving violations in traffic.

One may, however, ask oneself what the point of studying the role of personality variables is since it is unrealistic to be able to change a driver's personality. Would it not be more meaningful to study only motivational beliefs that are more open to change, such as risk-taking attitudes? The reason for focusing on personality traits in the present thesis is because traits are thought to influence the individual's perception and appraisal of the environment (McCrae & Costa, 1995). Several studies have supported this assumption (see Matthews & Deary, 1998, for a review). A study conducted by Yagil (2001) is worth mentioning in this context. Yagil (2001) studied the impact of personality traits on young male drivers attitudes and their intention to commit driving violations. Applying path analysis, Yagil (2001) found sensation seeking, locus of control and aggression to affect drivers' attitudes towards violations, which in the next turn influenced intentions to commit violations.

The study of Yagil (2001) demonstrates the importance of studying the relation between personality traits and attitudes. As mentioned above, Smith, Bruner and White (1956) believe attitudes to be reflections of functional schemas of an individual's consistency in thoughts, emotions, and behaviours. This means that they see attitudes and personality as an integrated part. On this basis they recommended that attempts to change attitudes should be considered in the context of the total person.

Elander, West and French (1993) have also made a good point pertaining to this issue. Attitudes, which safety campaigns usually aim to change, may be a reflection of enduring personality traits, such as antisocial motivations and sensation seeking. Following this assumption, road safety authorities could give a better position to design safety campaigns if they understand how adolescents who engage in risky

driving think, behave, and feel. Such knowledge may, for instance, help authorities to create interventions that appeal most to the target audience.

The technique of tailoring the message according to certain personality traits has been applied in several campaigns aimed at preventing drug abuse among adolescents. These studies have targeted high-sensation seeking adolescents, who usually abuse drugs more often than other adolescents. The results of the studies demonstrated that messages with a high sensation value, meaning the ability to elicit sensory, affective and arousal responses, were most appealing and efficient for high sensation-seekers (Zuckerman, 1994; Donohew, Lorch & Palmgreen, 1991; Everett & Palmgreen, 1995; Palmgren, Lewis, Pugzzles-Lorch et. al, 2001). Specifically, such messages are characterised as being novel, dramatic, unconventional, emotionally powerful or physically arousing.

Sensation seeking is, however, only one of several personality traits related to high-risk driving. The strategy of tailoring the message to specific target groups of young drivers should therefore not only consider sensation seeking when the messages and intervention strategies are planned. As a consequence, it may be valuable to know the specific personality traits that relate to risky driving interact with each other. This will be elaborated further in the next section.

1.3.4 Subgroups of young drivers as the target for road safety promotion

Studies applying personality variables have usually focused on the separate and distinctive contribution of each personality variable in order to understand individual differences in risky driving. This has traditionally been conducted by using multivariate methods such as multiple regression analysis, where the aim is to determine the unique contribution of each independent variable (IV), holding all other IV's in the model constant. This approach, however, treats personality traits as independent of each other and fail to capture the possible interactions between the traits. Although this to some extent can be done by computing interaction terms, this can lead to statistical difficulties of multicollinearity and failure to explain additional variance in the dependent variable (Evans, 1985; McClelland & Judd, 1993).

A more plausible method of identifying high-risk drivers could therefore be to identify specific subtypes of young drivers on the basis of the combinations of

certain traits, rather than studying the unique contribution of separate personality variables. Cluster analysis is a method well suited for this intention. A few studies have aimed at identifying such subtypes of drivers empirically by the use of this technique, and found that the clusters differ in both risky driving and accident involvement. Deery and Fildes (1999) identified five subgroups of young drivers. Two of these were labelled high-risk due to their high level of risky driving behaviour and accident involvement. The two groups were characterised by high levels of sensation-seeking, hostility, assaultiveness, and driving related aggression. One of the two groups also demonstrated high levels of depression and irritability, and low levels of emotional adjustment. Approximately 80 per cent of the high-risk groups were males.

Other studies using cluster analyses on personality measures have identified similar subtypes of drivers. Donovan, Umlauf and Salzberg (1988) found three clusters of high-risk drivers based on a sample of drivers who had been convicted of traffic offences (thus they were already defined as high-risk drivers). One cluster was characterised by high levels of impulsiveness, assaultivenss, sensation seeking, and hostility. Another cluster reported hostility, depression and low emotional adjustment. The third was, on the other hand, described as well adjusted, meaning that this cluster did not show elevated scores on any personality dimension. Wilson (1991) found four clusters of high-risk drivers based on drivers who were convicted of traffic offences or for driving while intoxicated. One cluster was characterised by high levels of thrill-seeking, hostility, and irresponsibility. Another cluster also displayed high levels of hostility, but low levels of thrill-seeking, and was thus described as emotionally unstable. A third cluster was characterised by depression and personal problems, whereas the fourth was defined as well-adjusted. Although the two studies were based on samples of mainly adult male drivers who already were defined as high-risk drivers, the results are to some extent similar to the high-risk groups found in Deery and Fildes' (1999) study. That is, similar combinations of personality traits seem to be related to high-risk driving and accident involvement.

Other studies have aimed at identifying subgroups of young drivers on the basis of *lifestyle measures*. Schulze (1990) conducted an interview study based on a sample of 1024 German adolescents between 18 to 24 years of age. Schulze (1990) categorised the adolescents who possessed a driver licence into seven different lifestyles groups. Three of these were identified as high-risk drivers in traffic, and

constituted 30 % of the total sample[6]. In addition to their high traffic accident rate, common characteristics of the three groups were that they consisted of mainly men (70-80%), consumed large amounts of alcohol and liked to drive around to kill time.

Gregresen and Berg (1994) have also attempted to identify sub-groups of young drivers on the basis of a cluster analysis of measures of lifestyle actions (e.g. interest in sports, fashion, reading, cars and driving etc.). On the basis of the analysis they identified four high-risk lifestyle groups in traffic. Three of the four groups were very similar to the ones identified by Schulze (1990)[7]. The four groups had in common that they drove a lot, and while driving extra motives seemed to play an important role, for instance to show off, seek sensation, and compete with other drivers. Berg (1994) conducted a follow-up study based on interviews in order to describe the individuals within the subgroups more thoroughly. The study showed that the high-risk drivers drive more emotionally, become more easily irritated by other drivers behaviour in traffic, and use the car as means for having fun or as a leisure-time activity compared to drivers identified as low- or medium risk. The high-risk drivers also seemed to perceive the risk of themselves being involved in traffic accidents as low, as well as being very confident in their driving skills.

Although the studies of Schulze (1990) and Gregersen and Berg (1994) did not include personality measures in their analyses, the high-risk groups identified share some of the characteristics in the high-risk groups of young drivers identified by Deery and Fildes (1999). That is, they consist of mostly young men, where one group of them are motivated to drive risky as means for seeking sensation. There is also some indication that emotional factors, such as irritation and aggression seem to be characteristics commonly associated with some of these groups. In addition, they use the car as an outlet for "extra motives". These results can also be

[6] The three groups were labelled the "fan type", the "action type", and the "nonconforming type". The "fan type" included individuals who are interested in football, action films, and disapprove intellectuals and intellectual films. They also frequently go to discothèques. The "action type" are also individuals who frequently visit pubs, discothèques and like action films, and dislike films of a more intellectual character. The "nonconforming type" were especially interested in music, in particular rock, heavy metal and punk rock. In contrast to the other high risk groups, they approve intellectual films and dislike to go to discothèques.
[7] As mentioned in the text, three of the four groups were very similar to the ones identified by Schulze. The forth group identified by Gregresen and Berg (1994) constituted adolescents who seldom drank alcohol.

interpreted as corresponding to explanations mentioned previously concerning young drivers' motivations for engaging in risky driving (see section 1.3.1).

Linderholm (1997) has to the author's knowledge carried out the only study aimed at influencing subgroups of young drivers differently in order to evaluate how they responded to messages aimed at promoting safe driving. Based on a qualitative study and a later quantitative study, Linderholm (1997) classified young male drivers into four subgroups based on their safety orientation in traffic[8]. These were labelled adventure seekers, risk takers, responsibility takers and safety seekers. Linderholm (1997) tested how the subgroups responded to two main types of arguments aimed at influencing attitudes towards speeding, respectively logical arguments and emotional arguments. The responsibility takers and the safety seekers responded primarily to logical arguments, whereas the adventure seekers responded most to emotional arguments. Risk takers did, however, not respond favourably to either of these types of arguments.

In sum, there seems to exist different subgroups of young high-risk drivers. As a consequence, these groups should be addressed differently when efforts made to promote safe driving are carried out. The present thesis aims at *identifying subgroups of adolescent drivers on the basis of combinations of personality traits*. If such subgroups are found to differ in their safety orientation in traffic, this suggests that traffic safety campaigns should especially target the motivations underpinning the safety orientation of these groups. The reason for focusing on combinations of personality traits instead of lifestyle measures is that traits are regarded as more direct measures of underlying motivations compared to lifestyle measures. In order to understand the functional motivations underpinning adolescents' attitudes towards traffic safety, the author regards personality traits as more theoretically meaningful than lifestyle measures in this context (see section

[8] Adventure seekers constituted of drivers who liked to take risks under control and who are motivated to drive by extra motives (e.g. show off skills to others and drive around for fun). They were, however, motivated to show concern for others in traffic. Risk takers like to speed and show low concern for others (e.g. speeds regardless of the presence of others on the road). The car is a very central part of his identity and much of the leisure time is spent in the car. He regards his driving skills as high and can become upset and irritated of others in traffic. Responsibility takers show no interest in speeding, no extra motives while driving, and experience low aggression while driving. The responsibility taker is thus the opposite of the risk taker. The safety seeker perceives his personal risk in traffic as high, and thus seeks safety and obeys rules. The safety seeker is helpful and shows concerned for others in traffic, and is aware that driving skills has to be practiced for a long time before becoming a safe driver

1.3.3). Still, it is acknowledged that classifying drivers on the basis of lifestyle measures may be a useful method when the aim is to design messages that appeal most the target audience of traffic safety campaign.

1.3.5 Social factors - the influence and the role of adolescent passengers

Traffic safety campaigns usually aim at influencing drivers' attitudes and behaviour individually through the use of mass media and/or enforcement. Based on the observation that people tend to trust others who are similar to themselves, several researchers also emphasise the use of social influence to motivate people to change their attitudes and behaviour (Bandura, 1986; Edwards, Tindale, Heath & Posavac, 1990). According to Tindall (1995, in Posavac, Kattapong & Dew, 1999), peers are particularly suited for reaching young people since they usually regard peers as more credible, to have a better understanding of the thoughts of other young people, and tend to model the peers' behaviour more easily as compared to adults (and authorities in general). The latter notion is also supported by social cognitive theory, which states that people more easily tend to imitate a behaviour if a model appears to be a realistic figure for self comparison (Pervin, 1989).

The belief that peer-based programs are advantageous as means for preventing health problems has been commonly accepted. Based on a meta-analysis of 47 peer-based intervention programs, Posavac, Kattapong and Dew (1999) found a consistent positive effect of such programs on various health behaviours. None of these studies did, however, concern driving behaviour. Campaigns focusing on peer influence may be of particular relevance for adolescent drivers and their passengers. Clark (1976) found that a group of young drivers who had been involved in traffic accidents were more open to the influence from peers who encourage them to take risks than young drivers who not had been involved in traffic accidents. On this basis, he suggested that safety campaigns should focus the driver's peer group rather than the driver himself.

Another argument for emphasising peer influence is that the crash risk of young drivers tends to increase when young drivers are accompanied by passengers of their own age, particularly as concerns night-time driving in weekends (Drummond & Triggs, 1991; Williams and Wells, 1995). Studies have estimated the accident risk to be doubled with one passenger present, and further augmented as the

passenger number is increased (Doherty, Andrey & MacGregor, 1998; Preusser, Fergurson & Williams, 1998; Chen et al., 2000). This negative effect of driving with passengers has not been found for other age groups (Preusser, Fergurson & Williams, 1998; Reiβ & Krüger, 1995).

The question is thus why this finding is particular for this young age group. It may be claimed that as young drivers are inexperienced, the presence of passengers as such cause a distraction of the driver, and hence, driver errors. However, studies indicate that young drivers are affected differently pertaining to the passengers' age and sex. Arnett, Offer and Fine (1997) found that young drivers tend to drive faster and take more risk in traffic when they were accompanied by peers than when their parents were present. As a result, Chen et al. (2000) concluded that drivers aged 16-17 were more likely to die in traffic accidents when accompanied by passengers aged 16 to 29 years than when carrying passengers 30 years or older. The risk of being killed was further doubled when the young passenger was male.

In sum, the previous studies indicate that young drivers are more prone to risky driving and its consequences when accompanied by passengers their own age. Social influence from the passengers may be one reason. This type of peer influence may be explicit or implicit. Through explicit influence, passengers may urge the driver to speed up, to overtake, or to conduct other risky acts in traffic. Implicit influence works through the process of normative social comparison. This means that people tend to compare their attitudes and own behaviour to the perceived norms of a reference group of other persons (Festinger (1950, 1954). Perceived discrepancies tend to motivate a change towards consistency with the norms of the reference group, creating a pressure to conform to the norms of the peer group. According to the Theory of Planned Behaviour, normative beliefs are thought to exert most influence on behaviour when the individual is motivated to comply with these referents (Ajzen, 1991).

Both explicit and implicit social influence may be particularly problematic for young drivers. As mentioned above, adolescents, especially males, usually show preferences towards risk-taking in traffic (Harré, Field & Kirkwood, 1996; Jessor, 1987). Moreover, Näätänen and Summala (1976) believe risky driving to be an outlet for so called "extra motives" while driving, such as showing off one's driving skills to one's peers or one's girlfriend. Young drivers, particularly males, may therefore experience an implicit pressure to conform to the peer group's presumed risk taking preferences, therefore attempting to impress their peer

passengers by driving recklessly. This assumption is supported by Harré et al. (1996), who found that young males reported that they were more likely to conform to the perceived unsafe driving norms of their friends than young females were.

Although young drivers in general seem to be more prone to risk taking when accompanied by peer passengers, the social influence of peers can also motivate safe driving practices. For instance, Brown (1998) found that drivers believing that their friends would disapprove of drinking and driving, were less likely to drive under the influence of alcohol themselves. Similar results have been found in a study of Swedish male drivers (Åberg, 1993). Furthermore, Parker, Manstead, Stradling et al. (1992) concluded that normative beliefs play a key role in drivers' intention to commit driving violations such as speeding, dangerous overtaking, close following, and driving under the influence of alcohol. They found that drivers who believed that significant others would disapprove of them committing these violations and at the same time felt motivated to comply to these referents, reported less intentions to commit the violations. They also found that younger drivers perceived less pressure from others to abstain from committing the violations. However, younger drivers were at the same time more motivated to comply with the perceived wishes to their referents. The authors concluded that publicity campaigns aiming to reduce the risky driving of young drivers should highlight the disapproval of their peers and their referents.

Thus, highlighting the role of other socially influential persons involved in the driving situation may be beneficial in order to promote safe driving. Some traffic safety campaigns have focused on this type of positive peer pressure. For instance, the "Peer Intervention Program" (McKnight & McPerson, 1985) aimed at motivating and enabling US high school youth through role playing to intervene in the drinking and driving of their peers. An evaluation of the program concluded that it had lead to a significant increase in self reported intervention behaviour (McKnight & McPerson, 1985).

Another example is the "Speak Out!" (Norwegian: "Si i fra!") campaign carried out among Norwegian adolescents. The primary aim of the campaign was to encourage teenage car passengers to let the driver know that they felt unsafe in the car, that is, verbally try to prevent unsafe driving. Alternatively, they were encouraged to choose other means of transportation. An evaluation of the campaign carried out five years after its implementation, concluded that it had resulted in a 30 %

reduction of adolescent passengers injured or killed in car accidents (Amundsen, Elvik & Fridstrøm, 1999; Elvik, 2000). However, the number of young car drivers injured or killed was not reduced. Apparently, the campaign did not succeed in reducing risky driving among young drivers, although it did reduce young passengers putting themselves at risk. A possible explanation is that the campaign had not helped the teenage passengers to prevent unsafe driving by voicing their opinion in a driving situation, but rather choosing the alternative strategy. From this one may draw the conclusion that future campaigns need to address this flaw in order to reach the goal of reducing risky driving. A final aim of the present thesis is therefore to *examine factors that may enhance or reduce the likelihood of adolescent passengers' willingness to confront unsafe drivers*.

1.4 Summary and aims of the thesis

The reasons for adolescents being especially at risk in traffic are several. First, young drivers are less experienced than drivers more of age, and are therefore found to be more likely to commit unintentional driving errors. Second, studies also demonstrate that adolescents, particularly males, are more prone to deliberately violating traffic rules and to engage in high-risk driving. The present thesis concentrate on motivational factors thought to influence adolescents' propensity to commit driving violations. The reason for focusing on motivational factors is that this type of motivation, in particular drivers' attitudes, is typically the target of road safety campaigns. The effect of such campaigns has, however, been questioned. One reason may be that the campaigns usually have aimed at influencing attitudes in general, and not the specific attitudes most likely to influence driving behaviour. The first aim of the present thesis is therefore to:

- develop a reliable and valid measure of adolescents' risk-taking attitudes and how such a measure relates to driving behaviour and accident involvement.

It has also been argued that attempts to change attitudes should focus on the motivational underpinnings of the attitudes in order to design the most appealing and effective messages. Previous studies indicate that personality characteristics are related to drivers' attitudes and behaviour in traffic. Taking such dispositions into account may result in a more efficient measure of communicating the message

to the target audience of safety campaigns, as well as changing their attitudes and behaviour. The second aim of the thesis is for that reason to:

- investigate how personality dispositions are related to adolescents' safety orientation in traffic.

Studies also suggest that specific combinations of personality traits are typical for high-risk drivers. As a consequence, it is of interest to examine the interactive effects of personality traits pertaining to young drivers' safety orientation in traffic. This can provide further insight into the motivations underpinning attitudes and behaviour in traffic. One method of studying how combinations of traits relate to safety orientation is to identify subgroups of drivers on the basis of personality traits. The third aim is consequently to

- identify reliable and valid subgroups of young drivers on the basis of personality traits and examine whether the subgroups differ in their safety orientation in traffic.

Studies also point out high-risk drivers to be the ones most difficult to reach trough traditional safety campaigns. An alternative means for reaching out to such drivers is to promote social influence among their peers, for instance to encourage passengers to influence the driver to drive more safely. The final aim of the thesis is accordingly to

- identify factors that may enhance or prevent adolescent passengers' willingness to confront high-risk drivers.

2. Method

2.1 Sample

A questionnaire survey was carried out among 5970 adolescents in Norway in the period between 1998-2000. A total of 5075 respondents returned the questionnaire, yielding a response rate of 85 %. Of these, 2856 (56 %) respondents reported that they had a driver licence, whereas the remaining 2219 (44 %) did not have a driver licence. The sample had an almost even gender distribution, 52 % were women and 48 % were men. The mean age of the respondents was 18,5 years of age (modal 18 years of age) and the age ranged from 18 to 23 years. The majority of these (84%) had possessed the driver licence for more than 3 months.

Paper I and II is based on 3942 of the 5075 respondents. The reason is that these two papers were based on data collected in the year 1998 and 1999. An additional number of 1133 questionnaires were returned in the year 2000 when the analyses presented in paper III and IV were carried out. The mean age and gender distribution of 3942 respondents were identical to the total sample of 5075 respondents. It should also be noted that paper II and III is based on the respondents who reported to possess a driver licence.

The survey was conducted in relation a road safety campaign initiated by the Norwegian Authorities of Public Roads (Statens Vegvesen) in cooperation with the Police department of Mid-Norway, the Norwegian Society of Road Safety (Trygg Trafikk) and the Traffic Safety Committees of two Norwegian counties[9]. The sample consisted of randomly selected high school classes from within these two Norwegian counties and the questionnaires were completed individually at the participating schools. Approximately half of the respondents (53 percent) answered the questionnaire before the school had been visited by the campaign team, the other half (47 per cent) after the campaign team had visited the school. In the latter group, a sub-sample of 678 respondents was also asked to evaluate different aspects of the campaign.

[9] The counties of Sør-Trøndelag and Møre og Romsdal

2.2 Measures

The measures the four papers are based on are all originating from the same questionnaire. The various measures will only by loosely described here. For a more detailed description, please see paper I, II, III and IV.

Background variables

Gender, Age, Driver licence, how long they had possessed a driver licence.

Personality measures

Sensation-seeking (Costa & McCrae, 1992b)
Aggression (Costa & McCrae, 1992b)
Anxiety (Costa & McCrae, 1992b)
Altruism (Costa & McCrae, 1992b)
Normlessness (Kohn & Schooler, 1983).

Driving anger

The Driving Anger Scale (Deffenbacher, Oetting & Lynch, 1994).

Driving behaviour

15 items measuring self-reported acts of risk-taking in traffic (Rundmo, 1996; Rundmo & Ulleberg, 2000).

Risk taking attitudes

89 attitude items. These included four attitude dimensions from the Young Driver Attitude Scale (Malfetti et al., 1989). Forty-one items made up these four dimensions. The remaining 46 attitude items were based on previous studies by Rundmo (1992, 1996 and 1998).

Risk perception

Probability rating of being involved in a traffic accident
Feeling of unsafety of being involved in a traffic accident
Worry and concern of being involved in a traffic accident

Accident involvement

Involvement in accidents with physical injury
Involvement in accidents without physical injury

Measures related to the friend the respondents most frequently ride with

Passenger frequency
Experience of stress as a passenger
Friends risk taking in traffic
Frequency of addressing the friend's driving
Powerlessness in own ability to influence other drivers' behaviour. This measure was based on a rewriting of four items from Seaman's Powerlessness scale (1974, in Robinson, Shaver & Wrightsman, 1991).

2.3 Statistical methods

A range of different statistical methods are applied in the four papers. Basic methods such as t-tests, analysis of variance (ANOVA), analysis of covariance (ANCOVA), Pearson's product-moment correlation, and multiple regression analysis are applied to a more or less degree in the papers. These methods aimed at testing hypotheses are commonly known, and a further description of these methods should be unnecessary. It is more important to give a more thoroughly description of the more advanced statistical method applied in the different papers.

2.3.1 Measures of internal consistency

The use of different methods aimed at evaluating the internal consistency of items was a central aim in paper 1. Cronbach's (1951) alpha coefficient was first applied to evaluate homogeneity of the items measuring the attitude dimensions identified in paper 1. Nunnaly (1978) recommends that the alpha coefficient should be equal or higher than 0.70, if a set of items are to make up a scale. However, the alpha coefficient tends to increase as a function of the number of items. Therefore, it is easier to obtain a satisfactory alpha with many as compared to few items given the same average inter-item correlation. Consequently, one should keep the number of items in mind when homogeneity is evaluated using this method.

Parametric methods such as the Cronbach's alpha may, however, in many cases be inappropriate for analysing internal consistency, due to that some items may have a skewed distribution (Van Schuur & Kiers, 1994). For instance, few respondents may «agree» or «strongly agree» on an item. The items may therefore not be parallel, that is, not having identical true scores and variances. The parametric methods of evaluating internal consistency have no safeguards against such items, and the results obtained may be misleading (Carmines & Zeller, 1979). An alternative methodology is Mokken's non-parametric latent trait analysis for unidimensional scaling (Mokken, 1971). This is a non-parametric item response model, which analyses the probability of a positive or high value on one item as compared to the values on other items. An advantage of applying this method is that the items do not have to fulfil the assumption of being parallel.

The Mokken model was first developed for dichotomous items, but has been generalised to Likert-type items (Molenaar, Debets, Sijtsma, & Hemker, 1994). The Mokken model uses Loevinger's weighted H-coefficient as a measure of item homogeneity. The H- coefficient varies from 0 to 1, where a set of items is said to

constitute a scale if H is greater or equal to 0.30. H = 0.30 is regarded as a weak scale, H between 0.40 and 0.50 is regarded as a moderate strong scale, and H > 0.50 is understood as a strong scale. The computer program MSP (Molenaar et al., 1994) was applied to analyse the data with the Mokken scale model.

2.3.2 Exploratory factor analysis

A principal component analysis (PCA), with varimax rotation, was used in paper I to determine the underlying dimensionality of the YDAS items. A principal component analysis is very similar to a factor analysis, and the terms "component" and "factor" can consequently be used as if they were interchangeable, even though they are not strictly the equivalent (Kline, 1994). Both principal component analysis and factor analysis are correctional techniques intended to explore the intercorrelation among a large number of variables.

Theoretical variables such as an attitude are not believed to be directly observable, and is therefore called a latent, unobserved variable, or a factor. Although such variables are not directly observable, it is assumed that these can be measured indirectly through their influence on a set of observed variables, or items. High intercorrelation among a cluster of variables may be interpreted as a reflection of the influence of an underlying, latent variable, meaning a "factor". The strength of the influence of a factor on an item is expressed as a factor loading, which is the correlation between the item and the factor (Kline, 1994). However, it is important to note that factors should not merely be evaluated on basis of the strength of their factor loadings. It is vital that each factor's theoretical substance is evaluated as meaningful on the basis of the content of the items clustering on the factor.

2.3.3 Structural Equation Modelling (SEM)

SEM was applied in paper I, II and IV. There are two components in a structural equation model, the measurement model and the structural model. The measurement model is the component of the model where the latent variables are prescribed, also referred to as factors. A confirmatory factor analysis concerns only this component of the total structural equation model. The structural model concerns the relationship between latent variables, as well as observed variables that not are indicators of latent variables. The structural model can also be represented as a path model, which allows estimating both indirect and direct

effects. Thus, SEM can perform both factor analysis, multiple regression analysis and path analysis simultaneously.

There are several advantages of using SEM models instead of e.g. multiple regression analysis or exploratory factor analysis. First, SEM analyses involves the elimination of measurement errors in the latent variables in the model. This is done by extracting only the variance the items representing the latent variables have in common. Second, SEM analyses opens for the researcher to evaluate the fit between data and theory. This cannot be done in traditional factor analysis and multiple regression analyses.

The LISREL 8 Program (Jöreskog & Sörbom, 1993) was used to estimate the various structural equation models presented in paper I, II and IV. The covariance matrix of the observed variables was used as basis for these analyses. With the purpose of comparing the fit between the hypothesised structural equation models, various fit indices were used.

The χ^2 statistics represents the discrepancy between the observed covariance matrix (the sample covariance matrix) and the covariance matrix reproduced on the basis of the parameters in the measurement and/or structural model (the implied covariance matrix). The χ^2 statistics thus represent the fit between the data and the hypothesised model. However, the χ^2 test is very sensitive to the size of the sample the analysis is based on. In large samples even trivial discrepancies between the model and the data is very likely to produce a high χ^2, which imply that the model should be rejected. On the other hand, large deviations between the model and data will not necessarily lead to model rejection in small samples. Due to the influence of sample size in the calculation of the χ^2, there is today commonly accepted that a model should not be rejected or accepted only on basis of the significance of the χ^2 test (e.g. Hu & Bentler, 1995; Lohelin, 1998).

The root mean square error of approximation (RMSEA) is today one of the most applied and highly recommended measure of model fit (Lohelin, 1998). Some of the major advantages of the RMSEA, is that it is relatively insensitive to sample size and at the same time takes model complexity into account. The latter refer to that the RMSEA "favours" few free parameters to be estimated, i.e. that model parsimony will more easily lead to a good model fit. An RMSEA of 0.00 represents an exact fit between the model and the data, but this is an unrealistic result to obtain. Browne and Cudek (1993, see also Lohelin, 1998) have suggested that a

RMSEA of 0.05 or less indicate a very good model fit, and that an RMSEA of 0.08 or below indicate a good model fit.

The goodness-of fit index (GFI) and the adjusted goodness-of fit index (AGFI) are other popular measures of model fit. Both measures are calculated on basis of the explained covariance of the model, relative to total covariance in the observed data. Thus, they are similar to the R^2 used in regression analysis. The higher GFI or AGFI, the better the model fits the observed data. The difference between the GFI and the AGFI, is that the latter also takes the number of estimated parameters (i.e. model parsimony) into account when the index is calculated. A GFI or an AGFI of 1.0 indicate an exact fit of the model to the data. A rule of thumb is that the GFI or AGFI should be above .90 in order to claim satisfactory model fit.

Another measure is the Comparative Fit Index (CFI), developed by Bentler (1990). The CFI has a similar cut-off criterion of 0.90 if the model can be said to fit the data well. However, Hu and Bentler (1999) later concluded that the CFI should be close to .95 in order to claim a good fit between the hypothesized model and the observed data.

Browne and Cudeck's (1993) Expected Cross-Validation Index (ECVI) emphasises that models that fit well and are simple stand a better chance of fitting well in a new sample than models that are not simple (hence the term cross-validation). The lower ECVI value, the better the model is supposed to cross-validate in a new sample (see also Loehlin, 1998).

Since the various indices of model fit put weight on different aspects, a total evaluation of the various fit indices was emphasised. If all indices indicate a satisfactory fit, this was interpreted as strong evidence for a good correspondence between the observed covariance matrix and the hypothesised model.

2.3.4 Cluster analysis

Cluster analysis was applied in paper III to identify subtypes of young drivers. ClustanGraphics5 cluster analysis software was used for this purpose (Wishart, 1999, 2000). In short, a cluster analysis uses algorithms to group together individuals whose pattern of scores on variables are similar. The analysis was based on scores derived from five personality measures and the measure of driving anger, using the squared Euclidean distance measure. The standardised scores of

the variables were used to avoid the problem of comparing Euclidean distances based on different measurement scales (Everitt, 1993). Missing cases were excluded listwise, resulting in a reduction of 332 respondents. Thus, the cluster analysis was based on the remaining 2524 respondents.

Ward's method for hierarchical clustering was undertaken in order to determine the number of clusters, or subgroups, present in the data (Everitt, 1993). Although there are no formal rules for determining the numbers of clusters present, one alternative is to study the graph of the fusion coefficients values against the number of hierarchical clusters (Aldenderfer & Blashfield, 1984). A marked flattening of the graph indicate that the following mergers of cluster portray no new information. An inspection of the graph suggested that four to six clusters were present in the data. As described in paper 3, the six cluster solution was chosen on basis of reproducibility and interpretability.

Although the hierarchical clustering method is advantageous in determining the number of clusters present in the data, it cannot produce the most optimal cluster solution pertaining to between-cluster heterogeneity. This is because the method is unable to separate clusters created at previous steps. It is therefore recommended to run a K-means cluster analysis after the number of clusters has been determined, using the centroids (i.e. the cluster centre means) generated from the hierarchical analysis as a starting point (Milligan & Sokol, 1980). K-means cluster analysis using FocalPoint clustering (Wishart, 2000) was therefore used to calculate the most optimal cluster solution. The results obtained from a K-means analysis is, however, sensitive to the order the cases are presented in the data file. To solve this problem, the FocalPoint clustering technique performs a series of 500 random trials on the chosen starting solution, in this case the means from the hierarchical six cluster solution. In each trial, the cases are considered in different random order. This strategy gives the researcher the option to choose among several "top-solutions", meaning the most replicable cluster solutions with the smallest Euclidean sum of square values. The FocalPoint clustering technique also identify outliers in the final cluster solution, that is, cases that cannot be easily classified or that are relatively remote from the cluster centres.

3. Results

Summary of paper I

The major aim of the paper I was to develop a reliable and valid measurement instrument of adolescents risk-taking attitudes related to driving. The structure of the instrument was thought to be multidimensional, indicating that the different attitude sub-scales reflect different dimensions of risk-taking attitudes. The results support this assumption; 11 factors were identified on the basis of an exploratory factor analysis. In addition, a confirmatory factor analysis demonstrated a satisfactory fit to the data of the suggested 11-factor structure. Further evidence for multidimensionality was found in discriminate analysis of the scales. As expected, the sub-scales turned out to be inter-correlated, but not strongly so. They can thus be considered to represent different constructs. Moreover, the content of the items clustering on each factor was evaluated as logically and conceptually associated with the factor they were thought to represent. The different attitude dimensions (factors) were also similar to those previously found in the studies by Rundmo (1992, 1996, 1998), as well as the dimensions included from the YDAS (Malfetti et al., 1989). Parametric as well as non-parametric methods were applied to test the homogeneity of items within each attitude dimension, which was regarded as satisfactory. As hypothesised, the correspondence between attitudes and the aggregated measure of self-reported behaviour were considerably stronger as compared to the attitude-accident correlation. The attitude dimensions accounted for a total of 50 per cent of the variance in risk taking behaviour. However, the influence of the various dimensions on behaviour differed in magnitude. This implies that some dimensions were more important predictors of behaviour than others were. Thus, the attitude dimensions with the highest correspondence with self-reported behaviour could be given special attentions when traffic safety programs are carried out.

Summary of paper II

Paper II aimed at investigating the influence of personality traits on adolescents' risk-taking attitudes in traffic, as well as the impact of personality traits and attitudes on the propensity to commit driving violations. The personality traits included in the study were sensation seeking, aggression, anxiety, altruism, and

normlessness. Risk-taking attitudes included three of the attitude scales developed in paper I, respectively attitudes towards traffic flow vs. rule obedience, speeding, and funriding. The results of a structural equation model suggested that the relation between the personality traits and driving violations was mediated through attitudes. On this basis it was concluded that personality traits primarily influence risky driving behaviour indirectly through affecting the attitudinal determinants of the behaviour. This suggests that deeper-lying motivations represented as personality traits is reflected in adolescents' attitudes towards traffic safety. A practical implication of the results would be to acknowledge the importance of personality traits in traffic safety campaigns. Consequently, the messages of attitude campaigns could be to tailor according to certain personality characteristics in order to appeal to high-risk drivers. However, if risk-taking attitudes are partly a consequence of permanent motivational factors, this implies that driver's risk-taking attitudes may be difficult to change trough traditional mass-media campaigns. Possible alternatives are discussed.

Summary of paper III

Paper III aimed at identifying subtypes of young drivers and to evaluate how these responded to a traffic safety campaign. On basis of a cluster analysis of personality measures, six subtypes of young drivers were identified. The subtypes were found to differ on self-reported risky driving behaviour, attitudes towards traffic safety, risk perception, estimation of own driving skills, and accident involvement. Two of the subtypes were identified as high-risk groups in traffic. The first high-risk group consisted of mostly men, characterised by low levels of altruism and anxiety, and high levels of sensation-seeking, irresponsibility, and driving related aggression. The second high-risk group reported high sensation seeking, aggression, anxiety, and driving anger. The subtypes were also found to differ on how they evaluated and responded to the traffic safety campaign. The results indicated that the campaign seemed to appeal most to the low-risk subtypes and least to the high-risk subtypes. Gender differences within each subtype were also found on the different traffic related measures, as well as on response to the campaign. It was concluded that young drivers should not be treated as a homogenous group pertaining to road safety. Possible consequences for traffic safety campaigns were also discussed.

Summary of paper IV

In contrast to the other papers, Paper IV focuses on the role of adolescent passengers rather than adolescent drivers. The aim of the paper was to examine factors that may affect the likelihood of adolescent passengers addressing unsafe driving. Factors hypothesised to affect the likelihood of addressing unsafe driving included personality traits, gender, perception of accident risk, attitude towards driving with an unsafe driver, confidence in own ability to influence an unsafe driver, perceived costs of addressing an unsafe driver and riding frequency. The respondents were also asked to rate the friend they most frequently rode with pertaining to the friend's risk-taking behaviour in traffic, experience of stress when riding with this friend, and how often they addressed the driver when feeling unsafe as a passenger. The results of a structural equation model showed that the factors influencing adolescents' willingness to address risky driving were several. In particular, strong direct and indirect effects of gender upon adolescent willingness to address unsafe driving were found. Females were in general most likely to report that they spoke out to the driver when feeling unsafe in the car. This could to some extent be explained by gender differences in certain beliefs. That is, males seemed to perceive more negative consequences of addressing unsafe drives, to be less confident in their ability to influence an unsafe driver, to be more likely to accept risk taking from other drivers, and perceive less risk than females. In turn, these beliefs affected the likelihood of confronting an unsafe driver. Passengers disposed to experience anxiety seemed to feel unsafe in their friend's car, an experience that increased the tendency to address unsafe driving. The results also demonstrated that a relatively large proportion of the adolescents thought that it is acceptable to ride with an unsafe driver. This kind of belief lessens the likelihood of addressing unsafe driving, as well as being most prominent among passengers who ride with friends with risky driving habits. Possible implications for peer-focused interventions in traffic safety promotion were also discussed.

4. Discussion

The following discussion will be general, and will not discuss the findings of the four papers in detail. A more detailed discussion of the findings is presented in the papers. The present discussion will focus on methodological problems relevant for all of the four papers, as well as discussing the results of the papers in relation to each other.

4.1 Methodological issues

4.1.1 Sample

The sample consisted of Norwegian high-school students aged 16-23 years. The relatively high response rate, 85 per cent, suggests that self-selection is not a problem of major importance in the present studies. Still, there is no information concerning the 15 percent who refused to answer the questionnaire. This means that problems with self-selection cannot totally be ruled out, although it is regarded to represent a minor problem. After all, a response rate of 100 % is unrealistic to achieve when the study relies on voluntary participation.

A more relevant methodological problem may be the representativity of the sample. The sample consisted of adolescents drawn from two counties, respectively Møre og Romsdal and Sør-Trøndelag, of totally 19 counties in Norway. Obviously, more confidence in the generalisability of the findings would be achieved if the study was based on a sample of Norwegian adolescents in general. However, there is no apparent reason to believe that adolescents from these two counties are radically different from those in other parts of Norway. First, the socio-demographic characteristics of the population in both counties are not different from those of the rest of Norway. Moreover, the traffic accident rate among adolescents does not differ from the rate in the rest of the population of Norwegian adolescents (see Appendix I).

The high response rate and representativity of the sample within Norway is, however, no guarantee for the results being applicable to other cultures. Cross-cultural studies conducted by Hofstede (1991) have shown that Norway differs from other countries on several cultural dimensions. Still, studies have found results similar to the ones in the present thesis when it comes to systematic gender differences in traffic safety orientation, the influence of personality traits, as well as

the high-risk groups identified based on the cluster analysis in paper III (see e.g. Deery & Fildes, 1999; Harré, Field & Kirkwood, 1996; Lawton, Parker, Stradling et al., 1997). This signify that the results may be applicable to other cultures, although it is recommended that more research concerning how cross-cultural differences relate to traffic safety orientations should be carried out.

Another potential problem is that one half of the sample answered the questionnaire before the had been visited by a traffic safety campaign team, while the other half filled in the questionnaire after they had been visited by the campaign team. Since one half of the respondents had been subjected to a traffic safety intervention, one may ask whether the two halves of the sample should have been subjected to separate analyses. Comparison of the two halves of the respondents did, however, show very small differences in traffic safety attitudes, risk perception, and risk behaviour between those who had been visited by the campaign and those who had not been visited (see Rundmo & Ulleberg, 2000). It is thus not likely that analysing the two halves separately would have affected the results of the four papers in the present thesis.

4.1.2 Problems related to the use of self-reported data

A well-known methodological problem related to the use of self-report data is the influence of social desirability responding, meaning a respondent's willingness to manipulate his or her answers according to what he or she regards as socially appropriate. Previous studies have found that drivers declaring a concern for safety tend to score high on measures of social desirability (Lajunen & Summala, 1995; Lajunen et al., 1998). As a consequence, the authors of these studies recommend that self-report studies of driving always should control for social desirability responding. The present study did, however, not control for such biases in responding, and it is therefore likely that some respondents may be motivated to express a higher degree of safety-oriented attitudes than they actually have.

The effect of social desirability responding may be particularly dominant on self-reports of driving behaviour. Behaviours like violating traffic rules and engaging in risk-taking behaviour represent sensitive information about the individual, and the respondents may choose not to report such behaviours in order to present themselves in a socially desirable way. Likewise, some respondents may be motivated to report that they address unsafe drivers more frequently than they actually do. If the same respondents also report more "ideal" attitudes towards

traffic safety, this may cause an overestimation of the influence of attitudes on both risk-taking behaviour and the likelihood of addressing unsafe driving. Thus, this may impose a major threat to the validity of the findings.

Although some authors are sceptical of the value of self-report measures, others are more confident in the value of such measures. Self-reports may, for instance, not give an objective representation of actual behaviour in traffic, but may nevertheless provide a good indication of it. This is supported by a study by West, French, Kemp and Elander (1993), who concluded that self-reports of driving behaviour could be used as a surrogate for actual driving behaviour. Their conclusion was based on the correlation coefficients found between observers' ratings of a driver's behaviour and the driver's self reported behaviour. A similar conclusion was reached in a longitudinal study of young drivers in Finland (Hattaka, Keskinen, Katila & Laapotti, 1997), where a significant relationship between self-reported driving habits and future accident involvement was found.

Hattaka (1998) has also presented a good point to the social desirability in self-reports of driving behaviour. Driving in traffic involves being in a social context where ones actions is observable to others. There is no evidence showing that social desirability should have a stronger effect on self-report measures than on actual driving behaviour. Actual engagement in undesirable activities can be considered to be just as much under the pressure of social desirability as reporting the behaviour on a questionnaire. Thus, if a driver is motivated to present himself or herself in a socially desirable way, this should also be reflected in his or her actual behaviour in traffic. The effect of social desirability in responding is also thought to be most problematic in studies involving face-to face interviewing, and not so prominent in anonymous questionnaires as applied in the present study (Schwartz, 1996).

The use of self-reports has also several advantages compared to the alternatives of studying driving behaviour through direct observations or simulation of the driving task. First, both the alternative methods have the disadvantage of placing the individual under observation, which may cause the driver to act more disciplined compared to normal driving behaviour. Second, these methods are both expensive and time consuming. And finally, self-reports represent summary judgements of information in a variety of situations, and may therefore be the most suited measure according to the multiple-act criterion (Epstein, 1979; Ajzen & Fishbein, 1980).

An alternative could be to use recorded accident frequency as the dependent variable in the analyses. This is, however, not desirable due to several reasons. For statistical measurement, it is difficult to find a link between accident frequency and psychological constructs since traffic accidents occur relatively seldom. Accident frequency can also be seen as an unreliable criterion measure, mainly because accidents are also influenced by numerous factors other than the drivers' behaviour, such as exposure (e.g. annual mileage), randomness, and weather conditions (see e.g. Fridstrøm et al., 1995, Maycock, 1997). Accident frequency as a criterion can thus be subject to a high degree of random measurement error. Such measurement errors will easily result in an underestimation of the relationship between accident frequency and psychological constructs. Moreover, accidents are very dependent on exposure (i.e. annual mileage), and such information can be difficult to obtain from young drivers[10].

Another problem is the difference in the level of measurement between accident frequency and psychological constructs such as attitudes and personality traits. The latter is often measured at a general level, meaning through an aggregation of items, whereas the former is a measure at a specific level. According to the multiple-act criterion, this will lead to an underestimation of the relationship between accidents and other variables measures at a general level.

4.1.3 The measurement of unobserved, latent variables and structural equation modelling

It may seem that the present thesis takes the existence of psychological concepts such as personality and attitudes for granted. Such constructs are, however, hypothetical because they are neither directly observable nor precisely defined. How can we be so certain that such abstract constructs exists, and if so, how can these be precisely measured? The question is thus how to connect these theoretical constructs with empirical observations. In order to answer this question thoroughly, it is important to review the basic principles psychometrics rely on, which is the fundament for the evaluation and measurement of psychological constructs.

[10] This can be illustrated by an example from the author's own experiences concerning young drivers. The questionnaire applied in the four papers also included a question concerning the annual mileage of the respondents. Most respondents did not answer this question, or filled a question mark in the box they were supposed to write down their annual mileage.

Psychometrics is a field within psychology focusing on the measurement of individual differences on psychological constructs. The theoretical fundament for psychometrics was established during the 20th century, especially in the period from 1900 to 1960. In this period, logical positivism can be said to be the dominant paradigm within theory of science. Accordingly, principles based on logical positivism have exerted great influence on the early development of psychometric methods and principles (Nash, 1990; Messick, 1993). Most of these principles are based on the logical-positivistic *principle of verification*, which postulates that only two types of statements are possible to verify, respectively *analytical* and *syntactical* statements. The former refers to statements that are so obvious that their verification do not need any reference to the external world (e.g. a bachelor is an unmarried man), whereas the latter refers to statements where verification depend on references to the external world. For instance, the statement "lead is heavier than water" can be evaluated by direct observation. This is usually referred to as the *correspondence theory of truth*.

A problem with abstract constructs such as personality and attitudes, is that they cannot be observed directly, and hence are not verifiable according to the correspondence theory of truth. However, Carl Hempel (1952, see also Gilje & Grimen, 1998) emphasised that the meaningfulness of theories and abstract concepts (such as the force of gravity) could be determined empirically through the use of a *deductive-nomological network*. This network is a set of hypothetical relations between theoretical concepts, which are operationalised through a set of directly observable statements. Theoretical concepts may thus be observed indirectly, through their supposed influence on directly observable statements.

Hempel's notion can be said to be one of the fundaments of how psychological constructs are operationalised and evaluated. This is well established in Blalock's (1968) two-level model of measurement. The two levels in Blalock's models are based on Northrop's (in Blalock, 1968) separation between concepts of intuition and concepts of postulation. The former represents concepts that can be sensed directly, such as colour and size, whereas the latter are concepts that are theoretical and exists primarily in the mind of the researcher. Concepts of postulation can therefore not be observed directly. According to Blalock (1968), they can be observed indirectly through their influence on the observable concepts of intuition. For instance, anxiety can be observed indirectly through the concept's influence on how a person responds to items on a test intended to measure anxiety. Based on the

scores on the items in the test (concepts of intuition), an individual's score on anxiety (concept of postulation) can be determined.

According to Blalock, the two-level model can determine the link between the theoretical concept and its indicators through so called "epistemic correlations", defined as a relation that connects an unobservable component (also called a latent variable) deduced from theory to its directly observable components[11]. This kind of measurement model of a theoretical construct is referred to as an "auxiliary theory". The more precisely the theoretical concept is defined, the easier it is to operationalise it empirically through the auxiliary theory. The correspondence of the theoretical construct (the latent variable) and the auxiliary theory (the measurement model) can be verified by testing whether the empirical indicators of the concept "behaves" as deduced from theory.

For instance, if four indicators are thought to reflect a latent variable, the shared variance between the four indicators should be accounted for by the factor loadings from the latent variable. The factor loadings are estimated on basis of the covariance matrix of the observed indicators. If the estimated loading can reproduce the shared variance between the observed indicators, this means that the whole model is consistent with the data. Costner (1972) has labelled this as the *consistency criterion*. If the loadings fail to reproduce the covariance matrix, the theory is either wrong and/or the measurement model incorrectly specified. Thus, the problem of connecting the theoretical with the operational level is solved by transforming the relation between the two levels into empirically testable equations.

The use of auxiliary theory also allows for further testing of the construct's relation to other abstract constructs. This strategy is well represented in structural equation models (SEM). As mentioned in the methods sections, SEM analysis express the observed indicators as a measurement model (an auxiliary theory) of the theoretical construct, as well as expressing the hypothesised causal relation of the theoretical construct to other constructs in the structural model. The measurement model can handle random measurement errors in the observed indicators through correcting the theoretical variable for attenuation[12], as well as for systematic measurement

[11] It should be noted that epistemic correlations are not the same as correlation coefficients.
[12] This is done by extracting the variance the items have in common. This is thought to give a better representation of the "true score" an individual has on a latent variable. This strategy is advantageous because it allows the construction of a score thought to be free of the measurement errors in the observable indicators of the latent variable. Measurement

errors. SEM analyses also opens for the researcher to evaluate the fit between data and theory, thereby transforming the nomological net into testable hypothesis. If the network to a satisfactory degree can account for the empirical covariance matrix between the observed indicators, this can be interpreted as support for the correspondence between the theoretical level and the observed, empirical level (expressed as observed covariance matrix). Thus, the consistency criterion is met. Does this mean that we have obtained an objective criterion for evaluating the meaningfulness of latent variables and structural models? Pawson (1980) has criticised the distinction between the theoretical and the observational level applied in measurement models of psychological constructs. Such measurement models are according to Pawson (1980) based on naive empiricism, meaning the belief in a neutral and objective observation of the external world. The belief of objective observation has been undermined by several theorists of science, who convincingly has demonstrated that observation is guided by and presupposes theory. According to Popper, observations are theory-laden, and theories can therefore not be established as true or probably true based on observable evidence[13]. Moreover, Kuhn (1962) further undermined the belief in an objective scientific method when introducing his term "scientific paradigm". According to Kuhn, researchers are influenced by the dominant view of science within their respective paradigm. A paradigm is a network of concepts, theories, and methods adopted among members within a particular scientific community. This implies that truth is relative within a specific paradigm. Accordingly, there is no objective standard for evaluating the meaningfulness of a theory or a hypothesis[14].

---

errors can be defined as the difference between an individuals true score on the concept that is aimed measured and the observed score on the indicator thought to reflect the theoretical measure. This can be represented as $X = \xi + \delta$. X is the observed score on an observed indicator, ξ represents the true score on the construct aimed to be measured and δ random measurement errors. Random measurement errors can be factors such as misinterpretation of an item on a test, ticking of other alternatives than intended etc.

[13] Popper instead introduced the falsification criterion as a method for evaluating the meaningfulness of theories, meaning that hypothesis can be proven to be wrong, but a hypothesis can not be proven to be true. This implies that obtaining a satisfactory model fit in a SEM analysis is no guaranty for the model being true. On the other hand, the model can be falsified if it does not correspond to the empirical data. One problem of Popper's criterion is that hypothesis are falsified on the basis of observation. If observation is theory-laden, the interpretations made during the testing of the hypothesis could also be erroneous, resulting in a misleading falsification of the theory. For instance, the auxiliary theory (measurement model) in a structural model may be erroneous specified by the researcher, causing the total model to be rejected.

[14] Paul Feyerabend (1975) proposes a more radical view of this relativistic theory of truth, stating that there is no external standard for separating science from pseudoscience – anything goes!

Based on the theory-laden nature of observations, as well as Kuhn's relativistic view of truth, Pawson (1980) further argues that the summation or weighting of items into a latent variable is no more than a summation of theory-laden observations. The fundamental problem of separating theory from observation can by no means be solved by transforming it to an empirical question, as suggested by Blalock. Therefore, neither the objectivity of measurement models nor structural models can be determined by using Costner's (1972) consistency criterion.

The theory-laden nature of observation obviously imposes limitations to the conclusions one can draw from evaluating a measurement model, as well as a structural model. The problem is further augmented by the fact that it is quite possible to fit alternative structural models with different directions of causation into the same correlation matrix, obtaining an equal model fit (see e.g. Stelzl, 1991). Thus, a good fit does not mean that the causal relationship between the latent variables in the model is reflecting the true causal relations between them. This is believed to be especially problematic pertaining to models that rely on cross-sectional data, as in the present thesis.

The limitations associated with the use of nomological networks are today widely accepted (see e.g. Cronbach, 1988; Messick, 1993). If a researcher accepts that there is no objective basis for evaluating a structural equation model, how can he or she defend the use of measures of model fit to evaluate the meaningfulness of the model? One "solution" is to adopt a constructive-realistic view of science. This view does, in contrast to relativism, accept the realist's belief of an external world that exists independent of our knowledge, which we partly can observe and test our theories and hypothesis against. At the same time, this view admits the theory-laden nature of observation, and is thus labelled constructivistic (Messick, 1993).

The author finds the constructive-realistic position appealing. This position believes that abstract concepts, such as personality traits and attitudes, have a reference to the external world, which implies that the existence of these can be observed empirically. If such constructs exist, they can be expected to reflect themselves in a logical and consistent way in their empirical indicators. It is therefore reasonable to apply empirical demands such as model consistency (and thereby reliability and validity) in order to evaluate the meaningfulness of hypothetical concepts and the relationship between these. Still, the theory-laden nature of observation and the influence of theory on the operationalisation of such constructs imply that we cannot have an objective basis for evaluating the

meaningfulness of the model. Thus, the measurement models and the structural models presented in paper I, II and IV are not regarded as objective evidence for the existence of attitude dimensions or the causal relations between personality traits, attitudes and behaviour.

Nevertheless, the structural equation models presented in paper II and IV appear meaningful in term of their correspondence between the data and the hypothesised models. For instance, the attitude dimensions identified in paper I was evaluated as conceptually meaningful. The content of the items clustering on each factor was evaluated as logically and conceptually associated with the factor they were thought to represent. Furthermore, the sample was randomly split in two parts to be compared, performing exploratory factor analysis on the first half and confirmatory analyses of the 11-factor model on the second half. The results yielded no difference in either the factor structure or model fit as compared to the same analyses carried on the total sample. This further strengthens the assumption of multidimensionality in risk-taking attitudes.

4.1.4 Limitations of cluster analysis

Six separate sub-groups of young drivers were identified in paper III based on a cluster analysis. Cluster analysis has, however, been criticised for testing no specific hypothesis, and being too subjective and dependent on the researcher's choice of variables, as well as on different clustering methods. For instance, Cormarck consider that "Cluster analysis has lead to waste of more valuable time than any other statistical innovation" (Cormarck, 1971). However, it is important to note that even though cluster is based on a set of rules, it is not aimed at giving an "objective" representation of reality, no more than other kinds of statistical method can give such a guarantee. The result of a cluster analysis is largely judged on the usefulness, interpretability, replicability, and stability of the results instead of the traditional strategy of testing hypothesis at a given level of significance. The analysis intends to generate rather than to test hypotheses (Everitt, 1993). Thus, the clusters found in this study should not be regarded as an objective classification of young drivers, but rather as a suggestion on how to classify young drivers.

The lack of any objective standard to evaluate a cluster analysis against does, however, not imply that the classification of young driver is useless. The different clusters identified were interpreted as meaningful and useful, especially since the clusters differed on several traffic related measures. Different clustering methods

also demonstrated almost identical profiles of the six-cluster solution. Moreover, the profiles of the high-risk clusters were very similar to high-risk groups found in previous studies aimed at identifying subtypes of drivers on basis of personality traits (Deery & Fildes, 1999; Donovan et al., 1988; Wilson, 1991). This is also encouraging, since the cluster analysis was not based upon variables identical to the ones used in these studies. An implication of the similarity in cluster profiles across studies indicates that the high-risk groups have similar profiles in different cultures. One major difference is, however, the relatively high proportion of female drivers in the high-risk group characterised by high aggression and driving anger (Cluster 5). This is, however, not so surprising since driving anger was the only traffic related measure used to classify the drivers into clusters. Lajunen, Parker and Stradling (1998) have found no gender difference on driver anger among younger drivers, demonstrating that gender differences regarding aggression and anger on the road are not so prominent, at least among young drivers. Still, the female drivers with these characteristics seemed to suppress their aggressive tendencies in relation to driving behaviour to a greater extend than the male drivers. Thus, the female drivers were not high-risk drivers to the same extent as males within this cluster.

Using personality variables as basis for a cluster analysis is, however, only one approach towards classifying young drivers. As mentioned in the introduction, other studies have applied measures of lifestyle actions as their point of departure (Schulze, 1991; Gregersen & Berg, 1994). Using such measures could result in a different classification of young drivers.

4.1.5 Attitude scales and their predictive validity

In paper II and IV, structural equation models were used to represent the hypothesised causal relationship between attitudes and behaviour. As mentioned above, a good fit index of a structural model is no proof for the causal relationship between the variables in the model. It is problematic to claim that attitudes *predict* behaviour, because risk-taking behaviour was measured at the same time as the attitudes were measured. An alternative interpretation is that attitudes may correspond to behaviour because people wish to justify their previous actions, not vice versa (Heider, 1958). Still, empirical evidence for the predictive value of attitudes in relation to behaviour have been found in a wide range of studies, in which attitudes and behaviour are measured on separate occasions (see, Kraus, 1995 for a meta-analysis). Furthermore, it is reason to believe that self-reported

driving behaviour reflects a stable behavioural pattern, and thus makes a reliable indicator of future driving behaviour. For instance, a longitudinal study of young drivers in Finland conducted by Hattaka, Keskinen, Katila and Laapotti (1997) found that self-reports of driving violations were correlated with future accident involvement, as well as future police registered traffic violations. On this basis, one may expect attitudes to be correlated with future behaviour. This does not, however, solve the causal dilemma of what comes first, attitudes or behaviour.

Another problem related to the estimated impact of attitudes on behaviour, is the exclusion of other potentially relevant independent variables. According to the theory of reasoned action (TRA) and the theory of planned behaviour (TPB), subjective norm and belief in personal control is thought to influence behavioural intentions as well as behaviour (Ajzen, 1988)[15]. The inclusion of these variables could thus have resulted in a reduction of estimated impact of attitudes on risky driving behaviour. On the other hand, results from studies of driving behaviour applying the TRA or TPB as their theoretical framework can give an indication of the consequences of not including subjective norm and perceived personal control.

Parker, Manstead, Stradling et al. (1992) applied the theory of planned behaviour, and found that a person's subjective norm and perceived personal control were the most important predictors of the intention to commit various driving violations. However, the impact of attitudes on behavioural intention as measured by the bivariate correlation coefficient did not change so much when the effects of subjective norm and perceived behavioural control were statistically controlled for in a multiple regression model. Subjective norm and perceived personal control did, however, explain additional variance in intentions to commit violations. The authors also concluded that subjective norm was the variable of greatest importance for intentions to commit violations. A later study conducted by Parker, Manstead and Stradling (1995) found the three predictors (attitude, subjective norm, and perceived personal control) to be of equal importance in their impact on drivers' intention to commit violations. This suggests that including subjective norm and perceived behavioural control would probably have increased the amount of explained variance of driving behaviour, but not changed the impact of attitudes on behaviour to a high extent.

[15] A person's perceived behavioural control is not included as a predictor of behaviour in the TRA.

Moreover, Åberg (1999) found that attitudes were the most important predictor of intentions to commit driving violations, as well as the frequency of committing actual driving violations. Subjective norm and perceived personal control also influenced intentions and behaviour, but not to the same extent. In a study of young, male Israeli drivers, Yagil (2001) found that subjective norms did not show any predictive value of intentions to commit driving violations. On the other hand, attitudes did. This further demonstrates that excluding variables such as subjective norm and perceived personal control probably did not have any consequences when analysing the attitude-behaviour relation.

4.2 General discussion and implications of the findings

4.2.1 Separate dimensions of risk-taking attitudes

The finding that there are several dimensions of adolescents' attitudes towards risk-taking in traffic can be regarded as an important finding. This implies that adolescents differ in the way they evaluate various aspects of traffic safety. This also means that "unideal" attitudes on one dimension not necessary imply "unideal" attitudes on other dimensions. For instance, if a person reports favourable attitudes towards speeding, this does not mean that he or she approves of drinking and driving.

The multidimensionality of risk-taking attitudes illustrates that campaigns should focus on specific attitudes towards traffic safety, and not attitudes in general. The results of paper I also provide further support for this suggestion. The various attitude dimensions were all associated with risk-taking behaviour and accident involvement, but the association differed somewhat in magnitude between the various dimensions. In particular, attitudes towards speeding, traffic flow vs. rule obedience and funriding had the strongest relationship with risk behaviour. This was the main reason for focusing on these three dimensions as measures further in paper II.

This does, however, not suggest that only these three attitude dimensions should be focused in traffic safety promotion. As shown in paper IV, a large proportion of the respondents found it acceptable to ride with unsafe drivers. This attitude dimension also showed a relationship to the respondents' willingness to address unsafe

driving. Thus, such beliefs should also be considered when promoting safety attitudes among adolescents. The other attitude dimensions also demonstrated a significant relationship to risk taking behaviour and accident involvement. However, the respondents expressed relatively ideal attitudes on several of these dimensions, as indicated by the mean score on the attitude scales (see paper I). In particular, most of the respondents were concerned about hurting others in traffic, expressed disapproval of drinking and driving, and thought the risk of being involved in an accident was relatively high. This indicates that the potential for improvement is not so large on these attitude dimensions.

4.2.2 The influence of personality traits on attitudes and behaviour

The results of paper II and III (and partly paper IV) demonstrated that personality traits primarily had indirect effects on risk-taking behaviour in traffic though their influence on attitudes. These results are of interest from several points of views. Theoretically, it provides some evidence for the interdependence of attitudes and personality, as proposed by Smith et al. (1956). This indicates that attitudes towards traffic safety are, in part, reflections of stable, underlying preferences. In addition, the impact of stable emotional predispositions such as trait anxiety, aggression and sensation seeking on driving behaviour may also provide some support for the role of emotional factors pertaining to driving behaviour. The importance of emotional factors as motivators has been incorporated in several models of driving (see section 1.2.4). This indicates that behaviour in traffic is more than a rationally based cost-benefit evaluations, as suggested by some theorists.

Practically, this demonstrates that one should acknowledge the importance of personality traits in attempts to change attitudes and/or behaviour related to traffic. In accordance with the functional matching effect, people are expected to be persuaded more easily by arguments addressing the functional basis for their attitudes than by equally strong arguments that addresses different functions (Katz, 1960). This illustrates that campaigns and messages should make more direct contact with the functional motivational underpinnings of the attitudes and/or the behaviour one aimed to change or promote. However, the functions of attitudes may not be as sharply divided as the five main functions proposed by Katz (1960). The finding that the personality traits are consistently related to attitudes provide support for Smith, Bruner and White's (1956) alternative functional approach, suggesting that attitudes should be considered in the context of the total person,

meaning that attitudes and personality are a part of one another. Specific recommendations related to this issue are more thoroughly considered in the next section.

4.2.3 Implications of finding subgroups with different safety orientation

How could the total person be considered when road safety is promoted? The cluster analysis in paper III can be seen as a continuation of the results pertaining to the motivational influence of personality traits in paper II, investigating how combinations of the personality traits would affect differences in traffic safety orientation. The results of paper III suggest that two subgroups of young drivers should be especially focused in traffic safety campaigns. The first (Cluster 2) consisted of mostly men, characterised by low levels of altruism and anxiety, and high levels of sensation seeking, normlessness, and driving related aggression. Presented in a more comprehensive way, this group consists of individuals who think it is acceptable to break rules and laws, do not care so much for others, as well as the consequences of one's actions has for others. Thus, antisocial tendencies seem to be a central motivational factor for the individuals within this group. They also seem to be motivated to experience risk, and lack fear when doing so. In many ways, the individuals within this cluster fit the description of high scorers on the Disinhibition subscale of Zuckerman's (1979) sensation seeking scale.

The other high-risk groups (cluster 5) reported high levels of aggression, anxiety and driving anger. This indicates that individuals characterised by personal maladjustment are typical members of this subgroup. These can further be described as being dominated by negative emotional factors and probably the lack of control over these. The relatively risky driving style reported by this group suggest that they use driving as an expression of inner conflicts, meaning that they use driving as a coping mechanism. For instance, becoming frustrated and angry in traffic situations can easily trigger responses such as speeding and rule violations. Other responses may be self-assertion when driving with other teenagers. They may therefore use the traffic environment as an arena to let out frustration and inner conflicts, a tendency that has been found in several studies (McMurray, 1970, Crancer & Quiring, 1970).

Both these groups provide a challenge for traffic safety promoters, especially since they were found to be the ones who were least responsive to safety messages of a road safety campaign. This is also a disappointing result, since one of the target groups of the campaign was a group labelled as "The normless". Information about the risk of accidents or telling them to change their attitudes and behaviour is probably not the best intervention strategy for these two clusters. The reasons are several. In Cluster 2, antisocial and authority defeating motivations seem to underpin the individuals' attitudes and behaviour. It may be difficult to change these by the traditional approach of authorities persuading drivers to adopt safer driving practices. An alternative intervention strategy is to let young drivers themselves find out the need for behavioural change, and to let them draw their own conclusions about how they could change. This strategy has been used for professional drivers, where a group following the strategy reduced their accidents by 50 % compared to a control group (Brehmer, Gregersen & Morén, 1993). Gregresen and Berg (1994) have proposed that a similar strategy could be used in relation to different high-risk groups of young drivers. This involves to identify sub-groups of high- risk adolescents and to tailor group discussions according to the preferences of these groups. Ideally, this will end up with individual decisions about what and how to change. This strategy of self-produced, individual decisions has probably the advantage of placing young drivers decisions under personal control, which in the next turn could make them more motivated for behavioural change. This may be especially relevant pertaining to authority defeating adolescents, but also for adolescents in general.

As mentioned in the introduction, Linderholm (1997) concluded that one group of young male drivers labelled "the risk takers", responded poorly to messages aimed at changing attitudes towards speeding. Linderholm's (1997) description of the risk-taker group is in many ways similar to the characteristics of Cluster 2; they like to speed, show low concern for others, regard their driving skills as high, and can become irritated of others in traffic. This study further strengthens the assumption that those who take most deliberate risks in traffic are the ones who are most difficult to reach trough campaigns, especially individuals with antisocial tendencies.

Lawton et al. (1997) have also found that antisocial tendencies, in the form of mild social deviance, are linked to the commitment of driving violations and accident rates. They concluded that individuals characterised by mild social deviance are motivated to seek short-term benefits associated with breaking rules (e.g. getting

ahead quicker in traffic), and lack self-control in traffic. They therefore recommended increasing the perceived costs associated with non-compliance with traffic rules by amplifying the rate of detection by more camera surveillance and/or police presence on the road. A similar type of intervention may be to introduce a penalty point system for drivers, meaning that they may lose their driver licence when a certain number of driving violations are registered. Another type of interventions may be rooted in a wish for exposure reduction, such as restricting driving for adolescents in situations where risky driving is most likely to manifest, such as at night time in weekends. However, several of these measures are probably very difficult to enforce, and they will probably not reduce the underlying motivation of engaging in risky driving (see e.g. Wilde, 1994).

Rewarding safe driving may also be a supplementary means of motivating drivers to take less risk in traffic. Providing insurance incentives for accident free drivers (e.g. repaying a part of the insurance premium) may be a relevant measure for young drivers, who usually has to pay higher insurance rates than older drivers. Vaaje (1991) evaluated this type of reward program among Norwegian drivers aged 18-22 years. After the implementation of the program, a reduction of 35 percent in insurance claims was found for drivers aged 18-22 years, whereas a control group showed a reduction of 12-13 percent in the reported insurance claims. Vaaje (1991), however, concluded that underreporting of accidents as well as self-selection of safe drivers to the program could have caused this reduction.

A relevant intervention strategy for Cluster 5 may be to focus on the control of emotions in traffic situations, and factors that can trigger such emotional reactions. For instance, a driver training program in Germany has focused on how to deal with emotional responses in traffic, like self-assertion when driving with others, and dealing with impatience and frustration in traffic (Heinrich, 1993, cited in Williams, 1998). Although this program has not been formally evaluated, it represents an alternative way of thinking in traffic safety promotion. A related intervention strategy has recently been applied by Deffenbacher et al. (2000), who applied physical and cognitive relaxation interventions to reduce driving anger among high-anger drivers. The results showed significant reduction in both driving anger and risky driving behaviour among these drivers, whereas a control group showed no reduction.

An intervention of a more extreme character is to deny drivers who possess the characteristics typical for the two high-risk groups for obtaining a driver licence.

This strategy involves a return to the theory of accident proneness, a theory that has shown its limitations in explaining the cause of accidents. Although the two high-risk clusters showed elevated accident involvement, excluding such drivers would probably reduce, but not eliminate the number of accidents occurring. This is because drivers in the other sub-groups also reported being involved in accidents. To deny certain drivers from obtaining a driver licence also involves problems of an ethical and juridical nature, since this involves punishing individuals for actions not yet done. Nevertheless, the results of the present thesis suggest that Cluster 2 and Cluster 5 are problem groups pertaining to traffic safety, and that safety promotion should be targeted towards these two groups. A more realistic intervention could be to single out adolescents with high-risk personality characteristics before they obtain their driver license, and provide special follow-up procedures for these individuals.

4.2.4 Generalisability of the high-risk groups to drivers more of age

The sub-groups identified were based on a sample of adolescent drivers. One may thus ask oneself whether these sub-groups would have been identified on basis of a sample of older drivers. The answer is probably both yes and no. One of the high-risk groups, Cluster 2, was interpreted as being characterized by individuals with authority defeating characteristics, with high scores on social deviance, sensation seeking and egocentrism (low altruism). According to Arnett (1991), such characteristics are typical adolescent characteristics that promote reckless behaviours, and these characteristics will decline when adolescents become older and achieve an adult status. As a result, a decline in risky driving behaviour will occur. This assumption has been confirmed in a longitudinal study of young New Zeeland drivers, where a significant reduction in risky driving for males from the age 21 to 26 was found (Begg & Langely, 2001). The authors concluded that risky driving is predominately a male activity that "matures out" when they become older. Based on these results, one may expect that Cluster 2 will not be so dominant among drivers more of age. Still, Lawton et al. (1997) have found social deviance to be associated with rule violations and accident rates for drivers in all age groups. This is a sign of social deviance being a stable characteristic influencing risky driving among drivers more of age.

The other high-risk group, Cluster 5, was characterized by aggression, anxiety and driving anger, indicating personal maladjustment. There is to the author's

knowledge no empirical support for these characteristics being less dominant when adolescents become older. This suggests that Cluster 5 can be expected to apply for drivers more of age. Studies of Donovan, Umlauf and Salzberg (1988) and Wilson (1991) support this assumption, since both studies found one subgroup similar to Cluster 5 being a high-risk group in traffic. Both studies were based on drivers in all age groups.

4.2.5 Promoting traffic safety and social influence among the other subgroups

Although the results indicate that two sub-groups of young drivers should be particularly focused in traffic safety promotion, this does not mean the drivers within the other sub-groups should be ignored when efforts to promote traffic safety are carried out. About one third of the respondents within these sub-groups reported being involved in a traffic accident as a driver, which may indicate that these groups also constitutes a risk in traffic. This is, however, not necessarily true, since the respondents were not asked whether they themselves were responsible for the traffic accident. Three of these four groups seemed to be more responsive to the safety campaign compared to the two high-risk groups, indicating that traditional campaign measures may be an effective way of reaching out to these sub-groups. The strategy of self-initiated decisions as proposed by Gregersen and Berg (1994) may nevertheless be more motivating for these sub-groups, since a decision which is placed under personal influence is expected to be more motivating and appealing than being told by others what to do.

Adolescents expressing relatively ideal attitudes, as well as safe driving practices, could also be focused in traffic safety campaigns by being encouraged to promote safe driving practices among their peers. Positive peer influence may be especially relevant for reaching out to high- risk drivers since the results of paper III showed that high-risk drivers were least responsive to safety campaign messages. However, the results of paper IV indicate that promoting positive peer influence is more than merely asking adolescents to speak out when their friends are driving unsafe. To use this kind of personal influence was perceived as especially problematic for young males, who seemed to fear negative consequences of voicing their opinion to unsafe drivers more than females did. In turn, this lessened the likelihood of addressing unsafe driving. It was believed that differences in gender role expectations might cause males to perceive the barriers against speaking out to

unsafe drivers as high. One way of encouraging male passengers to speak out may be to portray actions to address unsafe driving as "tough", that is, you are a "chicken" if you do not dare to speak your mind about unsafe driving.

The results of paper IV also revealed that the adolescents were moderately confident in their ability to influence the behaviour of other drivers. Efforts made to increase adolescents' confidence in this kind of self-efficacy may thus be another focus for campaigns aimed at promoting peer influence. There are several ways of promoting such self-efficacy. The traditional way of using mass-media messages was not regarded as the most constructive mean of promoting such actions. Results from other peer interventions programs (McKnight & McPerson, 1985) indicate that the use of role-playing can be a more effective method for providing confidence in own ability to influence other drivers, as well as promoting actions to address unsafe driving. Another way to lessen the barriers against addressing unsafe drivers may be to provide more alternative means of transport, especially at nighttime in weekends. This can make it easier for passengers to get out of cars with unsafe drivers in order to get home.

Telling drivers explicitly (directly) how to behave can, however, create the opposite effect. Brehm (1972) has found that people can react strongly against explicit social pressure, because this may threaten their behavioural and attitudinal freedom. Thus, a boomerang effect can cause the recipient of the pressure to either maintain the behaviour or attitude, or to change these in the opposite direction. If so, telling a driver to drive more carefully may imply maintenance of, or even an increase in, risk taking while driving. This may be especially relevant for passengers riding with drivers in Cluster 2 or Cluster 5.

Cluster 2 may be problematic to influence by such means, since the individuals within this group demonstrates low concern for norms and the well-being of others (i.e. a high degree of normlessness and low altruism). The characteristics associated with Cluster 2 may signify that they are low self-monitors, meaning that they are not motivated to present themselves in a socially desirable way for their peers. Normative influence on attitudes is found to be least efficient among low self-monitors (Snyder & DeBono. 1985; DeBono, 1987). On the other hand, high-risk drivers may also be motivated to maintain their attitudes and behaviour in order to express their identity as tough, rebellious, and authority defeating. This kind of expression clearly depends on an audience of peers. Since peers may be

regarded as more credible and trustworthy than authorities, promoting positive peer influence may nevertheless be advantageous in this context.

Cluster 5 may also be problematic to influence by peers, since this cluster was characterised by drivers with hostile/aggressive tendencies. Drivers with these tendencies can be expected to be less open to criticism than others. Moreover, such tendencies may also cause passengers to perceive the cost of addressing unsafe driving as high, because they may fear aggressive feedback from the driver. Nevertheless, a passenger may also help to calm down the driver and social control may help the driver to control his or her emotions to a greater extent while driving. Efforts made to promote peer influence could therefore focus on the learning of techniques to calm down an upset driver.

Personality factors[16], primarily anxiety, were also found to influence the likelihood of addressing unsafe driving. This may illustrate how a stable emotional predisposition may shape the individual's appraisal of the traffic situation, as well as the interaction with other drivers. This may also be interpreted as support for the assumed emotional nature of the experience of risk, as believed by the zero-risk theory (Näätänen & Summala, 1974, 1976), as well as other theories emphasising emotions as motivators of behaviour. The finding that sensation seeking and normlessness were only weakly related to the willingness to confront unsafe driving is, however, surprising. This is because these traits usually demonstrate a strong relation to risk-taking behaviour in traffic (see, e.g. Jonah, 1997; West & Hall, 1997). One reason may be that these characteristics are more relevant under highly controllable situations.

[16] The personality traits aggression and altruism were not included as predictors in paper IV. This is mainly because there were no immediate theoretical reasons for these traits affecting the likelihood of speaking out to unsafe drives. If there are no theoretical reasons for including a variable in a SEM- model, such an inclusion should not be implemented. Still, a post-hoc analysis was performed to examine whether these had either direct or indirect effect on the likelihood of speaking out. Since no such effects were found, the results are not presented here.

4.3 Conclusion

There are (hopefully) several lessons to learn from the results of the present thesis. First, adolescents' attitudes towards risk-taking in traffic should be regarded as multidimensional. The reported attitudes on the dimensions demonstrated that different adolescents evaluate these aspects of traffic safety differently. On some dimensions, most report quite ideal attitudes concerning road safety, on other dimensions the picture is the opposite. As a consequence, attempts to influence attitudes should focus on specific attitude dimensions, and not attitudes in general.

The results also propose that adolescent drivers' safety orientation can partly be seen as a manifestation of deeper-lying motives. This implies that efforts made to promote road safety should consider the total person, and not only the attitudes or behaviour aimed to be changed or promoted. This also demonstrates the importance of not treating adolescents as a homogenous group. In particular, some subtypes of adolescents require special attention when road safety programs are implemented. These subtypes seem, however, to be the ones most difficult to reach through traditional public campaigns. Alternative methods for reaching these drivers should therefore be considered.

A supplementary way of reaching high-risk drivers is to promote road safety indirectly through the use of peer influence. Adolescents seem, however, to perceive several barriers against addressing the driving of their friends. It is therefore my recommendation that efforts made to promote peer influence should not merely encourage adolescents to speak out to unsafe drivers, but also address the barriers against using peer influence to promote safe driving practices.

5. References

Aarø, L.E. & Rise, J. (1996). *Den Menneskelige Faktor* [The Human Factor]. (SF-report nr. 5-96), Oslo, Skadeforebyggende Forum. (In Norwegian).

Åberg, L. (1993). Drinking and driving: Intentions, attitudes, and social norms among Swedish male drivers. *Accident Analysis and Prevention, 3*, 289-296.

Åberg, L. (1999). The role of attitudes in decision to violate traffic regulations. Paper presented at the *European conference on transport psychology in Angers, France, June 16-19*, *1999.*

Åberg, L., & Rimmö, P.-A. (1998). Dimensions of aberrant driver behaviour. *Ergonomics, 41*, 39-56

Ajzen, I. (1991). The theory of planned behaviour. *Organizational Behaviour and Human Decision Processes, 50,* 179-211.

Ajzen, I. & Fishbein, M. (1980). *Understanding attitudes and predicting social behaviour*. New York: Prentice-Hall.

Ajzen, I. (1988). *Attitudes, personality and behaviour*. Buckingham: Open Press University.

Aldenderfer, M.S. & Blashfield, R.K. (1984). *Cluster Analysis*. Newbury Park, CA: Sage Publications.

Amundsen, A., Elvik, R. & Fridstrøm, L. (1999). *"Virkninger av "Sei i frå" kampanjen i Sogn og Fjordane på antall skadde og drepte i trafikken [Effects of the "Let it be known!" campaign in Sogn and Fjordane on the number of injured and killed persons in traffic]"* (Rep. No. 425). Oslo, Norway: Institute of Transport Economics.

Arnett, J.J (1990). Drunk driving, sensation seeking, and egocentrism among adolescents. *Personality and Individual Differences, 11*, 541-546.

Arnett, J.J. (1991). Still crazy after all these years: reckless behaviour among young adult aged 23-27. *Personality and Individual Differences, 18*, 267-278.

Arnett, J.J. (1996). Sensation seeking, aggressiveness and adolescent reckless behaviour. *Personality and Individual Differences, 20*, 693-702.

Arnett, J.J, Offer, D. & Fine, M.A. (1997). Reckless driving in adolescence. "State" and "trait" factors. *Accident Analysis and Prevention, 29*, 57-63.

Arthur, W.A., Barrett, G.V., Alexander, R.A.. (1991). Prediction of vehicular accident involvement: A meta analysis. *Human Performance* 4, 89-105.

Ashenbrenner, K.M., Biehl, B. & Wurm, G.W. (1987). *Einfluss der risikokompensation auf die Wirknung von Verkhersicherheitsmassnahmen am Beispiel ABS*. Sicriftenreihe Unfall- und Sicherheitsfurschung Strassenverkehr, Heft 63, 65-70. Bergish Gladbach, Bundesanstalt für Stassenwesen (BASt).

Assum, T., Midtland, K. & Opdal, L. (1993). *Bilføreres holdninger og risiko for ulykker*. [Drivers attitudes and risk for accidents]. (Report no. 223), Institute of Transport Economics, Oslo. (In Norwegian).

Bandura, A. (1986). *Social foundations of thought and action. A social cognitive theory.* Englewood Cliffs; NJ: Prentice Hall.

Barjonet, P. (1997). Transport psychology in Europe: a general overview. In: Rothengatter, T., Carbonell Vaya, E. (Eds.), *Traffic and Transport Psychology: Theory and Application*. Pergamon, Oxford, pp. 21-30.

Baxter, J.S., Manstead, A.S.R., Stradling, S.G., Campbell, K.A., Reason, J.T. & Parker, P. (1990). Social facilitation and driver behaviour. *British Journal of Psychology, 81*, 351-360.

Begg, D. & Langely, J. (2001). Changes in risky driving behavior from age 21 to 26 years. *Journal of Safety Research, 32*, 491-499.

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.

Beirness, D.J. & Simpson, H.M. (1988). Lifestyle correlates of risky driving and accident involvement among youth. *Alcohol, Drugs and Driving, 4*, 193-204.

Bentler, P.M. (1990). Comparative fir indices in structural models. *Psychological Bulletin, 107,* 238-246.

Berg, H.Y. (1994). *Lifestyle, Traffic and Young Drivers – An Interview Study*. VTI Report 389A. Swedish Road and Transport Research Institute, Linköping, Sweden.

Blalock, H.M. Jr. (1968). The Measurement Problem: A gap between the languages of theory and research. I H.M. Jr. Blalock & A. Blalock: *Research Methodology in Social Research*. McGraw-Hill Book Company, New York. Kap. 1, s. 5-27.

Brehm, J.W. (1972). *Responses to Loss of Freedom. A Theory of Psychological Reactance*. Morristown, NJ: General Learning.

Brehmer, B., Gregersen, N.P. & Morén, B. (1993). *Group Methods in Safety Works.* Uppsala: Department of Psychology, University of Uppsala.

Broadbent, D.E. (1958). *Perception and Communication.* New York: Pergamon Press.

Brown, S.L. (1998): *Associations between peer drink driving, peer attitudes towards drink driving, and personal drink driving*. Journal of Applied Social Psychology, 28, 423-436

Brown, I.D. & Groeger, J.A. (1988). Risk perception and decision taking during the transition between novice and experienced driver status. *Ergonomics, 31*, 585-597.

Brown, R.C., Sanders, J.M. & Schonberg, S.K. (1986). Driving safety and adolescent behaviour. *Pediatrics, 77.*

Browne, M.W. & Cudeck, R. (1993). Alternative ways of assessing model fit. In K.A. Bollen & J.S. Long (Eds.), *Testing Structural Equation Models* (pp. 136-162). Newbury Park: Sage Publications

Buchanan, C.M., Eccles, J.S. & Becker, J.B. (1992). Are adolescents the victims of raging hormones: Evidence for activational effects of hormones and mood and behaviour at adolescence. *Psychological Bulletin, 111*, 62-107

Carmines, E.G. & Zeller, R.A. (1979). *Reliability and validity assessment*. Beverly Hills: Sage Publications.

Cattell, R.B. (1950). *Personality: A Systematic, Theoretical and Factual Study*. New York: McGraw-Hill.

Cellar, D.F., Nelson, Z.-C., Yorke, C.M. (2000). The five-factor model and driving behaviour. Personality and involvement in vehicular accidents. *Psychological Reports, 86*, 454-456.

Chen, LH., Baker, S.P., Braver, E.P. & Li, G. (2000). Carrying passengers as a risk factor for crashes fatal to 16- and 17-year-old-drivers. *Journal of American Medical Association, 283*, 1578-1582.

Clark, A.W. (1976). A social role approach to driver behaviour. *Perceptual and Motor Skills, 42,* 325-326.

Cormarck, R.M. (1971). A review of classification. *Journal of Royal Statistical Society, 134,* 321-367.

Costa P.T.,Jr. & McCrae, R.R. (1992). *Trait psychology comes of age*. Nebraska Symposium on Motivation, 39, 169-204.

Costa P.T.,Jr. & McCrae, R.R. (1994). Set like plaster? Evidence for the stability of adult personality. In T.Heatherton & J. Weinberger (Eds.) *Can Personality Change?* Washington DC: American Psychological Association.

Costa, P.T.jr. & McCrae, R.R. (1992). *Revised NEO Personality Inventory (NEO-PI-R) and NEO Five Factor Inventory (NEO-FF-I). Professional Manual*. Odessa: Psychological Assessment Resources Inc.

Costner, H. (1972). Theory, deduction and rules of correspondence. In H.M. Blalock (Ed.) *Causal Models in the Social Sciences*. London, Macmillan,

Crancer, A. Jr., Quiring, D.L. (1970). Driving records of persons hospitalised with suicidal gestures. *Behavioural Research in Highway Safety, 1*, 33-42.

Cronbach, L.J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrica, 16,* 297–334.

Cronbach, L.J. (1998). Five perspectives on the validity argument. In H. Wainer & H. Brown (Eds.) *Test Validity*. Hillsdale New York, Erlbaum.

DeBono, K.G. & Harnish, R.J. (1988). Source expertise, source attractiveness, and the processing of persuasive information; A functional approach. *Journal of Personality and Social Psychology, 55*, 541-546.

DeBono, K.G. (1987). Investigating the social-adjustive and value-expressive functions of attitudes: Implications for persuasion processes. *Journal of Personality and Social Psychology, 52*, 179-287.

Deery, H.A. & Fildes, B.N. (1999). Young novice driver subtypes: relationship to high-risk behaviour, traffic accident record, and simulator driving performance. *Human Factors, 41*, 628-643.

Deery, H.A. (1999). Hazard and risk perception among young novice drivers. *Journal of Safety Research, 30*, 225-236.

Deffenbacher, J. L., Huff, M. E., Lynch, R. S., Oetting, E. R., Salvatore, N.F. (2000). Characteristics and treatment of high-anger drivers. *Journal of Counseling Psychology, 47*, 5-17.

Deffenbacher, J.L., Oetting, E.R. & Lynch, R. (1994). Development of a driving anger scale. *Psychological Reports, 74,* 83-91.

Delhomme, P., Vaa, T., Meyer, T., Gordon, H., Goldenbeld, C., Järmark, S., Christie, N. & Rehnova, V. (1999). *Evaluated road safety campaigns: an overview of 265 evaluated campaigns and some meta-analysis on accidents*. Gadget project, Work package 4, contract no. RO-97-SC.2235.

Doherty, S.T., Andrey, J.C. & MacGregor, C. (1998). The situational risks of young drivers: The influence of passengers, time of day and day of week on accident rates. *Accident Analysis and Prevention, 30*, 45-52.

Donohew, L., Lorch, E.P. & Palmgreen, P. (1991). Sensation seeking and targeting of televised anti-drug PSAs. In: Donehew, L., Sypher, H.E., Bukovski, W.J. (Eds.): *Persuasive Communication and Drug Abuse Prevention*. Hillsdale, NJ: Lawrence Erlbaum, pp 209-226.

Donovan, D.M., Umlauf, R.L. & Salzberg, P.M. (1988). Derivation of personality subtypes among high-risk drivers. *Alcohol, Drugs and Driving, 4*, 233-244.

Drummond, A.E. & Triggs, T.J. (1991): *Driving as Skilled Performance: A Perspective for Improving Young Driver Safety*. Monash University, Accident Research Centre.

Eagly, A.H. & Chaiken, S. (1993). *The Psychology of Attitudes*. Harcourt Brace Jovanovich Publishers, Fort Worth.

Edwards, J.D., Tindale, R.S., Heath, L., & Posavac, E.J. (1990). *Social Influence Processes and Prevention: Social Psychological Applications to Social Issues*. Vol. I. New York: Plenum.

Elander, J., West, R. & French, D. (1993). Behavioural correlates of individual differences in road-traffic crash risk: An examination of methods and findings. *Psychological Bulletin, 113*, 279-294.

Elvik, R. (1991). *Ulykkesteori. Historisk Utvikling og Status i Dag*. Oslo, Norway: TØI; Institute of Transport Economics.

Elvik, R. (1997). Evaluations of road accident blackspot treatment: A case study of the Iron law of evaluation studies? *Accident Analysis and Prevention, 29*, 191-199.

Elvik, R. (2000). Evaluating the effectiveness of Norway's "Speak Out!" road safety campaign. The logic of causal inference in road safety evaluation studies. *Transportation Research Record 1717*, 66-75.

Elvik, R., Mysen, A.B. & Vaa, T. (1997). *Trafikksikkerhetshåndboka. [Handbook of Traffic Safety]*. Institute of Transport Economics, Oslo. (In Norwegian).

Epstein, S. (1977). Traits are alive and well. In D. Mangusson & M.S. Endler (Eds.). Personality at the crossroad. Hillsdale, NJ, Lawrence Erlbaum Associates.

Epstein, S., 1979. The stability of behaviour: on predicting most of the people much of the time. Journal of Personality and Social Psychology, 37, 1097-1126.

Evans, L. (1991). *Traffic safety and the driver*. New York, Van Nostrand Reinhold.

Evans, L., Wasielewski, P, & Von-Buseck, C.R. (1982). Compulsory seat belt usage and driver risk taking behaviour. *Human Factors, 24*, 41-48.

Evans, M.G. (1985). A Monte Carlo study of the effects of correlated method variance in moderated regression analysis. *Organizational Behaviour and Human Decision Processes, 36*, 305-323.

Everett, M. & Palmgreen, P. (1995). Influence on sensation seeking, message sensation value, and drug use as mediators of PSA effectiveness. *Health Communication, 3*, 217-227.

Everitt, B. S. (1993). *Cluster Analysis*. (3.ed). London: Edward Arnold.

Eysenck H.J. & Eysenck, S.B.G. (1982). Recent advances in cross-cultural study of personality. In C.D. Spielberger & J.N. Butcher (Eds.). *Advances in Personality Assessment*. Hillsdale, NJ: Erlbaum.

Eysenck, H.J. (1991). Dimensions of personality: 16, 5 or 3? Criteria for taxonomic paradigm. *Personality and Individual Differences, 12*, 773-790.

Farmer, E. & Chambers, E.G., 1939. *A Study of Accident Proneness Among Motor Drivers*. Report no. 84, HMSO, Industrial Health Research Board, London.

Festinger, L. (1950). Informal social communication. *Psychological Review, 57*, 271-282.

Festinger, L. (1954). A theory of social comparison processes. *Human Relations, 7*, 117-140.

Festinger, L. (1957). *A Theory of Cognitive Dissonance*. Evanston, IL: Row Peterson.

Feyerabend, P. (1975). *Against method: outline of an anarchistic theory of knowledge*. London, NLB.

Fridstrøm, L. (1996). *Prognoser for Trafikkulykkene*. TØI-rapport 1027/96. Oslo Institute of transport Economics.

Fridstrøm, L., Ifver, J., Ingebrigtsen, S., Kulmala, R. & Thomsen, L.K. (1995). Measuring the contribution of randomness, exposure, weather, and daylight to the variation in road accident counts. *Accident analysis and prevention, 27,* 1-20.

Fuller, R. (1984). A conceptualization of driving behaviour as threat avoidance. *Ergonomics, 27*, 1139-1155.

Gibson, J.J. & Crooks, L.E. (1938). A theoretical field-analysis of automobile-driving. *American Journal of Psychology, 51*, 453-471.

Gilje, N & Grimen, H. (1993): *Samfunnsvitenskapenes Forutsetninger. Innføring i Samfunnsvitenskapenes Vitenskapsfilosofi*. Oslo: Universitetsforlaget

Grayson, G.B. & Maycock, G., 1988. From proneness to liability. In: Rothengatter, J.A, De Bruin, R. (Eds). *Road User Behaviour. Theory and Research*. Van Gorcum, Assen, pp. 234-242.

Gregersen, N. P. & Berg, H. Y. (1994). Lifestyle and accidents among young drivers. *Accident Analysis and Prevention, 26*, 297-303

Gregersen, N.P. & Bjurulf, P. (1996). Young novice drivers: Towards a model of their accident involvement. *Accident analysis and prevention, 28,* 229-241.

Gregersen, N.P., Bremher, B. & Morén, B., 1996. Road safety improvement in large companies. An experimental comparison of different measures. *Accident Analysis and Prevention, 28*, 297-306.

Groeger, J.A & Brown, I.D. (1989). Assessing one's own and others' driving ability: Influence of sex, age, and experience. *Accident Analysis and Prevention, 21*, 163-168.

Häkkinen, S. (1979). Traffic accidents and professional driver characteristics: a follow-up study. *Accident Analysis and prevention, 18*, 359-366.

Harré, N., Field, J. & Kirkwood, B. (1996). Gender differences and areas of common concern in the driving behaviours and attitudes of adolescents. *Journal of Safety Research, 27*, 163-173.

Hattaka, M. (1998). *Novice Drivers Risk- and Self-Evaluations. Use of Questionnaires in Traffic psychological Research. Method Development, General Trends in Four Sample Materials, and Connections with Behaviou*r. Academic dissertation, University of Turku, Finland.

Hattaka, M., Keskinen, E., Katila, A. & Laapotti, S. (1997). Self-reported driving habits are valid predictors of violations and accidents. In I T. Rothengatter & E. Carbonell Vaya (Eds.), *Traffic and Transport Psychology: Theory and application* (pp. 295-303). Oxford: Pergamon.

Heider, F. (1958). *The Psychology of Interpersonal Relationships*. Wiley, New York.

Hempel, C.G. (1952) *Fundamentals of concept formation in empirical science*.

Hilakivi, I., Veilahti, J., Asplund, P., Sinivuo, J.,, Laitinen, L. & Koskenvuo, K., 1989. A sixteen-factor personality test for predicting automobile driving accidents of young drivers. *Accident Analysis and Prevention, 21*, 413-418.

Hofstede, G. (1991). *Culture and Organisations*. London: McGraw-Hill.

Hofstede, G. (1998). Masculinity/femininity as a dimension of culture. In G. Hofstede (Ed.): *Masculinity and Femininity: The Taboo Dimensions of National Culture*. Thousand Oaks, CA: Sage Publications

Hu, L. & Bentler, P.M. (1995). Evaluating model fit. In R.H. Hoyle (Ed.), *Structural equation modeling: Concepts, issues and applications* (pp. 76-99) London, Sage Publications.

Hu, L. & Bentler, P.M. (1999). Cut-off criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modelling*, 6 (1), 1-55.

Jessor, R. (1987). Risky driving and adolescent problem behaviour: Theoretical and empirical linkage. In Benjamion, T. (Ed.), *Young drivers impaired by alcohol and other drugs* (pp.97-110). London: Royal Society of Medicine Services.

Jonah, B.A. (1986). Accident risk and risk-taking behaviour among young drivers. *Accident Analysis and Prevention, 18,* 255-271.

Jonah, B.A. (1997). Sensation seeking and risky driving: A review and synthesis of the literature. *Accident Analysis and Prevention, 29*, 651-665.

Jöreskog, K.A. & Sörbom, D. (1993). *LISREL 8: Structural equation modelling with the SIMPLIS command language.* Chicago: Scientific Software.

Karttunen, R. & Häkkinen, S. (1986). *Road accident investigation teams in Finland. Research in accident involving personal injuries in 1979-1983*. Helsinki University of Technology, Helsinki, Finland.

Katz, D. (1960). The functional approach to the study of attitudes. *Public Opinion Quarterly, 24,* 163, 204.

Kline, P. (1995). *The handbook of psychological testing*. London: Routledge.

Kohn, M. & Schooler, C. (1983). *Work and Personality: An Inquiry into the Impact of Social Stratification*. New York: Norwood Ablex.

Koneci, C., Ebbesen, E.B., & Koneci, D.K. (1976). Decision processes and risk taking in traffic: Driver response to the onset of yellow light. *Journal of Applied Psychology, 6*, 359-367.

Kraus, S.J. (1995). Attitudes and the prediction of behaviour: A meta-analysis of the empirical literature. *Personality and Social Psychological Bulletin, 21*, 58-75.

Kuhn, T.S. (1962). *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press.

Laapotti, S., Keskinen, E., Hatakka, M. & Katila, A. (2001). Novice drivers' accidents and violations – a failure on higher or lower hierarchical levels of driving behaviour. *Accident Analysis and Prevention, 33*, 759-769.

Lajunen, T. & Summala, H. (1995). Driving experience, personality, and safety-motive dimensions in drivers' self-assessments. *Personality and Individual Difference, 19*, 307-318.

Lajunen, T. Corry, A., Summala, H. & Hartley, L. (1998). Cross-cultural differences in drivers' self-assessment of their perceptual-motor and safety skills: Australians and Finns. *Personality and Individual Differences, 24*, 539-550.

Lajunen, T., Parker. D. & Stradling, S.G. (1998). Dimensions of driving anger, aggressive and highway code violations and their mediation by safety orientation in UK drivers. *Transportation Research Part F, 1*, 107-121

Lavine, H. & Snyder, M. (2000). Cognitive processes and the functional matching effect in persuation: Studies of personality and political behaviour. In G. Maio & J.M. Olson (Eds.). *Why We Evaluate. Functions of Attitudes*. London: Lawrence Erlbaum Associates, Inc.

Lavine, H., Burgess, D., Snyder, M. Transue, J., Sullivan, J.L., Haney, B. & Wagner, S.H. (1999). Threat, authoritarianism, and voting: An investigation of personality and persuasion. *Journal of Personality and Social Psychology Bulletin, 25*, 337-347.

Lawton, R., Parker, D., Stradling, S.G. & Manstead, A.S.R. (1997). Predicting road accidents: the role of social deviance and violations. *British Journal of Psychology, 88*, 249-262.

Linderholm, I. (1997). *Målgruppen och Budskapet, En Model för Målgruppanalys och Utformning av Budskap om Trafiksäkerhet Til Unga Manliga Trafikanter*. Lund Studies In Media and Communication, Lund University Press.

Loehlin, J.C. (1998): *Latent variable models. An introduction to factor, path and structural analysis*. 3rd ed., London: Lawrence Erlbaum Associates.

Malfetti, J.L., Rose, P.R., DeKorp, N.A. & Basch, C.E. (1989) *The Young Driver Attitude Scale. The developement and field testing of an instrument to measure young drivers' risk-taking attitudes*. New York: New York Teachers College, Columbia University.

Marek, J & Sten, T. (1977). *Traffic Environment and the Driver. Driver Behaviour and Driver Ttraining in International Perspective*. Charles C Thomas Publisher, Springfield, Illinois.

Matthews, G. & Deary, I.J. (1998). *Personality Traits*. University press, Cambridge.

Maycock, G. (1997). Accident liability – the human perspective. In: Rothengatter, T., Carbonell Vaya, E. (Eds.), *Traffic and Transport Psychology: Theory and Application*. Pergamon, Oxford, pp. 65-76.

Maycock, G., Lockwood, C.R. & Lester, J.F. (1991). *The Accident Liability of Car Drivers*. Report no. 315. Transport and Road Research Laboratory, Crowthorne.

McClelland, G.H. & Judd, C.M. (1993). Statistical difficulties of detecting interaction and moderator effects. *Psychological Bulletin*, *114*, 376-390.

McCrae, R.R. & Costa. P.T. (1995). Trait explanations in personality psychology. *European Journal of Personality, 9*, 231-252.

McCrae, R.R., Zonderman, A.B., Bond, M.H., Costa, P.T.,Jr & Paunonen, S.V. (1996).Evaluating replicability of factors in the revised NEO Personality Inventory: confirmatory factor analysis versus procrustes rotation. *Journal of Personality and Social Psychology, 70*, 552-566.

McKenna, F.P. (1983). Accident proneness: a conceptual analysis. *Accident Analysis and Prevention, 15*, 65-71.

McKenna, F.P., Waylen, A.E. & Burkes, M.E. (1998). *Male and Female Drivers: How Different are They?* AA Foundation for Road Safety Research. The University of Reading, Hampshire, UK:

McKnight, A.J. & McPerson, K. (1985): Evaluation of peer intervention training for high school alcohol safety education. *Accident Analysis and Prevention, 18*, 339-347.

McMurray, L. (1970). Emotional stress and driving performance: The effects of divorce. *Behavioral Research in Highway Safety, 1*, 100-114.

Messick, S. (1993): Validity. In R.L. Linn (Ed.). *Educational measurement*. (pp. 13-103). American Council on Education, Orxy Press

Milech, D., Glencross, D. & Hartley, L. (1989). *Skill acquisition by young drivers: perceiving, interpreting and responding to the driving environment.* (Report no. MR4), Canberra, Federal Office of Road Safety.

Milligan, G. W. & Sokol, L. M. (1980). A two-stage clustering algorithm with robust recovery characteristics. *Educational and Psychological Measurement, 40*, 755-759.

Millstein, S.G. (1993). Perceptual, attributional, and affective processes in perceptions of vulnerability through the life span. In Bell, N.J. & Bell, R.W. (Eds.), *Adolescent Risk Taking* (pp 55-65). London: Sage Publications.

Mischel, W. (1968). *Personality and Assessment*. New York: Wiley.

Moe, D. (1986). *Young drivers. Relation between perceived and real ability. Behavioural studies*. (Report STF63 A92002), Trondheim, SINTEF Samferdselsteknikk. (In Norwegian).

Mokken, R.J. (1971). *A Theory and Procedure of Scale Analysis*. The Hauge: Mouton.

Molenaar, I.W, Debets, P., Sijtsma, K., & Hemker, B.T. (1994). *MSP. A program for Mokken Scale analysis for Polytomus Items, version 3.0.* Groeningen: Iec ProGamma.

Näätänen, R. & Summala, H. (1974). A model for the role of motivational factors in drivers' decision making. *Accident Analysis and Prevention, 6,* 243-261.

Näätänen, R. & Summala, H. (1976). *Road User Behaviour and Traffic Accidents*. Amsterdam: North Holland.

Nash, R. (1990) *Intelligence and Realism*. Macmillan, Hong Kong.

Nunnaly, J.C. (1978). *Psychometric theory.* New York: McGraw-Hill.

OECD – Road Research Group (1988). *Road accidents: On-site Investigations*. Paris, OECD.

OECD (1994). *Improving Road Safety by Attitude Modifications*. Report prepared by an OECD scientific expert group. Paris: OECD.

Palmgren, P., Donohew, L., Pugzzles-Lorch, E., Hoyle, R.H. & Stephenson, M.T. (2001). Television campaigns and adolescent marijuana use: test of sensation seeking targeting. *American Journal of Public Health, 91*, 292-296.

Papadakis, E. & Moore, A. (1991). Drink-driving and adolescents lifestyles: rethinking policy. *Australian Journal of Social Issues, 25*, 83-106.

Parker, D. & Manstead, A.S.R. (1996). The social psychology of driver behaviour. In G. Semin & K. Fiedler (Eds.), *Applied Social Psychology* (pp. 198-224). London: Sage Publications.

Parker, D., Lajunen, T. & Strandling, S. (1998). Attitudinal predictors of interpersonally aggressive violations on the road. *Transportation Research Part F, 1*, 11-24.

Parker, D., Manstead A.S.R. & Stradling, S. (1995). Extending the theory of planned behaviour: the role of personal norm. *British Journal of Social Psychology, 34*, 127-137.

Parker, D., Manstead A.S.R, Stradling, S. & Reason, J.T. (1992). Determinants of intention to commit driving violations. *Accident Analysis and Prevention, 24*, 117-131.

Parker, D., Manstead, A.S.R, Stradling, S.G., Reason, J.T. & Baxter, J.S. (1992). Intention to commit driving violations: An application of the theory of planned behaviour. *Journal of Applied Psychology, 77*, 94-101.

Pawson, R. (1980) Empiricist measurement strategies: a critique of the multiple indicator approach to measurement. *Quality and quantity*, *14*, 651-678.

Pervin,L.A. (1989). *Personality theory and research.* (5th ed). New York: Wiley.

Posavac, E.J., Kattapong, K.R. & Dew, D.E. Jr. (1999). Peer-based interventions to influence health related behaviours and attitudes: A meta-analysis. *Psychological Reports, 85*, 1179-1194.

Prentice, D.A. (1987). Psychological correspondence of possessions, attitudes, and values. *Journal of Personality and Social Psychology, 53*, 993-1003.

Preusser, D.F., Ferguson, S.A. & Williams, A.F. (1998). The effect of teenage passengers on the fatal crash risk of teenage drivers. *Accident Analysis and Prevention, 30*, 217-222.

Ranney, T.A. (1994). Models of driving behaviour: a review of their evolution. *Accident Analysis and Prevention, 26*, 733-750.

Rasmussen, J. (1984). Information Processing and Human-Machine Interaction. An Approach to Cognitive Engineering. North-Holland, Amsterdam.

Rawson, A.J. (1944). Accident proneness. *Psychosomatic Medicine, 8*, 88-94.

Reason, J.T., Manstead, A., Stradling, S., Baxter, J. & Campell, K. (1990). Errors and violations on the road: A real distinction? *Ergonomics, 33*, 1315-1332.

Reiβ, J.A. & Krüger, H.P. (1995). Accident risk modified by passengers. Paper presented at the *13th International Conference on Alcohol, Drugs and Traffic Safety (T'95) Adelaide, Australia 13-15 August 1995*.

Rimmö, P-A. & Åberg, L. (1999). On the distinction between violations and errors: sensation seeking associations, *Transportation Research Part F: Traffic Psychology and Behaviour, 2,* 151-166.

Robinson, J.P, Shaver, P.R. & Wrightsman, L.S. (1991). *Measures of Personality and Social Psychological Attitudes*. San Diego, California: Academic Press.

Rosenstock, I. M. (1974). Historical origins of the Health Belief Model. *Health Education Monographs, 2*, 1-8.

Rothengatter, J.A. (1988). Risk and the absence of pleasure: A motivational approach to modelling road user behaviour. *Ergonomics, 31*, 599-607.

Rundmo, T. (1992). *Økt trafikksikkerhet ved motivasjon og belønning. Resultater fra en spørreskjema-undersøkelse*. [Increased traffic safety through motivation and rewards. Results from a questionnaire survey]. (Report no 0328) Oslo, Institute of Transport Economics. (In Norwegian).

Rundmo, T. (1996). Associations between risk perception and safety. *Safety Science, 24,* 197-209.

Rundmo, T. (1998). *Organizational factors, safety attitudes and risk behaviour*. Main report. Prepared for Norsk Hydro. (Report no 24), Trondheim, Rotunde publications.

Rundmo, T. & Ulleberg, P. (2000). *Var Det Verdt Det? Evaluering av 18-40 Aksjonen. Resultatrapport.* [Evaluation of The 18-40 Campaign. Main Report]. (Report no 43), Trondheim, Rotunde publikasjoner. (In Norwegian).

Rutter, D.R., Quine,L. & Chesham,D.J. (1995). Predicting safe riding behaviour and accidents: Demography, beliefs, and behaviour in motorcycling safety. *Psychology and Health, 10*, 369-386.

Røysamb, E. (1997). *Adolescent Risk Making: Behaviour Patterns and the Role of Emotions And Cognitions*. Doctoral dissertation, Department of Psychology, University of Oslo.

Sabey, B.E. & Taylor, H. (1980). *The Known Risks We Run: The Highway*. Transport and road research laboratory supplementary report 567. Crowthorne, TRRL, UK.

Sagberg, F. (1997). *Unge Føreres Risikoutviling – Evaluering av Endrede Regler for Føreropplæring og Førerprøve Klasse B*. TØI-rapport 371/1997. Oslo Institute of Transport Economics.

Schuerger, J.M., Zarrella, K.L. & Hotz, A.S. (1989). Factors that influence the temporal stability of personality by questionnaire. *Journal of Personality and Social Psychology, 56*, 777-783.

Schulze, H. (1990). *Lifestyle, Leisure Style and Traffic Behaviour of Young Drivers*. VTI report 364A. Linköping, Swedish Road and Traffic Research Institute.

Schwartz, N. (1996). Survey research. Collecting data by asking questions. In G. Semin & K. Fiedler (Eds.) *Applied Social Psychology*. Sage: London

Shavitt, S. (1989). Operationalizing functional theories of attitude. In A.R. Pratkandis, S.J. Breckler & A.G. Greenwald (Eds.) *Attitudes Structure and Function* (pp. 311-337). Hillsdale, NJ: Lawrence Erlbaum Associates.

Shinar, D. (1978). *Psychology on the Road: The Human Factor in Traffic Safety*. New York: John Wiley & Sons.

Simon, F., & Corbett, C. (1996). Road traffic offending, stress, age, and accident history among male and female drivers. *Ergonomics, 39*, 757-780.

Sivak, M., Soler, J., Trankle, U. & Spagnhol, J.M. (1989b). Cross-cultural differences in driver risk perception. *Accident Analysis and Prevention, 21*, 355-362.

Sivak, M., Soler, J. & Trankle, U. (1989a). Cross-cultural differences in driver risk-taking. *Accident Analysis and Prevention, 21*, 363-369.

Smeed, R. J. (1949). Some statsitical aspects of road safety research. *Journal of the Royal Statistical Society, 112A*, 1-32.

Smith, M.B., Bruner, J.S. & White, R.W. (1956). *Opinions and Personality*. New York: Wiley.

Snyder, M. & Cantor, N. (1999). Understanding personality and social behaviour: A functionalist strategy. In D.T. Gilbert, S.T. Fiske & G. Lindsey (Eds.) *Handbook of Social Psychology.* 4th ed. (pp. 635-679). Boston: McGraw-Hill.

Snyder, M. & DeBono, K.G. (1985). Appeals to image and claims about quality: Understanding the quality of advertising. *Journal of Personality and Social Psychology, 49*, 586-597.

Statistics Norway (2002). Road traffic accident statistics. *http://www.ssb.no/english/subjects/ 10/12/20/vtu_en/*

Stelzl, I. (1991). Rival hypothesis in linear structure modelling: Factor rotation in confirmatory factor analysis and latent path analysis. *Multivariate Behavioural Research, 26*, 199-225.

Summala, H. (1987). Young drivers accidents: Risk taking or failure of skills? *Alcohol, Drugs and Driving, 3*, 79-91.

Taylor, D.H. (1964). Drivers galvanic skin response and the risk of accidents. *Ergonomics, 7*, 253-262.

Tellegen, A. (1991). Personality traits: Issues of definition, evidence and assessment. In W.M. Grove & D. Cicchetti (Eds.). *Thinking Clearly About Psychology: Vol 2. Personality and Psychopathology* (pp. 10-35). Minneapolis, MN: University of Minnesota.

Tillman, W.A. & Hobbs, G.E. (1949). The accident prone automobile driver. *American Journal of Psychiatry, 106*, 321-331.

Treat, J.R., Tumbas, N.S., McDonald, S.T., Shinar, D., Hume, E.D., Mayer, R.E, Stanisfer, R.L. & Castellan, N.J. (1977). *Tri-level Study of the Caus s of Traffic Accidents*. Report No. DOT-HS-034-3-535-77 (TAC). Indiana University.

Trimpop, R.M. (1994). *The Psychology of Risk-Taking Behaviour*. Amsterdam: North-Holland.

Underwood, G., Chapman, P., Wright, S., & Crundall, D. (1999). Anger while driving. *Transportation Research Part F, 2*, 55-68.

Vaa, T., Berge, G., Glad, A. & Sagberg, F. (2000). *Utvikling av en modell for bilføreres atferd: Innledende arbeider. SIP Førertferdsmodeller: Rapport1. [Developing a model for driver behaviour: Introductory working papers. SIP:Driver behaviour models. Report 1].* Report no. 503/2000. Oslo: Institute of Transport Economics.

Vaaje, T. (1991). Rewarding in insurance: Return of part of the premium after a claim-free period. In M.J. Koornstra & J. Christenden (Eds.). *Enforcement and*

Rewarding: Strategies and Effects (pp 154-156). Liedschendam: SWOV Institute for Road Safety Research.

van der Molen, H. & Bötticher, A. (1988). A hierarchical model for traffic participants. *Ergonomics, 31*, 537-555.

Van Schuur, W.H. & Kiers, H.A.L (1992). Why factor analysis often is incorrect model for analysing bipolar concepts, and what model to use instead. *Applied psychological measurement, 18*, 97-110.

West, R., Elander, J. & French, D. (1992). *Decision Making, Personality and Driving Style as Correlates of Individual Crash Risk.* (Contractor's report No. 309). Crowthorne, England: Transport and Road Research Laboratory.

West, R. & Hall, J. (1997). The role of personality and attitudes in traffic accident risk. *Applied Psychology: An International Review, 46*, 253-264.

West, R., French, D., Kemp, R. & Elander, J. (1993). Direct observations of driving, self reports of driver behaviour and accident involvement. *Ergonomics, 36*, 557-567.

Wilde, G.J.S. (1993). Effects of mass media communication on health and safety habits: an overview of issues and evidence. *Addiction, 88*, 983-996.

Wilde, G.S. (1982). The theory of risk homeostasis: Implications for safety and health. *Risk Analysis, 2*, 209-225.

Wilde, G.S. (1994). *Target Risk: Dealing with the Dangers of Death, Disease and Damage in Everyday Decisions.* Toronto, Canada: PDA publications.

Williams, A. F. (1998). Risky driving behaviour among adolescents. In Jessor, R. (Ed.). *New Perspectives on Adolescents Risk Behaviour* (pp. 221-237). New York: Cambridge University Press.

Williams, A.F. & Wells, J.K. (1995). Deaths of teenagers as motor-vehicle passengers. *Journal of Safety Research, 26*. 161-167.

Wilson, R.J. & Jonah, B. (1988). The application of problem-behaviour theory to the understanding of risky driving. *Alcohol, drugs and Driving, 4*, 173-191.

Wilson, R.J. (1991). Subtypes of DWIs and high risk drivers: Implications for differential intervention. *Alcohol, drugs and Driving, 7*, 1-12.

Wishart, D. (1999). *Clustan Graphics Primer: A Guide to Cluster Analysis*. Edinburgh: Clustan limited.

Wishart, D. (2000). *FocalPoint Clustering User Guide*. Edinburgh: Clustan limited.

Wright, J.C. & Mischel, W. (1987). A conditional approach to dispositional constructs: the local predictability of social behaviour. *Journal of Personality and Social Psychology, 53*, 1159-1177.

Yagil, D. (2001). Reasoned action and irrational motives: A prediction of drivers' intention to violate traffic laws. *Journal of Applied Social Psychology, 31*, 720-740.

Yu, J., & Williford, W.R. (1993). Alcohol and risk/sensation seeking: specifying a causal model of high-risk driving. *Journal of Addictive Diseases, 12*, 79-96.

Zuckerman, M. (1979). *Sensation Seeking: Beyond the Optimal Level of Arousal*. New York: John Wiley & Sons.

Zuckerman, M. (1994). *Behavioural Expression and Biosocial Bases of Sensation Seeking*. New York, Cambridge University Press.

Appendix

Injury rate for persons killed or injured in road traffic accidents in Norway in 1998. Rate pr 10 000 inhabitants aged 15-24 years by county.

County	Population aged 15-24 years	Number of killed or injured persons aged 15-24	Injury rate pr 10 000
Østfold	30163	246	81.56
Akershus	54256	363	66.91
Oslo	52777	316	59.87
Hedmark	21730	206	94.80
Oppland	21694	183	84.36
Buskerud	28346	193	68.09
Vestfold	25899	142	54.83
Telemark	20561	171	83.17
Aust-Agder	14081	160	113.63
Vest-Agder	21143	166	78.51
Rogaland	50185	294	58.58
Hordaland	55920	305	54.54
Sogn og Fjordane	14395	94	65.30
Møre og Romsdal	32708	242	73.99
Sør-Trøndelag	32249	190	58.92
Nord-Trøndelag	16378	91	55.56
Nordland	30100	202	67.11
Troms	18641	106	56.86
Finnmark	9010	64	71.03
Total	550236	3734	67.86

Source: Statistics Norway 2002

Scandinavian Journal of Psychology, 2002, 43, 227-237

Paper I

Risk-taking attitudes among young drivers: the psychometric qualities and dimensionality of an instrument to measure young drivers' risk-taking attitudes

Pål Ulleberg and Torbjørn Rundmo,
Department of Psychology, Norwegian University of Science and Technology
7491 Trondheim
Norway

Abstract

Adolescents are more frequently involved in traffic accidents as compared to other age groups. A strategy for promoting road safety, is to change the attitudes likely to influence driving behaviour. However, the lack of valid and reliable instruments to measure risk-taking attitudes makes it difficult to evaluate the effects of measures aimed at changing attitudes among young drivers and their passengers. The present study aims at testing the psychometric qualities of a scale intended to measure adolescents' risk-taking attitudes related to driving. The results are based on a self-completion questionnaire survey carried out among 3942 adolescents, aged 16-23 years, in Norway in 1998/1999. Using both exploratory and confirmatory factor analyses, 11 dimensions of risk-taking attitudes were identified. Parametric as well as non-parametric methods were applied to test the homogeneity of items within each attitude dimension. The reliability and validity of the dimensions were satisfactory. The attitude dimensions were significantly correlated with self-reported driving behaviour, as well as accident frequency. The application of the new measurement instrument in studies aimed at evaluating safety campaigns is discussed.

Keywords: Risk, attitudes, adolescents, traffic, dimensionality, questionnaire

Introduction

Adolescents are more frequently involved in traffic accidents as compared to other age groups (Bjørnskau, 2000). Specifically, they are more involved in accidents such as driving off the road and head-on collisions with a meeting vehicle. These are accidents typically caused by speeding and loss of control over the vehicle (Michels & Schneider, 1984; Tränkle, Gelau & Metker, 1990). Insufficient skills and a lack of experience have often been regarded as the main causes of young drivers' accidents. There is, however, acknowledged that several factors may influence their accident involvement (see Gregersen & Bjurulf, 1997; for a review). A large number of studies have focused on perceived risk related to traffic hazards, as well as driving skills. Young drivers, as compared to other age groups, are more likely to underestimate the probability of the specific risks caused by traffic situations (Brown & Groeger, 1988; Deery, 1999). They also tend to perceive the hazards in traffic less holistically (Deery, 1999; Milech, Glencross & Hartley, 1989), and overestimate their own driving skills (Moe, 1986).

It has also been hypothesised that young drivers are more accident prone due to their risk-taking attitudes, meaning preferences towards risk-taking in traffic (Jessor, 1984). Such attitudes have been found to correlate with aggressive driving behaviour (Parker, Lajunen & Strandling, 1998), fast driving, and self-reported accident involvement (West & Hall, 1997), and intention to commit driving violations (see Parker & Manstead, 1996, for a review). Hence, an effective strategy to increase road safety may be to change the attitude dimensions that influence adolescents' driving behaviour. According to Festinger's cognitive dissonance theory (1957), changing the beliefs that underpin behaviour can lead to behavioural change. This assumption has later been incorporated in social cognition models such as the Theory of Reasoned Action /Planned Behaviour (Ajzen & Fishbein; 1980, Ajzen, 1988) and health behaviour models such as the Health Belief Model (Rosenstock, 1974). From these theories one can expect that a change in certain beliefs may reduce the probability of accidents.

Several literature reviews have, however, concluded that the majority of traffic safety campaigns aimed at influencing attitudes have failed to document any effects on the number of accidents (Elvik, Vaa & Østvik, 1989; OECD, 1994). A longitudinal study carried out among Norwegian drivers (Assum, Midtland & Opdal, 1993) did not demonstrate any predictive value of safety attitudes on the

risk of accidents. On this basis it was concluded that attitude campaigns should not be recommended as a measure to improve traffic safety. On the other hand, a meta-analysis carried out recently suggests that campaigns aimed at influencing attitudes may be the most efficient measure to improve safety on the roads (Delhomme et al., 1999).

There may be several reasons for the attitude campaigns' apparent lack of success. According to OECD (1994) and Wilde (1993), one reason is the rather weak methodology in some of the evaluation studies. Accident frequency is used as the criterion variable. This is, however, not always an appropriate criterion for measuring effects, mainly because accidents are also influenced by numerous factors, such as exposure (e.g. annual mileage), randomness, and weather conditions (see Fridstrøm et al., 1995). For statistical measurement, it is difficult to measure significant change in accident frequency since traffic accidents occur relatively seldom.

Sutton (1998) has suggested nine methodological issues as to why an underestimation of the correlation between attitudes and behaviour may occur. Several of these methodological issues are of particular relevance to attitudes and traffic accidents. One problem is the difference in the level of measurement. Attitudes are often measured at a general level, meaning through an aggregation of attitude items, whereas an accident is a measure at a specific level. In accordance with Ajzen and Fishbein's (1980) principle of compatibility, Sutton (1998; see also Aarø & Rise, 1996) suggests that a general attitude measure is a weak predictor of a specific behaviour, as for instance an accident. A more appropriate criterion measure would be an aggregate of different behaviours hypothesised to increase the risk of accidents, namely a multiple-act criterion (Ajzen, 1988). This is also related to another issue pointed to by Sutton; random measurement error in behaviour and/or attitudes causes an underestimation of the correlation between the measures. As mentioned, specific measures, like accident measures, are influenced by numerous factors additional to attitudes. Hence, accidents can be seen as an unreliable criterion measure. Random measurement error in attitudes will also cause the same problem. Furthermore, many of the previous studies aimed at investigating the relationship between attitudes and traffic accidents have applied attitude measures with unknown psychometric properties (see, OECD, 1994). Obviously, this imposes a limitation to the validity of the conclusions made from these studies. Additionally, Sutton points to a violation of the scale correspondence between the attitude and behavioural measures as well as unequal number of

response categories for attitudes and behaviour, to be causes for the underestimation of the attitudes-behaviour correlation. Although these may be seen as important issues in some contexts, we will not focus on these in the present paper. This is mainly due to the fact that these issues are most relevant pertaining to the relation between behavioural intention and behaviour.

A few studies have aimed at measuring young drivers' attitudes towards risk-taking in traffic. Malfetti, Rose, DeKorp & Basch (1989) have conducted an extensive work regarding adolescents' risk-taking attitudes related to driving. Their Young Driver Attitude Scale (YDAS) was based on a literature review and interviews with groups of adolescents, concerning teenager's risk- taking attitudes. Their work resulted in a 70 item attitude scale measuring 7 attitude dimensions, which were attitudes towards speeding, safe driving, riding with an unsafe driver (i.e. willingness to drive with a driver who violate the traffic rules), concern for others, concern for oneself, drinking and driving, and safety belts. In addition to these aspects, several studies have shown that peoples' attribution of accident causes as well as attitudes towards rule violations were significant predictors of risk-taking behaviour (Parker & Manstead, 1996; Rundmo, 1992, 1996). In the YDAS, there was a lack of indicators aimed at measuring these aspects of traffic safety attitudes. Thus, such additional attitude items should be included in order to cover relevant aspects of adolescents' traffic safety attitudes.

As implied in our introduction, the use of a reliable and valid measurement of attitudes can be advantageous in evaluating the effects of traffic safety campaigns. The first step in the process of improving traffic safety by influencing attitudes should consequently be to validate a measure covering relevant aspects of adolescents' traffic safety attitudes. Accordingly, the general aim of the present study is therefore to examine the reliability and validity of a measure of adolescents' risk-taking attitudes related to driving, including the following specific aims:

(1) Determining the multidimensionality of risk-taking attitudes.
The YDAS indicators were hypothesised to be multidimensional. Malfetti et al. (1989) found the internal consistency of the attitude dimensions to be satisfactory. However, measures of internal consistency are not aimed at determining multidimensionality of indicators (DeVills, 1991). Therefore, a more thorough examination of the hypothesised multidimensionality of risk-taking attitudes related to traffic still remains to be carried out. In addition, the structure of new

indicators intended to measure a broader aspect of adolescents risk-taking attitudes has to be examined.

(2) Comparing the suitability of parametric as well as non-parametric methods for evaluating the homogeneity of items within attitude dimensions.

Parametric methods (e.g. Cronbach's alpha) may in many cases be inappropriate for analysing internal consistency, due to that some items may have a skewed distribution (Van Schuur & Kiers, 1994). For instance, few respondents may «agree» or «strongly agree» on an item. The items may therefore not be parallel, that is, not having identical true scores and variances. The parametric methods of evaluating internal consistency have no safeguards against such items, and the results obtained may be misleading (Carmines & Zeller, 1979). An alternative methodology is Mokken's non-parametric latent trait analysis for unidimensional scaling (Mokken, 1971). This is a non-parametric item response model, which analyses the probability of a positive or high value on one item as compared to the values on other items. An advantage of applying this method is that the items do not have to fulfil the assumption of being parallel.

(3) Analysing the relationship between attitudes and risk-taking behaviour.

In accordance with Ajzen and Fishbein's (1980) principle of compatibility and their multiple-act criterion, we would expect attitudes to be most successful in predicting behaviour when both are at the same level of measurement. For this research, this implicates that general attitudes are expected to be significant predictors of an aggregate of risk-taking behaviours. At the same time, we hypothesise general attitudes to be weak predictors of actual traffic accidents. This is because the specific behavioural criteria of traffic accidents are thought to be influenced by numerous factors in addition to the attitude assessed.

Method

Sample

A questionnaire survey was carried out among 4500 adolescents in Norway in 1998/1999. The survey was conducted in the start of a traffic safety campaign, which is scheduled to last during the time period 1998-2003 (see also Rundmo & Ulleberg, 2000). The study was initiated by the Norwegian Authorities of Public Roads, in cooperation with the police, the Norwegian Society of Road Safety, and

Traffic Safety Committees of two Norwegian counties. The respondents were randomly selected high school classes, and the questionnaires were completed individually while the students were at school. A total of 3942 respondents returned the questionnaire, yielding a response rate of 85 %. Fifty-six percent of the respondents were women, 44 % were men. The mean age of the respondents was 18.5 years (modal 18 years) and the age ranged from 16 to 23 years. 2032 of the respondents had a driving licence. The majority of these (84%) had possessed the driving licence for more than 3 months.

Questionnaire

A total of 87 indicators measured traffic safety attitudes. Four attitude dimensions from the YDAS (Malfetti et al., 1989) were included; safe driving, speeding, riding with an unsafe driver, and concern for others. Forty-one items made up these four dimensions. They were judged to be of particular relevance for traffic accidents in which adolescents typically are involved, that is, accidents caused by speeding and loss of control over the vehicle. Also included were 46 other items based on studies previously carried out by Rundmo (1992, 1996 & 1998). These indicators were intended to measure attitudes towards violating rules of traffic in general, accident causation, and risk of traffic accidents. Ratings on all items were made on a five point scale in Likert format, ranging from strongly agree to strongly disagree.

In addition, a scale was included, consisting of 15 items measuring self-reported acts of risk-taking in traffic, such as speeding, tailgating, not stopping when the traffic light turn red, driving too close to the car in front, etc. (Rundmo, 1996; Rundmo & Ulleberg, 2000). Only the respondents who possessed a driving license were asked to fill out this part of the questionnaire. The respondents were asked to indicate how often they committed the different acts of risk-taking, ranging from never to very often. A complete list of the behavioural items with their mean score and standard deviation is presented in the Appendix. The respondents with a driving licence were also asked to report how many times they, as a driver, had been involved in a traffic accident.

Statistical analysis

Confirmatory as well as exploratory factor analyses were carried out to examine the structure of the attitude items. First, confirmatory factor analysis (maximum-likelihood method) was performed to assess how well the original four factor structure of the YDAS fit the data. The covariance matrix of the YDAS was analysed by means of the LISREL 8 Program (Jöreskog & Sörbom, 1993).

Thereafter, a principal component analysis (PCA), with varimax rotation, was used to determine the underlying dimensionality of the YDAS items. In order to exclude unreliable items from the YDAS, items with a factor loading below .50 were excluded. The final clusterings of items obtained in the PCA were interpreted to indicate different dimensions of the risk-taking attitudes of the YDAS. Each factor's theoretical substance was evaluated on the basis of the content of the items clustering on the factor.

With the purpose of comparing the fit of the factor structure suggested by Malfetti et al. (1989) and the factor structure suggested by the exploratory PCA, various fit indexes were used: the goodness-of-fit index (GFI), the adjusted goodness-of-fit index (AGFI), the comparative fit index (CFI), the root mean square error of approximation (RMSEA), and the expected cross-validiation index (ECVI). Traditionally, a GFI, an AGFI, and a CFI above .90 have been an agreed-upon cutoff criteria, indicating a close fit between the model and the data (Hoyle and Panter, 1995; Hu & Bentler, 1995; Loehlin, 1998). However, Hu and Bentler (1999) later concluded that the CFI should be close to .95 in order to claim a good fit between the hypothesized model and the observed data. An RMSEA of .05 or less is also thought to indicate a very good model fit, and the lower ECVI value the better the fit (Browne & Cudeck, 1993¸ Loehlin, 1998).

We also wanted to examine whether the 46 items selected from the safety attitude questionnaires (Rundmo, 1992, 1996 & 1998) represented attitude dimensions, separate from the dimensions identified in the YDAS. In order to do this, items from both the YDAS and the safety attitude questionnaires were included in the same exploratory PCA analysis. The criterion for factor extraction and item selection was the same as for the exploratory analysis of the YDAS.

In order to test the robustness of the factor model identified in the exploratory analysis, the sample was randomly split in half. Exploratory factor analysis was carried out on the first half and confirmatory factor analysis was performed on the second half. We also wanted to compare the factor structure of the attitude items between adolescents who had a driver license and those who did not have a driving licence. Hence, separate exploratory factor analyses, as well as confirmatory factor analyses, were performed for the two groups of respondents.

Cronbach's (1951) alpha coefficient was applied to evaluate homogeneity of the item within the attitude dimensions. Nunnaly (1978) recommends that the alpha

coefficient should be equal or higher than 0.70, if a set of items are to make up a scale. However, the alpha coefficient tends to increase as a function of the number of items. Therefore, it is easier to obtain a satisfactory alpha with many as compared to few items given the same average inter-item correlation. Consequently, one should keep the number of items in mind when homogeneity is evaluated using this method.

The non-parametric alternative, Mokken scale analysis for polytomus items, was also applied to evaluate item homogeneity. The Mokken model was first developed for dichotomous items, but has been generalised to Likert-type items (Molenaar, 1994). The Mokken model uses Loevinger's weighted H-coefficient as a measure of item homogeneity. The H- coefficient varies from 0 to 1, where a set of items is said to constitute a scale if H is greater or equal to 0.30. H = 0.30 is regarded as a weak scale, H between 0.40 and 0.50 is regarded as a moderate strong scale, and H > 0.50 is understood as a strong scale. The computer program MSP (Molenaar et al., 1994) was applied to analyse the data with the Mokken scale model.

Item analysis was also carried out by analysing the corrected item-scale correlation of the items within each sub-scale. The MSP program also makes it possible to analyse the contribution of individual items to the scale by computing a scalability coefficient for each item in addition to one for the total scale. It is therefore possible to identify items with an unsatisfactory fit to the rest of the scale. After evaluating item scalability, the sub-scales were constructed by adding the items belonging to each scale without differential weighting.

The last phase of the analysis was to establish the validity of the proposed scales. This was done by an assessment of discriminant validity. The item-discriminant validity was examined by correlating each item with the total scale score. Next, the intercorrelations between the scales' total scores were studied. The scales were expected to be correlated, but not too strongly if they were to reflect conceptually different dimensions of risk-taking attitudes.

Finally, criterion validity was examined by studying external correlates of the scales. Based on previous research (Evans, 1991), we expected women to show less preferences for risk-taking attitudes than men. We also hypothesised the scales to be related to risk-taking behaviour and accident involvement among the respondents with driving licence. The more "ideal" attitudes the respondents'

reported, the less risk-taking behaviour and accident involvement we expected them to report.

Results

Dimensionality of risk-taking attitudes

To test the structure of the original four factor model of the YDAS, a confirmatory factor analysis was carried out. The items were allowed to load on one factor only (i.e. the factor they were hypothesised to reflect). As indicated in Table 1, the fit of the four factor model was poor.

We then used a PCA with varimax rotation on an exploratory basis in order to detect latent sources of variation and covariation in the YDAS items. Of the original 41 items from the YDAS, 19 of these were excluded because they did not fulfil the criterion for item selection (as described in the Methods section). The remaining 22 items resulted in five factors of risk-taking attitudes. In order to test the robustness of the factor structure, a separate PCA was performed for respondents with a driver licence and for those without a driver licence. The PCA resulted in a nearly identical five-factor structure for both drivers and non-drivers. There was only one item in the drivers group, pertaining to the acceptability to ride with an unsafe driver, which failed to fulfil the criteria for item selection. The item showed a lower than acceptable factor loading, as well as substantial cross-loadings to other factors. For this reason, we decided to exclude this item from further analysis.

Thus, the results of the exploratory factor analyses suggested a five-factor structure consisting of 21 items. Three of the original scales from the YDAS, “speeding”, “riding with an unsafe driver” and “concern for others”, appeared as separate factors. Since several of the original items within these scales did not fulfil the criteria for item selection, the three factors identified in the exploratory analysis can be regarded as shortened versions of three of the original YDAS factors. In addition, two new factors were identified. Three of the items, which originally belonged to the factor “riding with an unsafe driver”, turned up as a separate factor in the analysis. These were all items that questioned the acceptability of riding with a driver who had been drinking alcohol, and the fourth factor was therefore named

"drinking and driving". Likewise, three of the items originally within the "speeding" factor in the YDAS, made up a separate factor. All three items were statements pertaining to the demonstration of one's own driver's skills to others, and the fifth factor was thus named "showing off skills to others".

The five-factor model of the YDAS was also subjected to a confirmatory factor analysis in order to compare the fit of this model with the original four-factor structure. The items were allowed to load on one factor only. As can bee seen from Table 1, the five factor model fit the data far better than the original four factor model; the GFI and AGFI were all above the accepted level of .90, whereas the CFI was .95. Moreover, the ECVI and RMSEA were both within an acceptable level for the five-factor model.

Table 1: Goodness-of fit indices for the original four factor model and the five factor model of the YDAS (N = 3942).

	χ^2	*Df*	*GFI*	*AGFI*	*CFI*	*ECVI*	*RMSEA*
Original 4 factor model of the YDAS, 41 items	11068.57*	773	0.83	0.81	.74	4.23	0.072
Revised 5 factor model of the YDAS, 21 items	1639.06*	179	0.95	0.94	.95	0.53	0.050

GFI = Goodness of Fit Index, AGFI = Adjusted Goodness of Fit Index, CFI = Comparative Fit Index, ECVI = Expected Cross-Validation Index, RMSEA = Root Mean of Square of Approximation. * $p < .001$.

In order to investigate whether the 46 items selected from the safety attitude questionnaires (Rundmo, 1992, 1996 & 1998), represented separate attitude dimensions, items from both the YDAS and the safety attitude questionnaires were included in the same exploratory PCA analysis. The criterion for item selection was identical to the exploratory analysis of the YDAS. The analysis resulted in 11 factors (or sub-scales) of risk-taking attitudes. It is interesting to note that the items from our previous questionnaires did not load on the same factors as the YDAS items; six additional factors consisting of items from the former questionnaire were identified in the analysis. The item clustering on these factors were as expected, and the factors can thus be seen as identical to those obtained in the previous studies (Rundmo, 1992, 1996 & 1998). Of the 46 items from the safety attitude questionnaires, 19 were excluded on basis of this analysis.

We also performed PCA separately for respondents with a driver licence and for those without a licence. The PCA resulted in a nearly identical 11-factor structure

Table 2: Standardised factor loadings for the attitude items.

Factor 1. Riding with an unsafe driver (items from the YDAS)	
I would get into my friend's car even though she/he is known to be an unsafe driver.	.79
I would probably ride with a friend who drives unsafe if I trusted him or her.	.76
I might get into the car with friends who I know are unsafe drivers.	.72
I would get into the car with a reckless driver if I had no other way to get home.	.72
I might get in the car with an unsafe driver if my friends did.	.65
I would rather walk a hundred miles than get into a car with an unsafe driver	.64
I would ask my friend to let me out of the car immediately if she/he drove recklessly	.59
Factor 2. Speeding (items from the YDAS)	
It is acceptable to drive in 100 km/h on a straight road if there are no others vehicles in a miles distance	.76
If you are a safe driver, it is acceptable to ex. speed limit by 10 km/h in areas perm. to drive in 80- 90 km/h	.75
I think it's O.K. to speed if the traffic conditions allow you to do so.	.77
Driving 5 or 10 miles above the speed limit is O.K. because everyone does it.	.72
If you have good skills, speeding is O.K.	.70
Factor 3. Concern about hurting others (items from the YDAS)	
Hurting someone else with my car would scar me for life	.85
I couldn't live with myself if I hurt another human being in traffic.	.74
If I should cause an accident, I hope to be the one who's hurt	.49
Factor 4. Drinking and driving (items from the YDAS)	
I might get in the car with a driver who has been drinking.	.77
I would not even consider riding with a drunk person	.70
I would get in the car with a driver who has been drinking if I knew and trusted him	.70
Factor 5. Showing off driving skills to others (items from the YDAS)	
Most people like to show off their skills by driving fast.	.69
When people drive they like to be different-not to be ordinary cautious drivers.	.61
People usually (or will usually) drive faster when their friends are in the car.	.57
Factor 6. Traffic flow vs rule obedience	
Sometimes it is necessary to bend the rules to keep traffic going	.79
If is better to drive smooth than always follow the traffic rules	.72
Sometimes it's necessary to break the traffic rules in order to get ahead	.70
Sometimes it is necessary to take chances in the traffic	.69
Sometimes it is necessary to bend the traffic rules to arrive in time	.68
There are many traffic rules which can not be obeyed in order to keep up the traffic flow	.68
It is more important to keep up the traffic flow rather than always follow the traffic rules	.65
Sometimes it is necessary to ignore violations of traffic rules	.62
A person who take chances and violate some traffic rules is not necessary a less safe driver	.55
Factor 7. Funriding	
Speeding and excitement belong together when you are driving	.90
Driving is more than transportation, it is also speeding and fun	.82
The adolescents have a need for fun and excitement in traffic	.76
Factor 8. Dare to speak up to an unsafe driver	
A driver who is speeding is a more attractive person than a driver who always follow the rules	.82
I would be very unpopular I should ask the person I am driving with to drive more carefully	.63
Boys prefer girls who dears to get into a car when you are speeding	.61
If I should ask my friends to drive more carefully, it would be perceived as an unnecess. hassle	.47
Factor 9. Risk of accidents	
Drunk driving is not so risky as people think it is	.78
The risk of dying young in an traffic accident is so low that you can ignore it	.75
Driving off the road accidents are so rare that there is no need to worry	.62

Factor 10. Fatalism	
Most accidents could be prevented if the authorities had put more efforts into prevention measures	.71
Traffic accidents are due to poor road standard	.59
The amount of old cars in Norway make accidents unavoidable	.55
Factor 11. Violation of traffic rules	
You should always follow the traffic rules, regardless of the driving conditions	.73
You should always obey laws while driving.	.71

for both drivers and non-drivers. However, the PCA carried out among the respondents with driver licence suggested to exclude three items originating from the safety attitude questionnaire, in addition to the 19 items mentioned above. This was due to lower factor loadings, as well as substantial loadings to other factors. On this basis, we decide to exclude these items from further analysis.

Finally, a confirmatory factor analysis of the suggested structure of 11 factors was carried out on the total sample. The items were allowed to load on their respective factor only. The results indicated a satisfactory fit of the data, χ^2 (889, N = 3942) = 6266.93 ($p > 0.0001$), GFI = 0.93, AGFI = 0.92, CFI = 0.93, ECVI = 1.76, RMSEA = 0.041. Still, the CFI was somewhat lower than the suggested cut-off value of .95 (Hu & Bentler, 1999), indicating that the model could use some refinements. However, we decided not to modify the model further in order to keep the model as parsimonious as possible. The 11-factor structure and standardised factor loadings are shown in Table 2.

Carrying out a confirmatory factor analysis on the same sample as for the exploratory analysis increases the probability of obtaining high fit indexes. Thus, this may lead to a self-fulfilling confirmation of the 11-factor structure. In order to test the robustness of the 11-factor model, the sample was randomly split in two parts. Exploratory factor analysis was carried out on the first half and confirmatory factor analysis was performed on the other half. The results showed no noteworthy difference in either factor structure or fit indexes compared to the total sample.

Evaluation of scalability

We also examined the homogeneity of the items within each factor (hereafter called sub-scale). This was done by both computing Cronbach's alpha and applying a Mokken scale analysis. At the same time, we performed an item analysis of each

item within the sub-scales. This was done through computing the corrected item-scale correlation for each item, and the H-coefficient of each item. Both the item-scale analysis and the Mokken scale analysis gave identical results; all items showed a satisfactory item-scale correlation (r >.30), as well as an acceptable H-coefficient (H > .30). The final sub-scale scores were constructed by adding the items within each sub-scale without differential weighting. Before the items were added, they were recoded. A high score indicated an «ideal» attitude, that is, less preference for risk-taking. This means that a high score on an attitude items such as «If you possess good driving skills, speeding is OK» indicated that the respondent disagreed or strongly disagreed with the item. Thus, a high score on a sub-scale implies low preferences for risk-taking. Table 3 pictures descriptive statistics, Cronbach's alpha, average inter-item correlation and Loevingers H-coefficient of the final sub-scales.

Table 3. Descriptive statistics, Cronbach's alpha and Loevingers weighted H-coefficient of the final sub-scales (N = 3942).

Sub-scale	*Number of items*	*Mean*	*SD*	*Min. score*	*Max. score*	*Skew-ness*	*Kurt-osis*	α	H
1. Riding with an unsafe driver	7	19.4	4,71	7	35	.06	.24	.84	.48
2. Speeding	5	14.6	4.09	5	25	-.11	-.37	.84	.56
3. Concern about hurting others	3	12.4	2.13	3	15	-.90	.88	.62	.40
4. Drinking and driving	3	12.0	2.72	3	15	-.70	-.32	.76	.58
5. Showing off skills to others	3	8.2	2.06	3	15	.02	-.07	.63	.41
6. Traffic flow vs. rule obedience	9	26.5	5.88	9	45	-.06	.20	.86	.45
7. Funriding	3	10.2	2.70	3	15	-.30	-.13	.83	.66
8. Dare to speak up to an unsafe driver	4	18.8	3.43	5	25	-.46	.37	.74	.41
9. Risk for accidents	3	12.8	2.06	3	15	-1.30	2.11	.77	.59
10. Fatalism	3	9.9	2.11	3	15	-.34	.38	.63	.36
11. Violation of traffic rules	2	6.8	1.76	2	10	-.18	-.31	.64	.51

Table 3 demonstrates similar results of both methods of estimating scalability. Sub-scale 1, 2, 4 and 6-9 have both alpha coefficients above 0.70 and H-coefficients above 0.40. This indicates that the items within these scales have satisfactory homogeneity according to both methods. The alpha is however low on the sub-scale 3, 5 and 11, ranging from 0.62 to 0.64, whereas the H-coefficient indicated satisfactory homogeneity of these items. The difference between the alpha and H-coefficient may be due to the fact that these sub-scales consisted of merely 2 or 3 items each, which increases the difficulty of obtaining a satisfactory alpha. Due to the low number of items in sub-scale 3, 5 and 11, we judged the items to have

satisfactory homogeneity. On the other hand, sub-scale 10, named "Fatalism", demonstrated both a low alpha and a low H-coefficient, indicating weak scalability. This suggests that further work should be done in order to improve the reliability of the "Fatalism" sub-scale.

Table 3 also describes the symmetry and shape, in terms of skewness and kurtosis, of the sub-scales' distributions. Most of the sub-scales demonstrate a symmetrical distribution. However, sub-scale 3, 4 and 9 were relatively negatively skewed, indicating that the respondents in general had high scores on these scales, meaning they reported low preferences for risk-taking.

Discriminant validity

In an item-discriminant analysis, items are evaluated with respect to how well they represent a particular construct *relative* to other constructs. In order to obtain discriminant validity, an attitude item should show the strongest correlation with the scale it is hypothesised to represent compared to other scales. Satisfactory discriminant validity was obtained for all the 45 items. Another way of establishing item-discriminant validity is to examine substantial factor loadings of the items on the other sub-scales, meaning a "cross-loadings" above .50 to other factors identified in the exploratory factor analysis. No cross-loadings of this magnitude were found.

A third way of establishing discriminant validity is to examine the intercorrelations between the sub-scales (Table 4). We expected the sub-scales to be positively correlated, however, not too highly, if they really are measuring different latent variables. In general, the discriminant validity was satisfactory for the sub-scales. However, the highest correlation is found between sub-scale 2 «Speeding» and sub-scale 6 «Traffic flow vs. rule obedience» ($r = .68$), indicating that these dimensions are quite similar. The high correlation between these two sub-scales may imply that the two scales measure the same concept, and not separate concepts. In order to test this hypothesis, a confirmatory factor analysis with 10 factors was carried out. The fit indexes indicated a clearly poorer model fit than the 11-factor structure. We also judged the item content to be somewhat different on the two sub-scales, and thus decided to keep the 11-factor structure of the attitude measures.

With the exception of the correlation between sub-scale 2 and 6, the remaining sub-scales are moderately to weakly correlated. This strengthens the sub-scales' discriminant validity, indicating that risk-taking attitudes in relation to driving are multidimensional. However, sub-scale 5 "Showing off skills to others" is characterised by weak and sometimes negative correlations with the other sub-scales. This may indicate that this sub-scale measures something different than the other attitude scales, for instance self-assertiveness. Nevertheless, the positive correlations with the other sub-scales suggest that some aspects of risk-taking attitudes are present in the scale.

Table 4: Intercorrelations between the sub-scales (N = 3942).

	1	2	3	4	5	6	7	8	9	10
1. Riding with an unsafe driver	-									
2. Speeding	.56	-								
3. Concern about hurting others	.12	.19	-							
4. Drinking and driving	.39	.33	.21	-						
5. Showing off skills to others	.17	.13	-.06	.06	-					
6. Traffic flow vs. rule obedience	.50	.68	.20	.32	.15	-				
7. Funriding	.45	.52	.19	.28	.26	.54	-			
8. Dare to speak up to an unsafe dr.	.26	.26	.18	.19	.29	.31	.43	-		
9. Risk for accidents	.25	.32	.31	.36	.06	.32	.35	.36	-	
10. Fatalism	.22	.33	.18	.19	.14	.42	.33	.28	.30	-
11. Violation of traffic rules	.31	.40	.18	.21	-.05	.43	.25	.10	.17	.14

All correlations are significant at the 0.01 level

External correlates of the sub scales

If the sub-scales really were indicators of risk-taking attitudes, women were expected to express less preferences towards risk-taking compared to men. Thus, women were hypothesised to have more "ideal" attitudes than men do by showing a higher mean scores on the sub-scales. Table 5 shows significant gender differences on all the sub-scales; women having a higher mean score on all the sub-scales, indicating that women show more «ideal» risk-taking attitudes than men.

Table 5. T-test for gender differences in mean score on the 11 sub-scales.

	Women (N = 2207)		Men (N =1735)		
	Mean	SD	Mean	SD	t
1. Riding with an unsafe driver	20.7	4.41	17.9	4.64	18.98*
2. Speeding	15.8	3.70	13.1	4.04	22.10*
3. Concern about hurting others	13.0	1.83	11.7	2.25	19.77*
4. Drinking and driving	12.5	2.54	11.5	2.85	11.26*
5. Showing off skills to others	8.3	2.00	7.9	2.11	6.24*
6. Traffic flow vs. rule obedience	28.1	5.40	24.6	5.94	18.61*
7. Funriding	11.0	2.46	9.4	2.72	19.55*
8. Dare to speak up to an unsafe dr.	19.5	3.08	17.8	3.59	16.21*
9. Risk for accidents	13.2	1.78	12.3	2.24	14.79*
10. Fatalism	10.3	1.87	9.3	2.22	15.10*
11. Violation of traffic rules	7.0	1.68	6.4	1.81	10.52*

* $p < .001$

Next, the relationship between attitudes, self-reported risk behaviour, and accident frequency among the respondents with a driver licence was examined. In order to control for gender differences, partial correlation coefficients were used. As hypothesised, the attitude sub-scales were negatively correlated with self- reported risk-taking behaviour (Table 6). Hence, the higher score on the sub-scales, the less risk-taking behaviour the respondents reported. Table 6 also pictures the relationship between self-reported accident frequency and attitudes. In accordance with the principle of compatibility (Ajzen, 1988), the relationship between attitudes (measured at a general level) and traffic accident frequency (a criterion at a specific level) was weak. However, all correlations were negative as well as significant. Thus, the respondents with "ideal" attitudes towards risk-taking reported less accident involvement than those with less "ideal" attitudes.

Finally, a multiple regression analysis was performed in order determine the total influence of the scores on the attitude dimensions for self- reported risk-taking behaviour (Table 7). Together, the attitude dimensions explained 50 per cent of the total variance in self-reported risk-taking behaviour.

Table 6: Partial correlations between the attitude sub-scales, risk-taking behaviour and accident involvement among respondents with driver licence (N= 1963). Controlling for gender differences.

Attitude sub-scale	*Risk-taking behaviour*	*Accident involvement*
1. Riding with an unsafe driver	-.35**	-.02
2. Speeding	-.45***	-.05**
3. Concern about hurting others	-.24***	-.10***
4. Drinking and driving	-.29***	-.06***
5. Showing off skills to others	-.20***	-.03*
6. Traffic flow vs. rule obedience	-.45***	-.05*
7. Funriding	-.45***	-.09***
8. Dare to speak up to an unsafe dr.	-.35***	-.05**
9. Risk for accidents	-.36***	-.10***
10. Fatalism	-.29***	-.11***
11. Violation of traffic rules	-.26***	-.07***

* p < .05 , ** p < .01, ** p < .001

Table 7: Prediction of risk-taking behaviour from attitudes. Multiple regression analysis based on respondents with driver licence (N= 1963).

Attitude sub-scale	*Standardised regression coefficient*
1. Riding with an unsafe driver	-.10***
2. Speeding	-.18***
3. Concern about hurting others	-.02
4. Drinking and driving	-.07***
5. Showing off skills to others	-.08***
6. Traffic flow vs. rule obedience	-.12***
7. Funriding	-.15***
8. Dare to speak up to an unsafe dr.	-.09***
9. Risk for accidents	-.17***
10. Fatalism	-.07***
11. Violation of traffic rules	-.05**
* p < .05 , ** p < .01, ** p < .001	$R^2 = .50$

Discussion

The major aim of the present paper was to develop a reliable and valid measurement instrument of adolescents risk-taking attitudes related to driving. The structure of the instrument was thought to be multidimensional, indicating that the different attitude sub-scales reflect different dimensions of risk-taking attitudes. The results support this assumption; 11 factors were identified on the basis of an exploratory factor analysis. In addition, a confirmatory factor analysis demonstrated a satisfactory fit to the data of the suggested 11-factor structure. Further evidence for multidimensionality was found in discriminate analysis of the scales. As expected, the sub-scales turned out to be inter-correlated, but not strongly so. They can thus be considered to represent different constructs. Moreover, the content of the items clustering on each factor was evaluated as logically and conceptually associated with the factor they were thought to represent. The different attitude dimensions (factors) were also similar to those previously found in the studies by Rundmo (1992, 1996, 1998), as well as the dimensions included from the YDAS (Malfetti et al., 1989). The study supported the assumption of multidimensionality on an empirical basis, as well as on a theoretical basis.

A 45-item scale with 11 sub-scales was constructed from the original pool of 87 items. A total of 42 items did not fulfil the criteria for item selection. There may be several reasons for this. One explanation may be that the items originating from the YDAS were translated from English into Norwegian. The translation may have changed both wording and meaning, causing the items to measure something other than their original intention. This may cause the items to fail to show the expected relation to other attitude items. A second explanation for why items failed to load may be cultural differences. The YDAS was developed on basis on a sample of adolescents in the USA. Thus, the excluded items may be of particular relevance for the North American culture, and not equally appropriate for Norwegian adolescents. A third explanation may be the use of different statistical methods by Malfetti et al. (1989) as compared to the present study. Malfetti et al. (1989) used internal consistency and item-scale correlation as the criteria for item selection, whereas the present study selected the items on basis of a factor analysis. The latter method is traditionally recommended in order to examine multidimensionality among items (Kline, 1995). Still, three of the four dimensions we included from the YDAS could be recovered in the factor analysis. This suggests that a similar

structure of risk-taking attitudes exists among Norwegian adolescents as compared to adolescents in the USA.

In order to obtain univariate scales of the latent attitude dimensions, the items that were selected on the basis of the exploratory analysis had to fulfil the criteria of a factor loading above 0.50. Easily, this causes a selection of items within clusters that discriminate most with other item clusters. In other words, the criteria may have maximised the differences between the final sub-scales of risk-taking attitudes. The satisfactory fit showed by the indexes of the confirmatory factor analysis was interpreted as evidence for the multidimensionality of risk-taking attitudes. However, the evidence of multidimensionality may be the result of a self-fulfilling prophecy. Although the statistical criteria applied in the present paper can not guarantee the validity of multidimensionality in risk-taking attitudes, there is still reason to believe that multidimensionality in risk-taking attitudes is conceptually meaningful. In line with critics of exploratory factor analysis (see Bynner, 1988), we believe that content validity criteria of factors are more important, than empirical criteria based on factor analytic considerations. The content of the items clustering on each factor was evaluated as logically and conceptually associated with the factor they were thought to represent. Furthermore, the sample was randomly split in two parts to be compared, performing exploratory factor analysis on the first half and confirmatory analyses of the 11-factor model on the second half. The results yielded no difference in either the factor structure or model fit as compared to the same analyses carried on the total sample. This further strengthens the assumption of multidimensionality.

The majority of the different attitude scales demonstrated sufficient reliability and item homogeneity. However, four of the sub-scales had alpha coefficients lower than .70, and one of these had a H-coefficient below .40. This suggests that the attitude measure should be viewed as a good preliminary measure that could use some refinement. The reliability analysis also gave similar results for both the parametric and the non-parametric method for evaluating item scalability. This indicates that the estimation of internal consistency by means of as Cronbach's alpha was quite robust against the skewness in item distributions. Some of the items that were selected in the final scales showed indeed a skewed distribution.

As hypothesised, the correlation between attitudes and the aggregated measure of self-reported behaviour were considerably stronger as compared to the attitude-accident correlation. This is not an unexpected result considering that it is unlikely

that accident involvement will capture all aspects of risky driving behaviour, since only a few of the risky actions taken in traffic situations can be expected to lead to an accident. Moreover, the incompatibility in the level of measurement of attitudes and accident easily causes an underestimation of the correlation. This may suggest that accident frequency is an inappropriate criterion for the study of the attitude-behaviour relationship.

However, one should make this conclusion with caution. First, the measure of accident involvement did not specify whether the driver caused the accident or simply was involved through no fault of his or her own. Ideally, a measure of the former kind should be included in order to eliminate this kind of "measurement error". Second, the attitude measure developed in this study is previously untested, and further studies should be done in order to test both the factor structure, as well as the validity of the instrument.

Nevertheless, the attitude dimensions were quite successful in predicting self-reported risk behaviour, in fact the dimensions accounted for a total of 50 per cent of the variance in behaviour. However, the correlation, as well as the standardised regression coefficient between the various attitude dimensions and behaviour differed in magnitude. This suggests that some dimensions were more important predictors of behaviour than others were. Thus, the attitude dimensions with the highest correspondence with self-reported behaviour could be given special attentions in safety program. This may also be an additional explanation of why attitude campaigns seem to be unsuccessful, as mentioned in the introduction. Several of the campaigns were aimed at influencing safety attitudes in general, and did not, to a proper extent, focus on the specific attitudes likely to influence risk-taking behaviour.

However, the term "predictor" should be used with caution. Risk-taking behaviour was measured through self-report measures at the same time as the attitudes were measured. Thus, the use of self-reports also makes it difficult to claim that the attitude scales *predict* behaviour, because reports of the latter are provided *after* the behaviour has occurred. In other words, attitudes may correspond to behaviour in order to justify previous actions, not vice versa (Bem, 1967; Festinger, 1957). Furthermore, a relationship with actual driving behaviour instead of self-reports would also give more powerful evidence of the influence of attitudes on behaviour. On the other hand, self-reports have several advantages as compared to some of the alternatives of studying driving behaviour: direct observations or simulation of the

driving task. First, both the alternative methods have the disadvantage that these places the individual under observation, which may cause the driver to act more disciplined as compared to his or her normal driving behaviour. Second, these methods are both expensive and time consuming. Third, an advantage of self-reports is that these represents summary judgements of information in a variety of situations, and may therefore be the most suited measure according to the principle of compatibility (Ajzen, 1988).

Another measurement problem is the validity of self-report measures in relation to actual behaviour in traffic. Behaviours like violating traffic rules and engaging in risk-taking behaviour represent sensitive information about the individual, and the respondents may choose not to report such behaviours in order to present themselves in a socially desirable way. However, West, French, Kemp and Elander (1993) have concluded that self-reports of driver behaviour, including deviant driving behaviour, can be used as a surrogate for actual driving behaviour. Their conclusion was based on the correlation coefficients found between observers' ratings of a driver's behaviour and the driver's self reported behaviour. A similar conclusion was reached in a longitudinal study of young drivers in Finland (Hattaka, Keskinen, Katila & Laapotti, 1997). They found a significant relationship between self-reported driving habits and future accident involvement. A relationship between self-reported driving habits and police registered traffic violations was also found in their study.

When it comes to the practical implementation of the measurement instrument, we see potential in the area of road safety programs. One possibility here, is to administer the scales longitudinally to obtain change scores over time. For instance, an assessment of adolescents joining road safety programs can be measured at an initial point in the program, and then again later in order to see if the attitudes have changed. Assessments can lend insight into whether interventions such as road safety programs can change attitudes, and if so, which attitudes are most likely to change, and how the changes are related to changes in behaviours in traffic. Another possible application of the instrument, is to administer the attitude measure to the target group before a safety program is conducted, in order to identify where potentials for improvements are best. In the next turn, such attitudes should be given particular focus when the program is carried out.

Acknowledgements

This study was supported by the Norwegian Authorities of Public Roads (Statens Vegvesen). Especially, the authors would like to thank the steering committee of the campaign, and the following members of the project group: Per Gjerde, Erik Hartmann, Rolf Robertsen and Bård Morten Johansen, as well as all the respondents who answered our questionnaire. We also would like to thank the two anonymous reviewers for their very helpful comments and suggestions for revisions.

References

Aarø, L.E. & Rise, J. (1996). *Den Menneskelige Faktor* [The Human Factor]. (SF-report nr. 5-96), Oslo, Skadeforebyggende Forum. (In Norwegian).

Ajzen, I. (1988). *Attitudes, personality and behaviour*. Buckingham: Open Press University.

Ajzen, I. & Fishbein, M. (1980). *Understanding attitudes and predicting social behaviour*. New York: Prentice-Hall.

Assum, T., Midtland, K. & Opdal, L. (1993). *Bilføreres holdninger og risiko for ulykker*. [Drivers attitudes and risk for accidents]. (Report no. 223), Institute of Transport Economics, Oslo. (In Norwegian).

Bem, D.J. (1967). Self-perception theory: An alternative interpretation of cognitive dissonance phenomena. *Psychological Review*, 74, 183-200.

Bjørnskau, T. (2000). *Road traffic risk in Norway 1997/98*. (Report no. 483), Oslo, Institute of Transport Economics.

Brown, I.D. & Groeger, J.A. (1988). Risk perception and decision taking during the transition between novice and experienced driver status. *Ergonomics, 31*, 585-597.

Browne, M.W. & Cudeck, R. (1993). Alternative ways of assessing model fit. In K.A. Bollen & J.S. Long (Eds.), *Testing Structural Equation Models* (pp. 136-162). Newbury Park: Sage Publications

Bynner, J. (1988). Factor analysis and the construct indicator relationship. *Human relations, 41,* 389-405.

Carmines, E.G. & Zeller, R.A. (1979). *Reliability and validity assessment*. Beverly Hills: Sage Publications.

Cronbach, L.J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrica, 16,* 297–334.

Deery, H.A. (1999). Hazard and risk perception among young novice drivers. *Journal of Safety Research, 30*, 225-236.

Delhomme, P., Vaa, T., Meyer, T., Gordon, H., Goldenbeld, C., Järmark, S., Christie, N. & Rehnova, V. (1999). *Evaluated road safety campaigns: an overview of 265 evaluated campaigns and some meta-analysis on accidents*. Gadget project, Work package 4, contract no. RO-97-SC.2235.

DeVellis, R.F. (1991). *Scale development: Theory and applications*. London: Sage publications.

Elvik, R., Vaa, T. & Østvik, E. (1989). *Trafikksikkerhetshåndboka.* [Handbook of Traffic Safety]. Oslo, Institute of Transport Economics. (In Norwegian).

Evans, L. (1991). *Traffic safety and the driver*. New York, Van Nostrand Reinhold.

Festinger, L. (1957). *A theory of cognitive dissonance*. Evanston, IL: Row Peterson.

Fridstrøm, L., Ifver, J., Ingebrigtsen, S., Kulmala, R. & Thomsen, L.K. (1995). Measuring the contribution of randomness, exposure, weather, and daylight to the variation in road accident counts. *Accident analysis and prevention, 27,* 1-20.

Gregersen, N.P. & Bjurulf, P. (1996). Young novice drivers: Towards a model of their accident involvement. *Accident analysis and prevention, 28,* 229-241.

Hattaka, M., Keskinen, E., Katila, A. & Laapotti, S. (1997). Self-reported driving habits are valid predictors of violations and accidents. In I T. Rothengatter & E. Carbonell Vaya (Eds.), *Traffic and Transport Psychology: Theory and application* (pp. 295-303). Oxford: Pergamon.

Hu, L. & Bentler, P.M. (1995). Evaluating model fit. In R.H. Hoyle (Ed.), *Structural equation modeling: Concepts, issues and applications* (pp. 76-99) London, Sage Publications.

Hu, L. & Bentler, P.M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, 6 (1), 1-55.

Jessor, R. (1984). Adolescent development and behavioural health. In J. Matarazzo, A.J. Herd, N.M. Miller & S.M. Weiss (Eds.), *Behavioural health: A handbook of health enhancement and disease prevention*. New York: Wiley.

Jöreskog, K.A. & Sörbom, D. (1993). *LISREL 8: Structural equation modelling with the SIMPLIS command language.* Chicago: Scientific Software.

Kline, P. (1995). *The handbook of psychological testing*. London: Routledge.

Loehlin, J.C. (1998): Latent variable models. An introduction to factor, path and structural analysis. 3rd ed., London: Lawrence Erlbaum Associates.

Malfetti, J.L., Rose, P.R., DeKorp, N.A. & Basch, C.E. (1989) *The Young Driver Attitude Scale. The developement and field testing of an instrument to measure young drivers' risk-taking attitudes*. New York: New York Teachers College, Columbia University.

Michiels, W. & Schneider, P. (1984). Traffic offences: another approach to description and prediction. *Accident Analysis & Prevention, 16*, 223-238.

Milech, D., Glencross, D. & Hartley, L. (1989). *Skill acquisition by young drivers: perceiving, interpreting and responding to the driving environment.* (Report no. MR4), Canberra, Federal Office of Road Safety.

Moe, D. (1986). *Young drivers. Relation between perceived and real ability. Behavioural studies*. (Report STF63 A92002), Trondheim, SINTEF Samferdselsteknikk. (In Norwegian).

Mokken, R.J. (1971). *A Theory and Procedure of Scale Analysis*. The Hauge: Mouton.

Molenaar, I.W, Debets, P., Sijtsma, K., & Hemker, B.T. (1994). *MSP. A program for Mokken Scale analysis for Polytomus Items, version 3.0.* Groeningen: Iec ProGamma.

Nunnaly, J.C. (1978). *Psychometric theory.* New York: McGraw-Hill.

OECD (1994). *Improving Road Safety by Attitude Modifications*. Report prepared by an OECD scientific expert group. Paris: OECD.

Parker, D. & Manstead, A.S.R. (1996). The social psychology of driver behaviour. In G. Semin & K. Fiedler (Eds.), *Applied social psychology* (pp. 198-224). London: Sage Publications.

Parker, D., Lajunen, T. & Strandling, S. (1998). Attitudinal predictors of interpersonally aggressive violations on the road. *Transportation Research Part F, 1*, 11-24.

Parker, D., Stradling, S.G. & Manstead, A.S.R. (1996). Modifying beliefs and attitudes to exceeding the speed limit: An intervention study based on the theory of planned behaviour. *Journal of Applied Social Psychology, 26*, 1-19.

Rundmo, T. (1992). *Økt trafikksikkerhet ved motivasjon og belønning. Resultater fra en spørreskjema-undersøkelse*. [Increased traffic safety through motivation and rewards. Results from a questionnaire survey]. (Report no 0328) Oslo, Institute of Transport Economics. (In Norwegian).

Rundmo, T. (1996). Associations between risk perception and safety. *Safety Science, 24,* 197-209.

Rundmo, T. (1998). *Organizational factors, safety attitudes and risk behaviour*. Main report. Prepared for Norsk Hydro. (Report no 24), Trondheim, Rotunde publications.

Rundmo, T., Ulleberg, P. (2000). *Var Det Verdt Det? Evaluering av 18-40 Aksjonen. Resultatrapport.* [Evaluation of The 18-40 Campaign. Main Report]. (Report no 43), Trondheim, Rotunde publikasjoner. (In Norwegian).

Rosenstock, I. M. (1974). Historical origins of the Health Belief Model. *Health Education Monographs, 2*, 1-8.

Sutton, S. (1998). Predicting and explaining intentions and behaviour: How well are we doing? *Journal of Applied Social Psychology*, 28, 1317 –1338.

Tränkle, U., Gelau, C. & Metker, T. (1990). Risk perception and age-specific accidents of young drivers. *Accident Analysis & Prevention, 22*, 119-125.

Van Schuur, W.H. & Kiers, H.A.L (1992). Why factor analysis often is incorrect model for analysing bipolar concepts, and what model to use instead. *Applied psychological measurement, 18*, 97-110.

West, R., French, D., Kemp, R. & Elander, J. (1993). Direct observations of driving, self reports of driver behaviour and accident involvement. *Ergonomics, 36*, 557-567.

West, R. & Hall, J. (1997). The role of personality and attitudes in traffic accident risk. *Applied psychology: An international review, 46*, 253-264.

Wilde, G.J.S. (1993). Effects of mass media communication on health and safety habits: an overview of issues and evidence. *Addiction, 88*, 983-996.

Appendix

Table 1: Mean and standard deviation of the behavioural items. Respondents with driver license (N = 1963).

How often do you…	*Mean*	*SD*
Exceed the speed limit in build-up areas (more than 10 km/h)	2.79	1.14
Exceed the speed limit on country roads (more than 10 km/h)	3.24	1.11
Drive on a yellow light when it is about to turn red	2.49	1.12
Disregard red light on an empty road	1.45	0.88
Overtake the car in front when it is driving at the speed limit	2.37	1.10
Drive too close to the car in front	2.56	0.93
Drive the wrong way down a one-way street	1.52	0.85
Drive fast because the opposite sex enjoys it	1.61	0.89
Ignore traffic rules to in order to get ahead in traffic	2.24	0.96
Bend the traffic rules in order to get ahead in traffic	2.65	0.96
Break traffic rules because they are too complicated to follow	1.78	0.92
Break traffic rules due to peer pressure	1.67	0.88
Drive recklessly because others expect me to do it	1.76	0.95
Drive fast to show others that I am tough enough	1.68	0.93
Drive fast to show others I can handle the car	1.84	0.97
Total mean score	**2.11**	**0.66**

α = .92, H = .48

Safety Science, in press

Paper II

Personality, attitudes and risk perception as predictors of risky driving behaviour among young drivers

Pål Ulleberg and Torbjørn Rundmo,
Department of Psychology, Norwegian University of Science and Technology
7491 Trondheim
Norway

Abstract

Within psychology, different research traditions have attempted to explain individual differences in risky driving behaviour and traffic accident involvement. The present study attempts to integrate two of these research traditions, the personality trait approach and the social cognition approach, in order to understand the mechanisms underlying young drivers' risk-taking behaviour in traffic. The study was based on a self-completion questionnaire survey carried out among 1932 adolescents in Norway. The questionnaire included measures of risk perception, attitudes towards traffic safety and self-reported risk-taking in traffic. Personality measures included aggression, altruism, anxiety, altruism and normelssness. The results of a structural equation model suggested that the relation between the personality traits and risky driving behaviour was mediated through attitudes. On this basis it was concluded that personality primarily influence risky driving behaviour indirectly through affecting the attitudinal determinants of the behaviour. Practical implications for traffic safety campaigns are also discussed.

Keywords: Personality, attitudes, driving behaviour, adolescents, traffic, mediator, structural equation modelling

Introduction

It is commonly acknowledged that human factors may contribute to accident involvement in traffic (Grayson & Maycock, 1988). Based on a study of 2041 traffic accidents, Sabey and Taylor (1980) concluded that human factors were contributing elements in 95 % of the accidents. In particular, driving behaviour was identified as the most central of these factors. Consequently, a variety of studies have been carried out in order to identify variables which may influence accident involvement and risk-taking behaviour in traffic, meaning behaviour that indicate the possibility of a negative health outcome for the individual as well as for others. Within psychology, the different perspectives of cognitive, personality and social psychology have all attempted to explain individual differences in risk-taking and traffic accident involvement (see e.g., Arthur, Barrett & Alexander, 1991; Parker & Manstead, 1996). Cognitive research has traditionally studied variables such as management of attention & information processing capabilities, whereas personality research has focused upon the predictive value of personality traits. At the same time, social psychological research has attempted to explain differences in risk-taking behaviour & accident involvement within the framework of social cognition models.

Despite the extensive research within these areas of psychology, few studies attempt to integrate variables from these different research traditions. For instance, personality traits are rarely studied together with social cognitive variables. The present study attempts to integrate these two research traditions, the personality trait approach & the social cognition approach, in order to understand the mechanisms underlying risk-taking behaviour in traffic. Specifically, we will focus on risky driving behaviour among young drivers. This is due to the fact that adolescents are more frequently involved in traffic accidents as compared to other age groups (Bjørnskau, 2000).

Within the social cognition approach, models such as the Theory of Reasoned Action/Planned Behaviour (Ajzen & Fishbein, 1980; Ajzen, 1988) and the Health Belief Model (Rosenstock, 1974) have frequently been applied to study the determinants of risky driving behaviour (see e.g., Parker, Manstead, Stradling & Reason, 1992; Parker, Manstead & Stradling, 1995; Parker, Lajunen & Stradling, 1998; Rutter, Quine & Chesham, 1995). According to these models, variables such as attitudes, perceived risk, social norms and perceived behavioural control are

central determinants of behaviour. Evidence for the predictive value of these variables has been found in several studies. In particular, attitudes towards traffic safety have been found to correlate with aggressive driving behaviour, fast driving, and self-reported accident involvement (Parker & Manstead, 1996; Parker, Lajunen & Strandling, 1998; West & Hall, 1997). Perceived risk seems also to be of importance, since young drivers, as compared to other age groups, are more likely to underestimate the probability of the specific risks caused by traffic situations (Brown & Groeger, 1988; Deery, 1999). They also tend to perceive the hazards in traffic less holistically (Deery, 1999; Milech, Glencross & Hartley, 1989), and overestimate their own driving skills (Moe, 1986).

Based on this knowledge, one of the most popular strategies of promoting road safety has aimed at changing adolescents' attitudes and risk perception related to driving. However, several literature reviews have concluded that the majority of traffic safety campaigns aimed at influencing attitudes and risk perception have failed to document any effect on the number of accidents (Elvik, Vaa & Østvik, 1989; OECD, 1994). There may be several reasons for the campaigns' apparent lack of success. One reason may be that the role of personality characteristics often has been ignored when such campaigns are carried out.

Personality traits can be defined as dimensions of individual differences in tendency to show consistent patterns of thoughts, feelings and behaviour (McCrae & Costa, 1990). In contrast to social cognitive variables such as an attitude, defined as an evaluative condition with reference to a specific object (Eagly & Chaiken, 1993), traits are not evaluative, and are not referring to specific objects. Thus, traits are thought to be more stable and more general as compared to attitudes. The role of personality traits in traffic accidents can be traced back to Farmer and Chambers' (1939) theory of "accident proneness", who suggested that the majority of traffic accidents are caused by a small number of individuals who possess certain personality characteristics. The theory is now regarded as unsatisfactory. However, recent studies have found that personality traits are weakly, but consistently associated with accident involvement in traffic (see e.g., Elander, West & French, 1993, for a review). In particular, sensation-seeking, aggression and social deviance are frequently related to traffic accident involvement. (Hilakivi, Veilahti, Asplung et al., 1987; Jonah, 1997; West & Hall, 1997).

There is, however, reason to believe that the role of personality traits pertaining to accident involvement in traffic may be underestimated. General measures such as

personality traits are assumed to be weak predictors of accidents, mainly for the reason that accidents are relatively rare, and influenced by numerous factors, such as exposure (e.g. annual mileage), randomness and weather conditions (Friedstøm et al. 1995). From a psychometric point of view, an accident is therefore regarded as both an unsuitable and an unreliable criterion. Among others, Epstein (1979) has suggested that an aggregation of different behaviours across situations, a multiple act criterion, is a more appropriate and reliable criterion when studying the influence of personality on behaviour. Based on this, one can expect personality traits to be more successful in predicting an aggregate of different risk-taking behaviours in traffic as compared to accident frequency. This has been also been acknowledged by several researchers, who have found that the correlation between personality traits and risky behaviour increases when a multiple-act criteria is applied (see e.g., Booth-Kewley & Vickers, 1994). It should also be mentioned that the same problems apply equally well when studying the relation between attitudes and specific behaviours like accidents (Ajzen, 1988; Sutton, 1998).

Another reason for a possible underestimation of personality in relation to accident involvement and risky driving behaviour is that indirect effects of personality traits are rarely studied. Theoretically, personality traits are thought to influence the individual's perception and appraisal of the environment (McCrae & Costa, 1995). Several studies have supported this assumption (see Matthews & Deary, 1998, for a review). Such appraisals are subsequently thought to affect behaviour. A similar point of view has been incorporated within social cognition models, which acknowledge that personality traits may affect behaviour indirectly through influencing the attitudinal or normative determinants of behaviour (Ajzen, 1988; Rosenstock 1974). Still, such indirect effects of personality variables are rarely studied. This is probably due to that the majority of studies carried out within the social cognitive framework aims at identifying the determinants of behaviour hypothesised to be most open to change. Personality traits are regarded as less open to change as compared social cognitive variables, and consequently of minimal interest in such studies.

We still believe that the role of personality should not be ignored in road safety promotion. First, taking both personality and social cognitive variables into account as sources of variation in behaviour may provide more explanational power than either one alone. Second, traffic safety campaigns often fail to demonstrate any effects on behaviour. Designing safety programs that take personality dispositions

into account may result in a more efficient measure of both communicating the message to the target audience as well as changing their behaviour.

As implied by the previous presentation, the present study aims at examining the relative importance of both traits and social cognitive variables in relation to risky driving behaviour. A central aim is to investigate whether personality traits have a direct influence on behaviour when the effects of social cognitive variables are controlled for, or whether traits primarily have indirect effects on behaviour through their influence on social cognitive variables such as attitudes and risk perception.

METHOD

Sample

A questionnaire survey was carried out among 4500 adolescents in Norway in 1998/1999. The survey was conducted in the beginning of a traffic safety campaign carried out among adolescents in Norway during the time period of 1998 to 2003 (see also Rundmo & Ulleberg, 2000a). The project was initiated by the Norwegian Authorities of Public Roads (Statens Vegvesen) in cooperation with the Police department, the Norwegian Society of Road Safety (Trygg Trafikk) and the Traffic Safety Committees of two Norwegian counties. The respondents were randomly selected high school classes from within these counties and the questionnaires were completed individually at the participating schools. A total of 3942 respondents returned the questionnaires, yielding a response rate of 85 %. Of these, 56 % were women and 44 % were men. Mean age of the respondents was 18,5 years (modal 18 years) and the age ranged from 16 to 23 years. The analyses of the present paper are based on the 1932 respondents who had a driver licence. The majority of these (84%) had possessed the driver licence for more than 3 months.

Measures

Through a review of the literature we selected five personality traits that have demonstrated to have a significant relationship with risk-taking behaviour in traffic or involvement in traffic accidents (see e.g., Booth-Kewley & Vichers, 1994; Caspi, Begg, Dickinson et al., 1997; Cellar, Nelson & Yorke 2000; Hilakivi et al., 1989; Jonah, 1997; West & Hall, 1997). These included: *Sensation-seeking* (i.e. the

need for excitement and stimulation), *Aggression* (the tendency to experience anger and frustration), *Anxiety* (a tendency to be fearful, prone to worry and being nervous), *Altruism* (characterised by active concern for others), and finally *Normlessness* (i.e. the belief that socially unapproved behaviours are required to achieve certain goals). Sensation-seeking, aggression, anxiety and altruism were measured using facets from the NEO-Personality Inventory (Costa & McCrae, 1992). Normlessness was measured using Kohn & Schooler's (1983) normlessness scale, which consists of four items. These four items are listed in the Appendix. All items were answered on five point Likert scales ranging from "strongly agree" to "strongly disagree". A mean score on each of the traits was constructed on the basis of the items measuring the trait.

Risk perception was measured by 2 items. First, the respondents were asked to rate their subjective evaluation of the probability of them being involved in a traffic accident in the future, ranging from 1: not probable at all to 7: very probable. Second, they were asked to express how worried and concerned they were regarding being hurt in a traffic accident, ranging from 1: not worried at all to 7: very worried.

Three attitude scales were included to measure the respondents' risk-taking attitudes related to driving. These scales had previously been developed in a study by Ulleberg & Rundmo (2000, see also Rundmo & Ulleberg, 2000a). The three scales, named traffic flow vs. rule obedience, speeding and funriding, consisted of 9, 5, and 3 items, respectively. The items are listed in the Appendix. A mean score on each scale was computed on the basis of the items within each scale. A high score on a scale indicated a positive attitude towards traffic safety, meaning low preferences for risk-taking in traffic.

In addition, 3 behavioural scales consisting of 15 items were included to measure self-reported acts of risk-taking in traffic. The scales, named speeding, rule violations and self-assertiveness, had also been developed in a previous study by Rundmo and Ulleberg (2000a). The items are listed in the Appendix. The respondents were asked to indicate how often they partook in the different acts of risk-taking, ranging from "never" to "very often". A mean score on each scale was constructed on the basis of the items within each scale. A high score on a scale indicated a high degree of risky driving.

Statistical analysis

Cronbach's alpha coefficient was applied to evaluate the internal consistency of the personality measures, the attitude scales and the risk behaviour measure. The relationship between personality, attitudes, risk perception and risky driving behaviour were estimated using structural equation modelling. When preparing the data for analysis, we first standardised the raw data and then computed the covariance matrix. The covariance matrix was analysed by means of the LISREL 8 Program (Jöreskog & Sörbom, 1993). Missing cases were deleted listwise.

Various fit indices were used to assess the fit of the model: the goodness-of-fit index (GFI), the adjusted goodness-of-fit index (AGFI), the comparative fit index (CFI), the root mean square error of approximation (RMSEA) and the expected cross-validiation index (ECVI). A GFI, an AGFI and a CFI above .90 indicate a close fit of the model to data (Hu & Bentler, 1995). Moreover, an RMSEA of 0.08 or less also indicates a good fit, and the lower ECVI value the better fit (Browne & Cudeck, 1993).

Results

The number of items, mean scores, and internal consistency for all measures are listed in Table 1. The reliability coefficients were acceptable, with the exception of the one relating to perceived risk. This was probably due to the fact that only two items made up the scale measuring risk perception.

Table 2 pictures the correlations between the variables. To simplify the correlation matrix, latent variable scores (see Jöreskog, Sörbom, du Toit & du Toit, 2000) were computed for risk perception, attitude toward traffic safety, and risk-taking behaviour. The measurement models for the three latent variables are shown in Figure 1. As shown in the table, all the five personality measures were significantly correlated with risk perception, attitudes towards traffic safety, and risky driving behaviour. Altruistic and anxious individuals tended to perceive the risk related to traffic accidents as high, as well as having a positive attitude towards traffic safety. At the same time, they reported less risk-taking in traffic. In contrast, those scoring high on sensation seeking and normlessness, perceived the risk of traffic accidents as lower, demonstrated a negative attitude towards traffic safety, and reported more risk-taking in traffic. Aggressive individuals demonstrated a bit more complex pattern. They were more likely to perceive the risk related to traffic accidents as

higher compared to individuals scoring low on this trait. At the same time, they had a negative attitude towards traffic safety, as well as reporting more risky behaviour in traffic.

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

Measures	Number of items	Mean (range 1-5)	SD	α
Personality variables				
Altruism	8	3.58	0.51	.713
Anxiety	8	3.01	0.60	.744
Normlessness	4	2.80	0.62	.714
Sensation-seeking	8	3.56	0.61	.701
Aggression	8	2.88	0.49	.625
Attitude scales				
1. Traffic flow vs. rule obedience	9	2.93	0.65	.871
2. Speeding	5	2.93	0.83	.842
3. Funriding	3	3.38	0.90	.830
Risk perception				
"Probability of being involved in a traffic accident"	2	4.49[2)]	1.52	.298[1)]
"Worry and concern for yourself being hurt in traffic"		4.76[2)]	1.72	
Risk-taking behaviour scales				
1. Self- assertiveness	5	1.70	0.77	.906
2. Speeding	6	2.64	0.79	.862
3. Rule violations	4	1.80	0.69	.731

[1)] The correlation coefficient between the two risk perception items. [2)] Range 1-7

Both risk perception and attitude towards traffic safety were correlated with reported risk-taking in traffic. In particular, adolescents with a positive attitude towards traffic safety were less likely to report risky driving behaviour, as indicated by the strong negative correlation between the variables ($r = -.79$). Similarly, young drivers who perceived the risk related to traffic accidents as high, reported that they were less likely to take risk when driving.

Table 2: Correlations between personality traits, risk perception, attitude towards traffic safety and self-reported risk behaviour. N = 1881

	1	2	3	4	5	6	7
1. Altruism							
2. Anxiety	.11**						
3. Normlessness	-.22**	-.27**					
4. Sensation- seeking	.01	-.29**	.30**				
5. Aggressiveness	-.30**	.25**	.16**	.10**			
6. Risk perception[1)]	.20**	.38**	-.20**	-.12**	.06*		
7. Attitude towards traffic safety[1)]	.25**	.30**	-.54**	-.38**	-.17**	.29**	
8. Risk-taking behaviour in traffic[1)]	-.31**	-.25**	.47**	.34**	.21**	-.22**	-.79**

[1)] Latent variable score was computed for risk perception, risk-taking attitudes and risk-taking behaviour.
* p < .05, ** p < .01

A structural equation modelling analysis was performed in order to investigate whether the hypothesised effect of personality upon risk-taking behaviour was mediated through attitudes and risk perception. Figure 1 shows the tested model, with standardised path coefficients. Only significant paths ($p < .01$) are shown in the figure, exempting the nonsignificant path from risk perception to risk-taking behaviour. The latter path was included to illustrate the hypothesised causal relationship between the variables in the model. The fit measures indicated that the proposed model fitted the data well: χ^2 (42, N = 1852) = 442.23, GFI = 0.96, AGFI = 0.93, CFI = 0.95, ECVI = 0.29, RMSEA = 0.067.

The path model explained 68% of the total variance in risk-taking behaviour. Risk-taking attitudes and altruism were the only variables with direct effects on risk-taking behaviour. As indicated by the size of the standardised path coefficient (β = -.79), there was a considerable effect of risk-taking attitudes on risk-taking behaviour. Thus, the more positive attitude towards traffic safety the respondents stated, the less risky driving behaviour they reported. The relationship between altruism and behaviour demonstrate that individuals scoring high on altruism reported less risk-taking in traffic as compared to those scoring low on this trait.

Risk perception was not related to risk behaviour in traffic in the path model. This suggests that adolescents' perception of risk does not play an important role in traffic risk-taking, at least not when the effects of the other variables in the model are statistically controlled for.

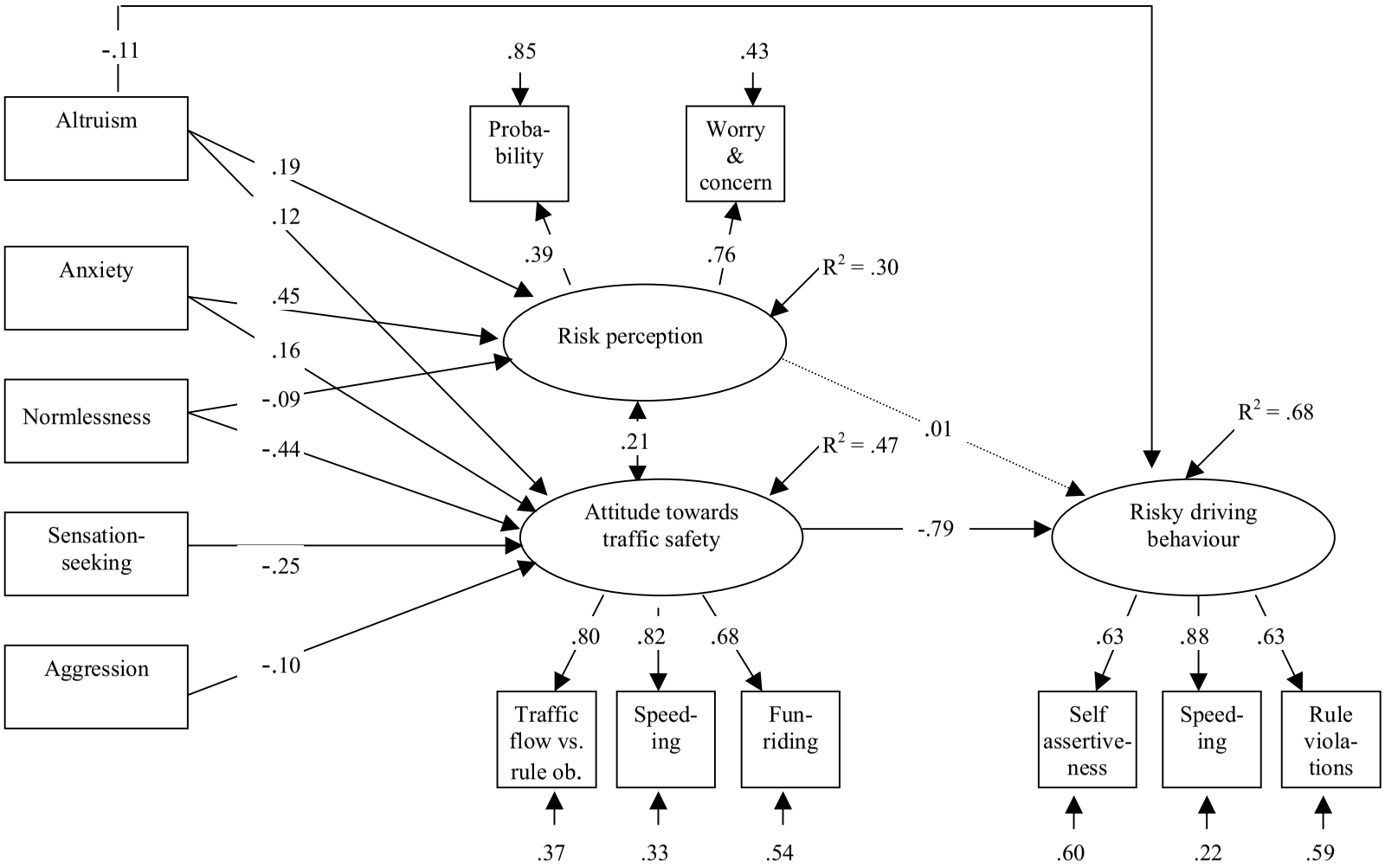

Figure 1: Path diagram of the relationship between personality traits, attitudes, risk perception and risky driving behaviour

As shown in the path model, a total of 47 % of the variance in attitude towards traffic safety were explained by the different personality traits. The lack of direct effects of the personality traits on risk-taking behaviour implies that the effects on risk-taking behaviour were generally mediated through attitudes. That is, the personality traits had indirect effects on behaviour through influencing attitudes. In order to determine the total effects of the personality variables on risky driving behaviour, both direct and indirect effects of the personality variables were computed (Table 3). The total effects demonstrated a similar pattern as found in the correlation analysis in Table 1. High scores on sensation seeking and normlessness were associated with risk-taking in traffic. In contrast, the higher score on altruism the less risk-taking was reported. However, aggression and anxiety demonstrated small total effects on risk-taking behaviour, as shown by the sizes of the standardised total effects.

Table 3: Direct, indirect and total effects of the personality traits on risk-taking behaviour in traffic. Standardised coefficients.

	Altruism	*Anxiety*	*Normless-ness*	*Sensation-seeking*	*Aggression*
Direct effect	-.11	-	-	-	-
Indirect effect (through attitudes)	-.09	-.13	.33	.19	.08
Total effect	-.20	-.13	.33	.19	.08

Discussion

The main aim of the present study was to estimate the importance of personality traits and social cognitive variables in relation to risk behaviour in traffic. The results indicate that personality traits primarily have indirect effects on risk-taking behaviour trough their influence on attitude towards traffic safety. Hence, the assumption that personality primarily influences behaviour through affecting the behaviour's attitudinal determinants is supported in the present study.

The findings pertaining to the personality traits are consistent with what would be expected on the basis of the descriptions of the traits. High scores on sensation seeking, normlessness and aggression were associated with both risk-taking attitudes (i.e. negative attitudes towards traffic safety), and risky driving behaviour.

A plausible explanation for this is that sensation-seekers are expected to seek excitement and stimulation in traffic, which is reflected in risky driving behaviour. When it comes to normlessness, individuals scoring high on this trait are assumed to have low barriers towards socially unapproved behaviour. This may mirror itself in traffic situations, were normless individuals can be expected to show low barriers towards rule violation in traffic. Individuals scoring high on aggression are thought to be easily angered and frustrated, which may manifest itself in aggressive behaviour in traffic, such as driving fast, tailgating etc. (see e.g., Deffenbacher, Oetting & Lynch, 1994). In contrast, adolescents scoring high on altruism, as well as on trait anxiety, were more likely to have a positive attitude towards traffic safety and were less likely to report risk-taking in traffic. A possible explanation is that individuals scoring high on altruism are expected to show active concern for others. Related to driving, this may cause more concern for others in traffic and thus reflect itself in less risky driving behaviour among the individuals scoring high on this trait. The link between trait anxiety and behaviour in traffic may be due to the fact that anxious individuals are characterised by the tendency to be fearful and nervous. Pertaining to traffic situations, this may cause an anxious driver to be more aware of the risk of accident involvement, hence being more careful and defensive when driving.

Furthermore, the suggested indirect effect of the personality traits presupposes a causal relationship, where the personality traits are thought of as exogenous variables influencing attitudes, which in turn affect behaviour. The present study relies on cross-sectional data, and the causal relationship between the variables is consequently difficult to determine. Although we believe that causality never can be proven, especially in cross-sectional studies, the theoretical basis for treating the personality traits as exogenous variables seems reasonable. Personality traits have been found to be relatively stable across time, and there is also evidence for them having a biological basis (Loehlin, 1992). Nevertheless, other factors such as social learning are naturally also believed to influence such traits (Bandura, 1977). But in sum, there is reason to believe that traits are more basic and fundamental in nature compared to attitudes.

Attitude towards traffic safety was the only variable with a direct effect on risky driving behaviour in the path model. The attitude measure seemed to function as a mediating variable in the relation between personality traits and behaviour. However, the personality variables accounted for 47 percent of the total variance in the attitude measure, suggesting that the attitude measure also had an independent

effect on risk-taking behaviour. In other words, risk-taking attitudes can be said to predict additional variance in behaviour.

It is, on the other hand, problematic to claim that attitudes *predict* behaviour, because risk-taking behaviour was measured at the same time as the attitudes were measured. An alternative interpretation is that attitudes may corresponded to behaviour because people wish to justify their previous actions, not vice versa (Heider, 1958). Still, empirical evidence for the predictive value of attitudes in relation to behaviour have been found in a wide range of studies, in which attitudes and behaviour are measured on separate occasions (see, Kraus, 1995 for a meta-analysis). Furthermore, it is reason to believe that self-reported driving behaviour reflects a stable behavioural pattern, and thus makes a reliable indicator of future driving behaviour. For instance, a longitudinal study of young drivers in Finland conducted by Hattaka, Kesinen, Katila and Laapotti (1997) found that self-reports of driving violations were correlated with future accident involvement, as well as future police registered traffic violations. On this basis, one may expect attitudes to be correlated with future behaviour. This does not, however, solve the causal dilemma of what comes first, attitude or behaviour.

Another methodological problem is the unknown validity of self-report measures in relation to actual behaviour in traffic. Behaviours like violating traffic rules and engaging in risk-taking behaviour represent sensitive information about the individual, and the respondents may choose not to report such behaviours in order to present themselves in a socially desirable way. On the other hand, West, French, Kemp and Elander (1993) have found that observers' ratings of a driver's behaviour are correlated with the driver's self-reported behaviour. The use of self-reports has also several advantages compared to the alternatives of studying driving behaviour through direct observations or simulation of the driving task. First, both the alternative methods have the disadvantage of placing the individual under observation, which may cause the driver to act more disciplined compared to normal driving behaviour. Second, these methods are both expensive and time consuming. And finally, self-reports represent summary judgements of information in a variety of situations, and may therefore be the most suited measure according to the multiple-act criterion (Epstein, 1977).

Risk perception demonstrated a non-significant association with risk behaviour, suggesting that risk perception is a weak predictor of adolescent risk behaviour. Similar results have been found in studies by Rundmo (1999) and Rundmo and

Ulleberg (2000b), who found that risk perception does not affect behaviour when other factors (e.g. attitudes) are controlled for. However, in the study, there were only two items measuring risk perception, subjective probability, and worry and concern. These were moderately correlated with each other, causing low reliability in the risk perception measure. Thus, one may question both the reliability and the validity of this measure. Ideally a more comprehensive measures should have been applied. It should also be mentioned that there exist other methods of measuring risk perception. According to Sjöberg (1998), perceived consequences of a negative event should also be applied as a measure of risk perception. An alternative assessment of risk perception could thus have given a better estimate of the influence of perceived risk on risky driving behaviour. There is, however, reason to question the hypothesised causal relationship between risk perception and behaviour in general. For instance, Hoarth and Zuckerman (1993) have suggested that risk perception is a consequence of behaviour, rather that being the cause of it.

A practical implication of the results would be to acknowledge the importance of personality traits in traffic safety campaigns. Of course, we do not mean that interventions should try to change the personality of young drivers, efforts that surely would be a waste of time and resources. A more meaningful intervention would be to target young drivers' risk-taking attitudes, which were strongly related to risky driving behaviour. However, one implication of the findings could be to tailor the message of attitude campaigns according to certain personality characteristics, in order to be more appealing to high-risk drivers. For instance, Palmgren, Pugzzles-Lorch, Donohew et al. (cited in Green, Krcmar, Walters et al., 2000), have found that messages with a high sensation value, meaning ability to elicit sensory, affective and arousal responses, are more appealing and efficient for high sensation-seekers. Thus, one practical implication could be to apply messages of high sensation value in traffic safety campaigns, in order to promote safety attitudes and safe driving among sensation seeking adolescents.

The strategy of traffic safety campaigns has traditionally been to get authorities of different kinds to tell young drivers to drive safe. However, individuals scoring high on normlessness are assumed to have low respect for law and authorities. Their authority defeating characteristics make them a hard to reach group, and consequently very resistant to change in both attitudes and behaviour. An alternative to the traditional authority-based strategy is to let young drivers themselves find out the need for attitudinal and behavioural change. That is, to let them draw their own conclusions about how they can change. This strategy has

been successfully used in health education of students (Arborelius & Bremberg, 1988), as well as in safety programs for professional drivers (Gregersen, Bremher & Morén, 1996). In the latter study study, a group following this strategy reduced their accidents by 50 % compare to a control group. To our knowledge, the strategy of self-produced, individual decisions has not yet been applied in traffic safety work among young drivers. Still, it represents an interesting alternative, especially for the adolescents with the most authority defeating characteristics.

As mentioned, aggression was indirectly linked to risky driving behaviour. This may indicate that emotional factors and probably lack of control over these are related to risky driving style. For instance, becoming frustrated and angry in traffic situations can easily trigger responses such as speeding and rule violations. To inform drivers with high aggression about the risk of accidents or to tell them to change their attitudes and behaviour is probably not a suitable intervention for such drivers. A more relevant intervention may in this case be to focus on how to deal with emotional responses in traffic. For instance, to focus on situations that can trigger reactions such as self-assertion when driving with others, and impatience and frustration in traffic. Deffenbacher et al. (2000) have recently carried out physical and cognitive relaxation interventions in order to reduce driving anger among high-anger drivers. The results showed significant reduction in driving anger and risky driving behaviour among these drivers, whereas a control group showed no reduction.

To sum up, the results of the present study demonstrate the importance of examining indirect effects of personality in relation to risk-taking attitudes and behaviour. In short, those who possessed certain personality characteristics had the least ideal attitudes towards traffic safety and tended to drive risky. However, since one can not expect to change a driver's personality, one may ask oneself what implications for safety research that the results have. The conclusion is that the results indeed may have valuable implications. Our suggestion is to apply different strategies in road safety promotion, and that these should be tailored to certain personality characteristics of young drivers.

Acknowledgements

This study was supported by the Norwegian Authorities of Public Roads (Statens Vegvesen). Especially, the authors would like to thank the steering committee of the campaign, and the following members of the project group: Per Gjerde, Erik Hartmann, Rolf Robertsen and Bård Morten Johansen, as well as all the respondents who answered our questionnaire.

References

Arborelius, E. & Bremberg, S. (1988). "It is your decision!" — Behavioural effects of a student-centred health education model at school for adolescents. *Journal of Adolescence, 11*, 281-297.

Arthur, W.A., Barrett, G.V. & Alexander, R.A. (1991). Prediction of vehicular accident involvement: A meta analysis. *Human Performance 4*, 89-105.

Ajzen, I. (1988). *Attitudes, Personality and Behaviour*. Open Press University, Buckingham.

Ajzen, I., Fishbein, M. (1980). *Understanding Attitudes and Predicting Social Behaviour*. Prentice-Hall, New York.

Bandura, A. (1977). *Social Learning Theory*. Englewood Cliffs, Prentice-Hall, New York.

Bjørnskau, T. (2000). *Road Traffic Risk in Norway 1997/98*. Report no. 483, Institute of Transport Economics, Oslo.

Booth-Kewley, S. & Vichers, R.R.jr. (1994). Associations between major domains of personality and health behaviour. *Journal of Personality, 62,* 281-298.

Brown, I.D. & Groeger, J.A. (1988). Risk perception and decision taking during the transition between novice and experienced driver status. *Ergonomics, 31*, 585-597.

Browne, M.W. & Cudeck, R. (1993). Alternative ways of assessing model fit. In: Bollen, K.A., Long, J.S. (Eds.), *Testing Structural Equation Models.* Sage Publications, Newbury Park, pp. 136-162.

Caspi, A., Begg, D., Dickson, N, Harrington, H., Langley, J., Moffitt, T.E. & Silva, P.A. (1997). Personality differences predict health-risk behaviours in young adulthood: Evidence from a longitudinal study. *Journal of Personality and Social Psychology, 73*, 1052-1063.

Cellar, D.F., Nelson, Z.-C. & Yorke, C.M. (2000). The five-factor model and driving behaviour. Personality and involvement in vehicular accidents. *Psychological Reports, 86*, 454-456.

Costa, P.T.jr., McCrae, R.R. (1992). *Revised NEO Personality Inventory (NEO-PI-R) and NEO Five Factor Inventory (NEO-FF-I)*. Professional manual, Psychological assessment Resources Inc., Odessa.

Deery, H.A. (1999). Hazard and risk perception among young novice drivers. *Journal of Safety Research, 30*, 225-236.

Deffenbacher, J. L., Huff, M. E., Lynch, R. S., Oetting, E. R. & Salvatore, N.F. (2000). Characteristics and treatment of high-anger drivers. *Journal of Counseling Psychology, 47*, 5-17.

Deffenbacher, J.L., Oetting, E.R. & Lynch, R. (1994). Development of a driving anger scale. *Psychological Reports, 74* , 83-91.

Eagly, A.H. & Chaiken, S. (1993). *The Psychology of Attitudes*. Harcourt Brace Jovanovich Publishers, Fort Worth.

Elander, J., West, R. & French, D. (1993). Behavioural correlates of individual differences in road-traffic crash risk: An examination of methods and findings. *Psychological Bulletin, 113*, 279-294.

Elvik, R., Vaa, T. & Østvik, E. (1989). *Trafikksikkerhetshåndboka.* [Handbook of Traffic Safety]. Institute of Transport Economics, Oslo. (In Norwegian).

Epstein, S. (1979). The stability of behaviour: on predicting most of the people much of the time. *Journal of Personality and Social Psychology, 37*, 1097-1126.

Farmer, E. & Chambers, E.G. (1939). *A Study of Accident Proneness Among Motor Drivers*. Report no. 84, HMSO, Industrial Health Research Board, London.

Fridstrøm, L., Ifver, J., Ingebrigtsen, S., Kulmala, R. & Thomsen, L.K. (1995). Measuring the contribution of randomness, exposure, weather, and daylight to the variation in road accident counts. *Accident Analysis and Prevention, 27*, 1-20.

Grayson, G.B. & Maycock, G. (1988). From proneness to liability. In: Rothengatter, J.A, De Bruin, R. (Eds). *Road User Behaviour. Theory and Research*. Van Gorcum, Assen, pp. 234-242.

Green, K., Krcmar, M., Walters, L.H., Rubin, D.L. & Hale, J.L . (2000). Targeting adolescent risk-takers: the contribution of egocentrism and sensation-seeking. *Journal of Adolescence, 23,* 439-461.

Gregersen, N. P. & Berg, H. Y. (1994). Lifestyle and accidents among young drivers. *Accident Analysis and Prevention, 26*, 297-303.

Gregersen, N.P., Bremher, B. & Morén, B. (1996). Road safety improvement in large companies. An experimental comparison of different measures. *Accident Analysis and Prevention, 28*, 297-306.

Hattaka, M., Keskinen, E., Katila, A. & Laapotti, S. (1997). Self-reported driving habits are valid predictors of violations and accidents. In: Rothengatter, T., Carbonell Vaya, E. (Eds.), *Traffic and Transport Psychology: Theory and Application*. Pergamon, Oxford, pp. 295-303.

Heider, F. (1958). *The Psychology of Interpersonal Relationships*. Wiley, New York.

Hilakivi, I., Veilahti, J., Asplund, P., Sinivuo, J.,, Laitinen, L. & Koskenvuo, K. (1989). A sixteen-factor personality test for predicting automobile driving accidents of young drivers. *Accident Analysis and Prevention, 21*, 413-418.

Horvath, P. & Zuckerman, M. (1993). Sensation-seeking, risk appraisal and risk behaviour. *Personality and Individual Differences, 14*, 41-52.

Hu, L. & Bentler, P.M. (1995). Evaluating model fit. In: Hoyle, R.H. (Ed.), *Structural Equation Modeling: Concepts, Issues and Applications*. Sage Publications, London, pp. 76-99.

Jonah, B.A. (1997). Sensation seeking and risky driving: A review and synthesis of the literature. *Accident Analysis and Prevention, 29*, 651-665.

Jöreskog, K.A. & Sörbom, D. (1993). *LISREL 8: Structural Equation Modelling with the SIMPLIS Command Language*. Scientific Software, Chicago.

Jöreskog, K.A, Sörbom, D, du Toit, S. & du Toit, M. (2000). *LISREL 8: New Statistical Features*. Scientific Software International, Chicago.

Kohn, M. & Schooler, C. (1983). *Work and Personality: An Inquiry into the Impact of Social Stratification*. Norwood, Ablex, New York.

Kraus, S.J. (1995). Attitudes and the prediction of behaviour: A meta-analysis of the empirical literature. *Personality and Social Psychological Bulletin, 21*, 58-75.

Loehlin, J.C. (1992). *Genes and Environment an Personality Development*. Sage, Newbury Park, CA.

Matthews, G. & Deary, I.J. (1998). *Personality Traits*. University press, Cambridge.

McCrae, R.R. & Costa. P.T. (1995). Trait explanations in personality psychology. *European Journal of Personality, 9*, 231-252.

Milech, D., Glencross, D. & Hartley, L. (1989). *Skill Acquisition by Young Drivers: Perceiving, Interpreting and Responding to the Driving Environment*. Report no. MR4, Federal Office of Road Safety, Canberra.

Moe, D. (1986). *Young Drivers. Relation Between Perceived and Real Ability. Behavioural Studies*. Report STF63 A92002, SINTEF Samferdselsteknikk, Trondheim. (In Norwegian).

OECD (1994). *Improving Road Safety by Attitude Modifications*. Report prepared by an OECD scientific expert group. OECD, Paris.

Parker, D. & Manstead A.S.R., 1996. The social psychology of driver behaviour. In: Semin, G., Fiedler, K. (Eds), *Applied Social Psychology*. Sage Publications, pp.198-224, London.

Parker, D., Manstead A.S.R, Stradling, S., Reason, J.T. (1992). Determinants of intention to commit driving violations. *Accident Analysis and Prevention, 24*, 117-131.

Parker, D., Manstead A.S.R, & Stradling, S. (1995). Extending the theory of planned behaviour: the role of personal norm. *British Journal of Social Psychology, 34*, 127-137.

Parker, D., Lajunen, T. & Stradling, S. (1998). Attitudinal predictors of interpersonal violations on the road. *Transportation Research Part F, 1*, 11-24.

Rosenstock, I. M. (1974). Historical origins of the Health Belief Model. *Health Education Monographs, 2*, 1-8.

Rundmo, T. (1999). Perceived risk, health behaviour and consumer behaviour. *Journal of Risk Research, 2*, 187-200.

Rundmo, T. & Ulleberg, P. (2000a). *Var det vært det? Evaluering av 18-40 Aksjonen. Resultatrapport. [Evaluation of the 18-40 Campaign. Main report]*. Report no. 43, Rotunde publications, Trondheim. (In Norwegian).

Rundmo, T. & Ulleberg, P. (2000b). *Organisational Factors, Safety Attitudes and Risk Behaviour. Main Report*. Report no. 45, Rotunde publications, Trondheim.

Rutter, D.R., Quine,L. & Chesham,D.J. (1995). Predicting safe riding behaviour and accidents: Demography, beliefs, and behaviour in motorcycling safety. *Psychology and Health, 10*, 369-386.

Sabey, B.E. & Taylor, H. (1980). *The Known Risks We Run: The Highway*. Transport and road research laboratory supplementary report 567. Crowthorne, TRRL, UK.

Sjöberg, L. (1998). Why do people demand risk reduction? In: Lydersen, S., Hansen, G.K., Sandtorv, H. (Eds), Safety and Reliability. Vol 1. *Proceedings of The European Conference on safety and Reliability – ESREL'98, Trondheim, 16-19 June*. Brookfield, AA Balkema Publications, Rotterdam, pp. 751-758.

Sutton, S. (1998). Predicting and explaining intentions and behaviour: How well are we doing? *Journal of Applied Social Psychology*, 28, 1317 –1338.

Ulleberg, P. & Rundmo, T. (2001). Risk-taking attitudes among young drivers: The psychometric qualities and dimensionality of an instrument to measure young drivers' risk-taking attitudes. *Scandinavian Journal of Psychology*, in press.

West, R., French, D., Kemp, R., Elander, J., 1993. Direct observations of driving, self reports of driver behaviour and accident involvement. Ergonomics, 36, 557-567.

West, R. & Hall, J. (1997). The role of personality and attitudes in traffic accident risk. *Applied Psychology: An International Review, 46*, 253-264.

Appendix

Table 1: Mean and standard deviation of the items measuring Normlessness, attitudes towards traffic safety, and risk behaviour (N = 1881).

	Mean	*SD*
Normlessness[a)]		
It is all right to do anything you want as long as you keep out of trouble	2.97	1.02
It is OK to get round laws and rules as long as you don't break them directly	3.07	.95
If something works, it is less important whether it is right or wrong	2.73	.88
Some things can be wrong to do even though it is legal to do it[*)]	2.43	.86
Attitude scale 1: Traffic flow vs. rule obedience[b)]		
There are many traffic rules which can not be obeyed in order to keep up the traffic flow	3.13	.94
Sometimes it is necessary to bend the rules to keep traffic going	2.94	.96
It is more imp. to keep up the traffic flow than always follow the traffic rules	2.93	.94
It is better to drive smooth than always follow the traffic rules	3.07	.96
Sometimes it's necessary to break the traffic rules in order to get ahead	2.83	1.04
Sometimes it is necessary to ignore violations of traffic rules	2.75	.89
Sometimes it is necessary to take chances in the traffic	3.13	.94
Sometimes it is necessary to bend the traffic rules to arrive in time	2.88	.99
A person who take chances and violate some traffic rules is not necessary a less safe driver	2.76	.99
Attitude scale 2: Speeding[b)]		
If you have good skills, speeding is OK	3.27	.98
I think it's OK to speed if the traffic conditions allow you to do so.	3.43	1.06
Driving 5 or 10 miles above the speed limit is OK because everyone does it.	2.80	1.03
If your are a safe driver, it is acceptable to exceed the speed limit by 10 km/h in areas permitted to drive in 80 to 90 km/h	2.57	1.09
It is acceptable to drive in 100 km/h on a straight road if there are no others vehicles in a miles distance	2.59	1.11
Attitude scale 3: Funriding[b)]		
Adolescents have a need for fun and excitement in traffic	3.22	1.06
Speeding and excitement belong together when you are driving	3.63	1.01
Driving is more than transportation, it is also speeding and fun	3.27	1.06
Risk behaviour scale 1: Self-assertiveness[c)]		
Drive recklessly because others expect me to do it	1.76	0.95
Drive fast to show others that I am tough enough	1.68	0.93
Drive fast to show others I can handle the car	1.84	0.97
Break traffic rules due to peer pressure	1.67	0.88
Drive fast because the opposite sex enjoys it	1.61	0.89
Risk behaviour scale 2: Speeding[c)]		
Exceed the speed limit in build-up areas (more than 10 km/h)	2.79	1.14
Exceed the speed limit on country roads (more than 10 km/h)	3.24	1.11
Overtake the car in front when it is driving at the speed limit	2.37	1.10
Drive too close to the car in front	2.56	0.93
Bend the traffic rules in order to get ahead in traffic	2.65	0.96
Ignore traffic rules to in order to get ahead in traffic	2.24	0.96

Risk behaviour scale 3: Rule violations[c)]		
Drive on a yellow light when it is about to turn red	2.49	1.12
Disregard red light on an empty road	1.45	0.88
Drive the wrong way down a one-way street	1.52	0.85
Break traffic rules because they are too complicated to follow	1.78	0.92

[a)]All items measured on five point Likert scales ranging from 1 "strongly disagree" to 5 "strongly agree.

[b)]All items answered on five point Likert scales ranging from 1 "strongly agree" to 5 "strongly disagree".

[c)]All items measures on five point scale ranging from 1: "never" to 5 "very often". [*)] Recoded.

Transportation Research Part F, Traffic Psychology and Behaviour, 2001, 4, 279-297

Paper III

Personality subtypes of young drivers. Relationship to risk-taking preferences, accident involvement, and response to a traffic safety campaign

Pål Ulleberg
Department of Psychology
Norwegian University of Science and Technology
7491 Trondheim
Norway

Abstract

The present study aimed at identifying subtypes of young drivers (N = 2524) and evaluate how these responded to a traffic safety campaign. On basis of a cluster analysis of personality measures, six subtypes of young drivers were identified. The subtypes were found to differ on self-reported risky driving behaviour, attitudes towards traffic safety, risk perception, estimation of own driving skills, and accident involvement. Two of the subtypes were identified as high-risk groups in traffic. The first high-risk group consisted of mostly men, characterised by low levels of altruism and anxiety, and high levels of sensation-seeking, irresponsibility, and driving related aggression. The second high-risk group reported high sensation seeking, aggression, anxiety, and driving anger. The subtypes were also found to differ on how they evaluated and responded to the traffic safety campaign. The results indicated that the campaign seemed to appeal most to the low-risk subtypes. Gender differences within each subtype were also found on the different traffic related measures, as well as on response to the campaign. It is concluded that young drivers should not be treated as a homogenous group pertaining to road safety. Practical suggestions on how to promote safe driving among these subtypes are also discussed.

Keywords: Risk-taking, personality, young driver, traffic safety campaign, cluster analysis

Introduction

It is well known that young novice drivers are more frequently involved in traffic accidents as compared to other age groups (Bjørnskaug, 2000; Summala, 1987). Studies have also found that young drivers tend to have a more risky driving style than others. Specifically, they are more likely to drive too fast, follow too closely, and overtake dangerously, compared to other drivers (Jonah, 1986). Several factors are hypothesised to influence their risky driving and accident involvement (see Gregersen & Bjurulf, 1997; for a review). Insufficient skills and a lack of experience have frequently been regarded as the main causes. Other reasons are adolescents' persistent bias in their perception of risk and evaluation of their own driving skills. This is because that young drivers, as compared to other age groups, are found to be more likely to underestimate the probability of the specific risks caused by traffic situations (Brown & Groeger, 1988; Deery, 1999), and to have a propensity to perceive themselves as invulnerable to negative outcomes (Millstein, 1993). They also tend to perceive the hazards in traffic less holistically (Deery, 1999; Milech, Glencross & Hartley, 1989), and overestimate their own driving skills (Moe, 1986).

It has also been hypothesised that adolescents' risky driving style is an expression of a general propensity towards deliberately engaging in high-risk behaviour, meaning a risky lifestyle (Jessor, 1987). This is supported by studies finding that risky driving tend to covary with other forms of risk-taking, such as problem drinking, marijuana use, and delinquency (Jessor, 1987; Beirness & Simpson, 1988). Jonah (1986) has hypothesised that adolescents' risky driving may serve as a means for expressing independence, defying authority, impressing peers, and satisfying a need for excitement.

It is, however, uncertain whether risky driving and accident involvement is caused by deliberate risk-taking, by inexperience and lack of driving skills, or the combination of these. It is also important to note that although young drivers as a group are more likely to drive in risky ways and to be involved in accidents, this does not mean that all young drivers are equivalent. Both accident involvement and the propensity to engage in high-risk behaviour is found to be linked to certain personality characteristics. In particular, the personality trait sensation seeking, indicating a need to experience novelty, excitement, and dangers (Zuckerman, 1979), has frequently been associated with a risky lifestyle, risky driving and accident involvement (see, e.g. Wilson & Jonah, 1988; Jonah, 1997). A range of

other personality factors are also related to risky driving and crash involvement. The most prominent ones are social deviance, hostility, aggression, impulsiveness, emotional liability, and low altruism (Jonah, 1997; West & Hall, 1997, Ulleberg & Rundmo, in press a; Underwood, et a.l, 1999; see, Beirness, 1993; Elander, West & French, 1993 for a review).

Studies applying personality variables have usually focused on the separate and distinctive contribution of each personality variable in order to understand individual differences in risky driving. A more plausible method of identifying high-risk drivers could, however, be to identify specific subtypes of young drivers on the basis of the combinations of certain characteristics, instead of merely studying the contribution of separate personality variables. A few studies have aimed at identifying such subtypes empirically by the use of cluster analysis. In a recent study, Deery and Fildes (1999) identified 5 subtypes of young novice drivers, applying this analysis on personality and driving related measures. Two of these subtypes were identified as high-risk groups, meaning that they reported risky driving behaviour, a poor driving accident record, and unfavourable attitudes towards traffic safety. The two high-risk groups were characterised by high levels of sensation-seeking, hostility, assaultiveness, and driving related aggression. One of the two groups also demonstrated high levels of depression and irritability, and low levels of emotional adjustment. Approximately 80 per cent of the high-risk groups were males. The authors concluded that these two groups merit special attention in safety promotion.

Other studies using cluster analyses on personality measures have identified similar subtypes of drivers. Donovan, Umlauf and Salzberg (1988) found three clusters of high-risk drivers. One cluster was characterised by high levels of impulsiveness, assaultivenss, sensation seeking, and hostility. Another cluster reported hostility, depression and low emotional adjustment. The third was, on the other hand, described as well adjusted, meaning that this cluster did not show elevated scores on any personality dimension. Moreover, Wilson (1991) found four clusters of high-risk drivers. One cluster was characterised by high levels of thrill-seeking, hostility, and irresponsibility. Another cluster also displayed high levels of hostility, but low levels of thrill-seeking, and was thus described as emotionally unstable. A third cluster was characterised by depression and personal problems, whereas the fourth was defined as well-adjusted. Although these studies were based on samples of mainly adult male drivers who already were defined as high-risk drivers, the results are to some extent similar to the high-risk groups found in

Deery and Fildes' (1999) study. That is, similar combinations of personality traits seem to be related to high-risk driving and accident involvement. However, the three studies mentioned above differ on the number of high-risk clusters derived, indicating that there is no agreed-upon definition for the number of sub-groups to be labelled high-risk in traffic. One explanation can be that samples from different driver populations were used in the three studies, another can be that the studies applied different measures of personality variables. A third explanation is the rather arbitrary nature of clustering techniques, since different clustering techniques can produce different results.

Nevertheless, the studies mentioned above indicate that some subtypes of young drivers appear to be especially at risk. Obviously, such groups merit special attention when traffic safety programs are carried out. The present study aims at identifying subtypes of young drivers and to evaluate how these responded to a traffic safety campaign. The campaign is currently carried out among adolescents in two Norwegian counties. It began in 1998, and is planned to continue to through the year 2002. The main focus of the campaign is accidents caused by speeding, driving off the road, and head-on collisions with a meeting vehicle. This is because adolescents are found to be particularly at risk regarding these types of accidents (Bjørnskau, 2000). The campaign aims at enhancing favourable traffic safety attitudes, to generate more awareness of accident risks, and to promote safe driving among adolescents.

The campaign is conducted through visits at high schools, where two movies are shown to the students. Teachers are also given a manual that is the basis of traffic safety projects completed in the classes after the campaign team has visited the school. In addition, various reminders of the campaign takes place in the aftermath. This includes mass-media advertisements (e.g. movie commercials), posters, free CD and T-shirts, WEB pages, and a competition on traffic safety knowledge among adolescents. The road safety campaign is also combined with other actions, such as increased enforcement of traffic rules and special attention regarding the campaign at driving schools (see also Rundmo & Ulleberg, 2000 for a further description).

In particular, the campaign aimed at reaching different subtypes of adolescents hypothesised to be high-risk groups. One was labelled "sensation-seekers", meaning individuals with a need for excitement and stimulation. Another one was called "the normless", and was thought to consist of adolescents with a lack of

respect for laws and rules, and who act rebellious and irresponsible. The campaign addressed these two groups differently, by using role models that were thought to represent either a typical sensation seeker or a typical normless adolescent. It is important to note that the campaign team did not empirically try to identify these groups before they implemented the campaign. The rationale for targeting these groups was based on studies linking sensation seeking and social deviance to risk-taking in traffic (see e.g. Jonah, 1997; West & Hall, 1997). A third group specifically targeted by the campaign was passengers. The purpose of this was to aid the passengers to cope with the pressures to accept unsafe rides, and to "speak out", that is, to tell a driver to drive more carefully when they are feeling unsafe as a passenger.

The major aim of the present paper is to identify reliable and valid subtypes of young drivers on the basis of a cluster analysis of personality characteristics. In addition, it will investigate whether these subgroups differ on driving related measures, such as driving behaviour, attitudes, risk perception and accident involvement. If there are differences in risk-taking and accident liability among the separate subtypes, it is possible to define the groups on which to focus and give practical suggestions on how to target these groups. This is also related to the final aim, which is to examine how the different subgroups evaluated, and responded, to the traffic safety campaign.

Method

Sample

A questionnaire survey was carried out among 5970 adolescents in Norway in the period between 1998-2000. A total of 5075 respondents returned the questionnaire, yielding a response rate of 85 %. Of these, 2856 (56 %) respondents reported that they had a driver licence, whereas the remaining 2219 (44 %) did not have a driving licence. The analyses of the present paper are based on the 2856 respondents who possessed a driver licence. The sample had an almost even gender distribution, 52 % were women and 48 % were men. The mean age of the respondents was 18,5 years of age (18 years of age) and the age ranged from 18 to 23 years. The majority of these (84%) had possessed the driver licence for more than 3 months.

The survey was conducted in relation to the road safety campaign presented in the introduction (see also Rundmo & Ulleberg, 2000). The campaign was initiated by the Norwegian Authorities of Public Roads (Statens Vegvesen) in cooperation with the Police department, the Norwegian Society of Road Safety (Trygg Trafikk) and the Traffic Safety Committees of two Norwegian counties. The sample consisted of randomly selected high school classes from within these two Norwegian counties and the questionnaires were completed individually at the participating schools. Approximately half of the respondents (53 percent) answered the questionnaire before the school had been visited by the campaign team, the other half (47 per cent) after the campaign team had visited the school. In the latter group, a sub-sample of 678 respondents was also asked to evaluate different aspects of the campaign.

Measures

Five personality measures and one measure of driving anger were included in the questionnaire. Four of the personality measures were assessed using facets from the NEO-Personality Inventory (Costa & McCrae, 1992), respectively Sensation-seeking, Aggression, Anxiety, and Altruism. Each facet consisted of eight items. The fifth personality trait was a measure of Normlessness (i.e. the belief that socially unapproved behaviours are required to achieve certain goals). This was measured using Kohn & Schooler's (1983) Normlessness scale, which consists of four items. The questionnaire also included seven items from the Driving Anger Scale (Deffenbacher, Oetting & Lynch, 1994). These were intended to measure tendency to become irritable, frustrated and angry in various traffic situations. All items were answered on five point Likert scales ranging from "strongly agree" to "strongly disagree". A mean score on each measure was constructed on the basis of the items within each facet or scale. Descriptive statistics and measures of internal consistency of the scales are presented in Table 1.

The respondents were asked to rate their perception of risk on three different aspects; their evaluation of the probability, how unsafe they felt, and how worried and concerned they were from being injured in a traffic accident. All ratings had a range from 1 to 7. In addition, they were asked to express how often they thought about the risk of being injured in a traffic accident.

Eight attitude scales were included to measure the respondents' risk-taking attitudes related to driving. These scales had previously been developed by

Ulleberg & Rundmo (in press b). The eight scales intended to measure attitudes towards traffic flow vs. rule obedience, speeding, funriding, to ride with an unsafe driver, drinking and driving, rule violations, fatalism, and concern about hurting others as a driver. A mean score on each scale was computed on the basis of the items within each scale. A high score on a scale indicated a positive attitude towards traffic safety, meaning low preferences for risk-taking in traffic. All items were answered on a five-point response scale ranging from "strongly agree" to "strongly disagree".

Three scales aimed at measuring different aspects of self-reported risky driving behaviour were also included (Rundmo & Ulleberg, 2000). The three scales intended to measure speeding, rule-violations, and self-assertive behaviour in traffic. The items within these scales included behavioural items like breaking the speed limit, overtaking dangerously, tailgating, not stopping when the traffic light turn red, ignoring traffic rules, and drive fast to impress others. The respondents were asked to indicate how often they partook in different acts of risk-taking, ranging from never to very often. A mean score on each scale was constructed on the basis of the items within each scale. A high score on a scale indicated a high degree of risky driving. The respondents were also asked to report whether they had been involved in accidents as a driver, both with and without an injury. In addition, they were asked to rate their own skill as a driver, ranging from poor to excellent. A sub-sample of the respondents (n = 678) who had been visited by the campaign were also asked to rate their satisfaction with and evaluation of different aspects of the campaign.

Statistical analysis

ClustanGraphics5 cluster analysis software (Wishart, 1999, 2000) was used to identify subtypes of young drivers. In short, a cluster analysis uses algorithms to group together individuals whose pattern of scores on variables are similar. The analysis was based on scores derived from the five personality measures and the measure of driving anger, using the squared Euclidean distance measure. The standardised scores of the variables were used to avoid the problem of comparing Euclidean distances based on different measurement scales (Everitt, 1993). Missing cases were excluded listwise, resulting in a reduction of 332 respondents. Thus, the cluster analysis was based on the remaining 2524 respondents.

Ward's method for hierarchical clustering was undertaken in order to determine the number of clusters, or sub- groups, present in the data (Everitt, 1993). Although there are no formal rules for determining the numbers of clusters present, one alternative is to study the graph of the fusion coefficients values against the number of hierarchical clusters (Aldenderfer & Blashfield, 1984). A marked flattening of the graph suggests that the following mergers of cluster portray no new information. An inspection of the graph suggested that four to six clusters were present in the data. As described later in the results section, the six cluster solution was chosen on basis of reproducibility and interpretability.

Although the hierarchical clustering method is advantageous in determining the number of clusters present in the data, it cannot produce the most optimal cluster solution pertaining to between-cluster heterogeneity. This is because the method is unable to separate clusters created at previous steps. It is therefore recommended to run a K-means cluster analysis after the number of clusters has been determined, using the centroids (i.e. the cluster centre means) generated from the hierarchical analysis as a starting point (Milligan & Sokol, 1980). K-means cluster analysis using FocalPoint clustering (Wishart, 2000) was therefore used to calculate the most optimal cluster solution. The results obtained from a K-means analysis is, however, sensitive to the order the cases are presented in the data file. To solve this problem, the FocalPoint clustering technique performs a series of 500 random trials on the chosen starting solution, in this case the means from the hierarchical six cluster solution. In each trial, the cases are considered in different random order. This strategy gives the researcher the option to choose among several "top-solutions", meaning the most replicable cluster solutions with the smallest Euclidean sum of square values. On this basis, the most replicable six-cluster solution was chosen, reproduced in 352 out of the 500 random trials. The FocalPoint clustering technique also identify outliers in the final cluster solution, that is, cases that cannot be easily classified or that are relatively remote form the cluster centres. This technique identified 26 outliers, which were excluded from further analysis. Thus, final cluster solution relied on 2498 respondents.

One-way analysis of variance and chi-square tests were applied to examine whether the clusters differed on traffic related measures. Bonferroni post-hoc tests were also used to determine which clusters that differed from each other in their mean scores on the variables. In order to measure the strength of the association between the clusters and the various dependent variables, the η^2 was calculated.

The η^2 was applied to estimate the proportion of the variance in a dependent variable that was explained by cluster membership.

Results

Cluster analysis

Table 1 presents correlations, descriptive statistics, and internal consistency of the personality variables the cluster analysis was based on. In general, the correlations between the variables were low, indicating that potential problems of multicollinearity not were present. The internal consistency of the different measures was also acceptable. The six variables were then standardised and subjected to a hierarchical cluster analysis using Wards's method. An inspection of the graph of the fusion coefficient values estimated in the hierarchical analysis suggested that four to six clusters of young drivers could be identified. The reproducibility of the clusters was checked using two randomly split samples. Both the four- and the six-cluster solution were reproduced in both samples, whereas the one of the clusters in the five-cluster solution demonstrated low reproducibility. The six-cluster solution was preferred over the four-cluster solution, because it was regarded as most meaningful and interpretable. That is, the profile of the six-cluster solution demonstrated the best face validity.

The six-cluster centre means generated from Ward's analysis were used as starting points for a K-means cluster analysis. In order to test the reliability of the final

Table 1. Correlations, mean scores, SD and Cronbach's alpha for the personality measures (N = 2524).

	1	2	3	4	5	Mean (range 1-5)	SD	α
Sensation seeking	-					3.55	.60	.691
Anxiety	-.25	-				3.02	.59	.741
Aggression	.11	.29	-			2.88	.50	.671
Normlessness	.29	-.24	.14	-		2.78	.63	.712
Altruism	.00	.11	-.26	-.22	-	3.59	.50	.727
Driving anger	.29	-.05	.27	.25	-.12	3.40	.67	.793

cluster solution, the results of Ward's method were compared with those from the K-means method by correlating the six clusters' means estimated by the two analyses. The correlations between the six clusters' means were in general very high, respectively .99, .98, .99, .94, .94 and .78. This indicates high similarity between the profile shapes of the clusters, meaning that the six-cluster solution demonstrated satisfactory reliability across clustering methods. The standardised cluster means of the variables generated by the K-means analysis are presented in Figure 1.

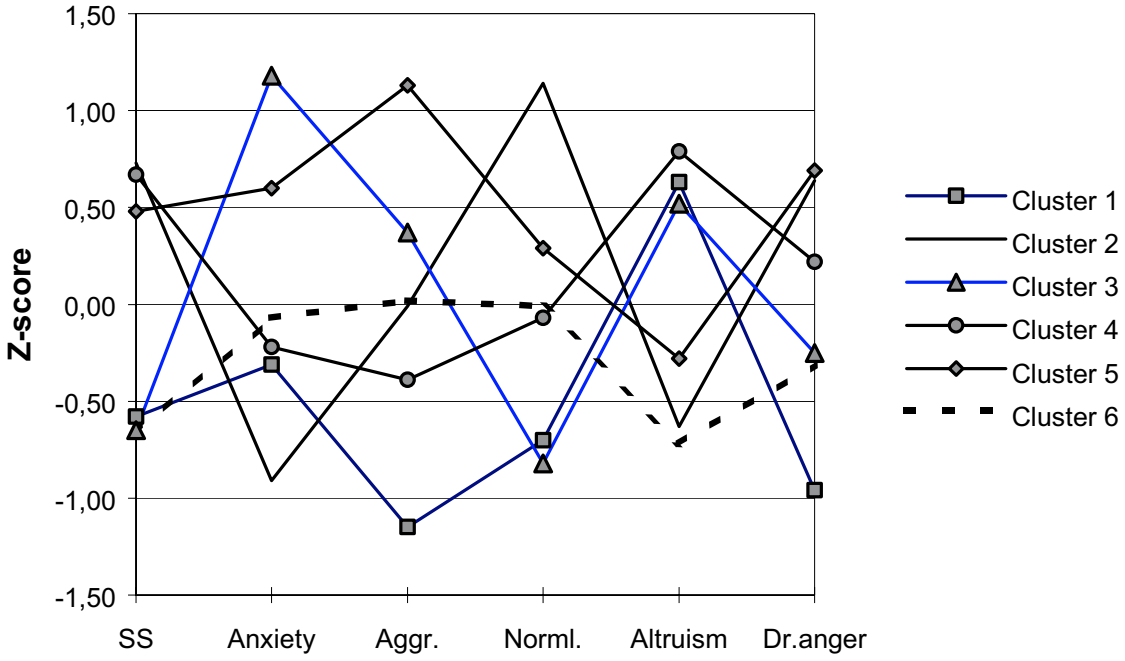

Figure 1. Profile plot of the six k-means clusters.

Cluster 1 is characterised by low scores on sensation seeking, anxiety, aggression and driving anger. The pattern of means suggest that the individuals in Cluster 1 are relatively calm and emotionally well-adjusted. The low scores on normlessness and high scores on altruism indicate that they have respect for laws and rules, and at the same time values concern for others. These characteristics may also indicate a high degree of conformity and conventionality. Another description may be that this group is characterised by responsible and philanthropic values. Based on these descriptions, the cluster is expected to be a low risk group in traffic situations.

The individuals in Cluster 2 reported the most deviant scores on several of the classification variables. The combination of high normlessness and low altruism suggests that this group is relatively irresponsible, non-conforming, and egoistic. The mixture of high sensation-seeking and low anxiety indicates that they are thrill-seeking, and at the same time cold and tough-minded. The drivers in this cluster also shows low frustration tolerance in traffic, as indicated by their high scores on driving anger. The combination of these qualities suggests that Cluster 2 is a high-risk group in traffic.

Cluster 3 is characterised by very high anxiety. The cluster shows almost the opposite profile of scores compared to Cluster 2: low scores on sensation-seeking, normlessness, and driving anger, and high scores on anxiety and altruism. The combination of these characteristics may indicate that this group is careful and tend to avoid risky situations. Thus, Cluster 3 is expected to be a low risk group in traffic.

The individuals in Cluster 4 reported high scores on sensation-seeking and altruism, and moderate scores on the other variables. On basis of the profile of this group, it is difficult to predict whether they are a high or a low risk group in traffic. The high score on sensation seeking may imply a general preference towards risk-taking, which may reflect itself in risky driving behaviour. However, the moderate score on normlessness indicate that the group has respect for laws and rules, and may prefer to engage in risky activities on other areas than in traffic. Moreover, the high score on altruism may imply that the cluster is relatively unselfish, which may manifest itself in concern for others in traffic situations.

Cluster 5 is characterised by high levels of aggression, anxiety, and driving anger. This suggests that the individuals within this cluster have low level of emotional adjustment, meaning that they easily become frustrated and irritated. The combination of these characteristics suggests an angry-hostile personality (Zuckerman, 1988). This group also had above average scores on sensation seeking, and below average scores on altruism. On basis of the combination of sensation-seeking and low emotional adjustment, one can expect this cluster to be a high-risk group in traffic. However, the above level of anxiety may cause these subjects to be more aware of traffic hazards, and consequently not so prone to deliberate risk-taking in traffic.

The individuals in Cluster 6 tended to score moderately on most variables. However, the cluster showed the lowest scores on sensation seeking and altruism compared to the other clusters. This suggests that the group have low preferences towards risk-taking, and at the same time low concern for others. Due to the low scores on sensation seeking, it is not expected that this cluster will be a high-risk group in traffic.

External validation of the cluster solution

In short, an external validation of a cluster solution is obtained by using significance tests on relevant criteria variables not used to generate the cluster solution (Aldenderfer & Balshfield, 1984). The six clusters of young drivers were compared on various behavioural, attitude, and risk perception measures related to driving. Table 2 shows that there were significant differences between the clusters on all measures. The η^2 value indicated that the impact of cluster membership was greatest on driving behaviour and attitudes towards traffic safety.

In particular, the scores in Table 2 pointed towards Cluster 2 as a high-risk group in traffic. Post hoc tests demonstrated that this cluster had significantly higher scores on risk-taking behaviour, and lower scores on the attitude and the risk perception measures compared to the other clusters. They also rated their own skills as a driver significantly better than the other clusters. Their risky driving style and risk-enhancing attitudes seemed to reflect itself in the relatively high accident rate of this group. Males, at 81 per cent, dominated this cluster.

The scores also indicated that Cluster 5 was a high-risk group. Similarly to Cluster 2, Cluster 5 reported relatively risky driving habits and unfavourable attitudes towards traffic safety. They also reported most involvement in traffic accidents without a physical injury. In contrast to Cluster 2, they did not rate their own skills as a driver as particularly good, and perceived the risk of themselves being injured in an accident as relatively high. The latter is probably due to the high degree of anxiety in this group. Interestingly, 59 per cent of the drivers within this cluster were women.

Table 2. Cluster differences on gender, use of car, driving behaviour, attitudes, accident involvement, risk perception and rating of own driving skills. Means with standard deviation in parentheses.

	Young driver clusters (N = 2498)							
	1 (n = 374)	2 (n = 374)	3 (n = 362)	4 (n = 478)	5 (n = 393)	6 (n = 517)	F or χ^2	η^2
Percent males	40.1 %	80.9 %	15.6 %	46.1 %	41.1 %	57.6 %	350.3**	-
Drive car daily	36.0 %	47.9 %	32.3 %	48.0 %	38.5 %	43.4 %	33.3**	-
Risky driving behaviour[a]								
Self-enhancing	1.30 (.43)	2.01 (.77)	1.40 (.51)	1.58 (.61)	1.86 (.78)	1.78 (.79)	64.0**	0.11
Speeding	2.15 (.58)	3.19 (.78)	2.25 (.59)	2.71 (.66)	2.90 (.73)	2.64 (.67)	126.6**	0.20
Rule violation	1.46 (.41)	2.08 (.72)	1.51 (.45)	1.65 (.47)	1.83 (.61)	1.90 (.71)	67.4**	0.12
Accident involvement (% involv)								
Acc. with physical injury, as driver	6.8 %	14.3 %	7.0 %	7.3 %	8.6 %	9.0 %	18.53*	-
Acc. without physical injury, as driver	26.7 %	39.0 %	32.6 %	34.0 %	41.3 %	34.7 %	18.82*	-
Driving attitudes[b]								
Traffic flow vs. rule obedience	3.35 (.57)	2.48 (.58)	3.28 (.56)	2.93 (.62)	2.70 (.59)	3.00 (.53)	124.1**	0.20
Speeding	3.40 (.71)	2.25 (.76)	3.45 (.65)	2.87 (.75)	2.71 (.79)	3.05 (.66)	146.0**	0.27
Funriding	3.88 (.77)	2.76 (.85)	3.86 (.79)	3.43 (.84)	3.14 (.82)	3.41 (.76)	106.8**	0.18
Rule violations	3.55 (.85)	2.89 (.87)	3.52 (.88)	3.30 (.90)	3.17 (.92)	3.26 (.79)	29.1**	0.06
Riding with an unsafe driver	3.19 (.68)	2.40 (.64)	3.27 (.56)	2.81 (.58)	2.69 (.60)	2.92 (.57)	107.5**	0.18
Drinking and driving	4.50 (.69)	3.73 (1.00)	4.53 (.64)	4.21 (.85)	3.98 (.95)	4.09 (.79)	52.2**	0.10
Fatalism	3.45 (.57)	2.86 (.67)	3.48 (.59)	3.24 (.60)	3.13 (.60)	3.15 (.57)	54.7**	0.10
Concern about hurting others	4.23 (.64)	3.82 (.77)	4.47 (.54)	4.32 (.62)	4.25 (.64)	3.93 (.69)	56.7**	0.10
Rating of own driving skills[c]	5.02 (1.17)	5.35 (1.34)	4.75 (1.13)	5.19 (1.08)	4.95 (1.24)	4.81 (1.34)	13.6**	0.03
Risk perception[d]								
Probability rating	4.46 (1.36)	4.23 (1.58)	4.96 (1.38)	4.58 (1.45)	4.78 (1.52)	4.37 (1.42)	13.2**	0.03
Feeling of unsafety	4.61 (1.46)	3.83 (1.60)	5.33 (1.38)	4.64 (1.54)	4.85 (1.55)	4.52 (1.37)	39.7**	0.07
Worry and concern	4.90 (1.57)	3.81 (1.77)	5.64 (1.32)	4.89 (1.69)	5.01 (1.69)	4.58 (1.53)	51.8**	0.09
How often do you think of the acc. risk	3.80 (1.59)	3.05 (1.60)	4.30 (1.70)	3.53 (1.61)	3.82 (1.59)	3.74 (1.49)	24.4**	0.04

* $p < .01$, ** $p < .001$ [a]Range 1-5 . A high score indicate risky driving behaviour. [b]Range 1-5. A high score reflects ideal (safety oriented) attitudes. [c]Range 1-7, a high score indicates high rating of own skill. [d]Range 1-7. A high score imply high perception of risk regarding a traffic accident.

The drivers in Cluster 1 and Cluster 3 showed quite similar scores on the various measures. Females, respectively 60 and 84 per cent dominated both clusters. The profiles of the clusters suggested that they consisted of careful drivers who have favourable attitudes towards traffic safety, and are aware of the risk of being injured in a traffic accident. Their driving behaviour and attitudes seemed to be consistent with their relatively low accident involvement. Thus, these two subtypes can be regarded as low-risk drivers. The difference between the two clusters lay in their perception of risk, where Cluster 3 tended to feel more at risk of being injured in an accident.

Cluster 4 and 6 also showed similar scores on several measures in Table 2. Compared to the other clusters, their scores on the measures were in-between the high-risk clusters (2 and 5) and the low-risk clusters (1 and 3). Thus, Cluster 4 and 6 appeared to be "medium-risk" groups compared to the other clusters. This also seemed to manifest itself in their level of accident involvement, which also fell in-between the other clusters. Cluster 6 seemed, however, to be more prone to self-enhancing and rule-violating behaviour than Cluster 5.

An alternative explanation is, however, that the differences on the driving related variables between the clusters are not caused by differences between personality subtypes, but really are a reflection of cluster differences in driving experience. This is because the increased driving experience if found to decrease young drivers concern for traffic safety aspects (see e.g. Lajunen & Summala, 1995). As shown in Table 2, the clusters differed in how frequently the individuals reported to drive a car. In order to remove the variance that could be attributed to driving experience, a one-way analysis of covariance was carried out, adding how often the respondents reported to drive as a covariate. The clusters' means on the driving related variables were then compared as if the clusters had not differed on driving experience. These results, of the one-way analysis of covariance, are not shown here, due to the fact that adding driving experience as a covariate did not affect the differences between the clusters.

To sum up, the analyses showed significant differences between the clusters in the external validation variables. Basis on the analyses, two high-risk clusters, two medium-risk and two low-risk clusters were identified. In particular, Cluster 2 singled out as the most deviant group.

Gender differences by cluster

As shown in Table 2, both men and women were present in the high-risk clusters (2 and 5). In particular, Cluster 5 consisted of 59 percent women. Previous research have, however, found young men to be more likely to express risk-enhancing attitudes in traffic (Yagil, 1998), to drive more risky (Groeger & Brown, 1989), and to be more involved in accidents than young women (Evans, 1991). In order to examine gender differences within each cluster on the traffic related measures, independent sample t-tests were used. In short, the analyses demonstrated the same pattern for all measures: men had significantly more risk-enhancing attitudes ($p<$ .001), reported more risky driving behaviour ($p <.001$), perceived less risk ($p <. 01$) and rated theirs skills as a driver as better than the women within the same cluster ($p <.01$). Men were also found to have a higher accident rate than women within all clusters. However, chi-square tests detected only significant gender differences in accident rate for Cluster 4, 5 and 6 ($p < .05$).

The analyses also detected another interesting pattern. Although female drivers, on average, differed from the males within their cluster, the profile of the six clusters was identical for both genders. That is, Cluster 2 and 5 turn out to be high-risk groups when the clusters of male and female drivers were compared separately. Likewise, Cluster 1 and 3 are identified as low-risk groups. In Figure 2, gender differences by cluster on risk-taking behaviour and accident involvement are presented to exemplify this general pattern. As shown in the figure, there were consistent gender differences within all six clusters, and the same high- and low-risk groups were present for both men and women. This further strengthens the six clusters external validity.

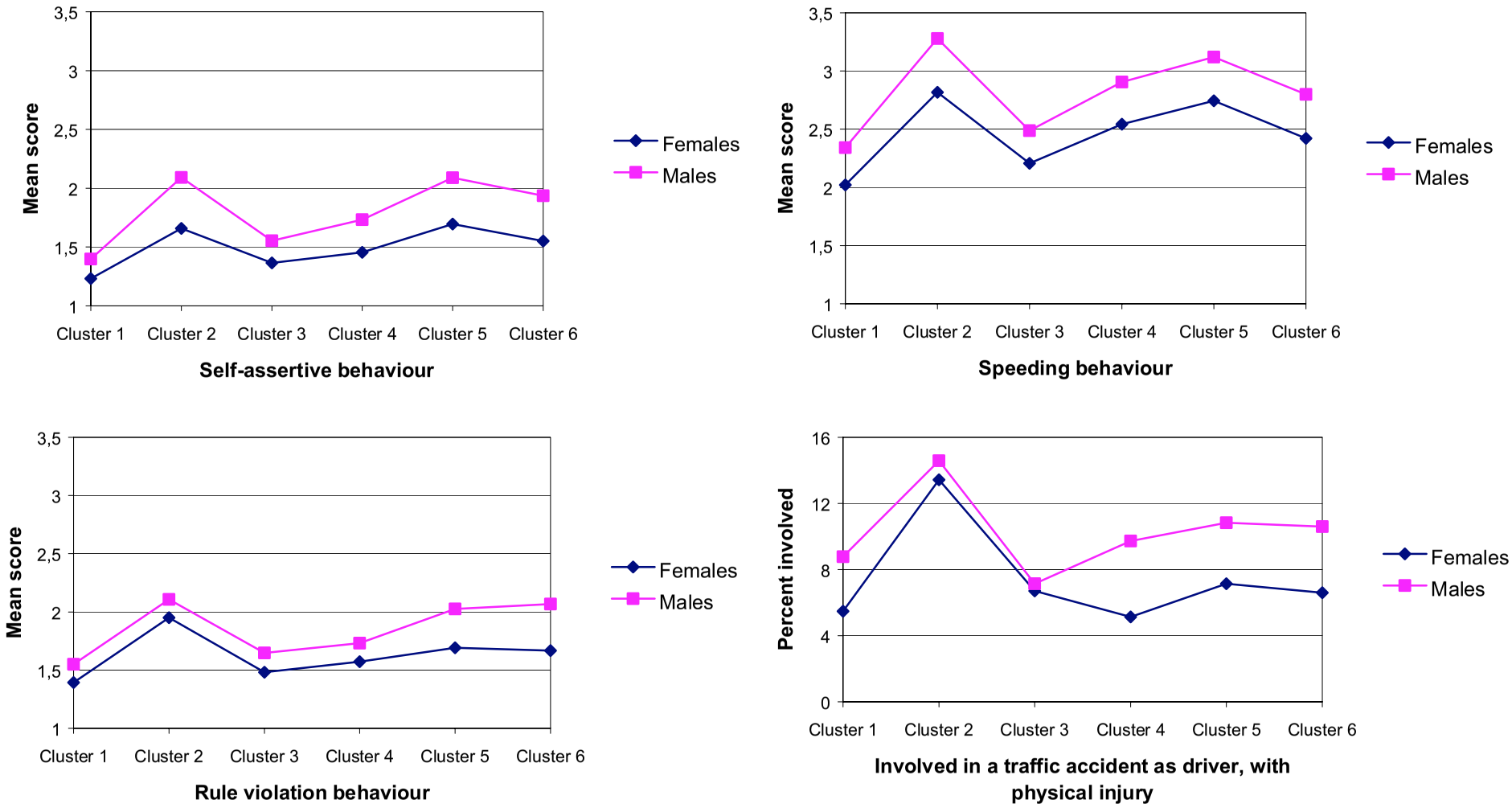

Figure 2. Gender differences by cluster. Scores on risk-taking behaviour and percent involved in traffic accidents with a physical injury.

Table 3. Evaluation of the campaign by cluster. Means with standard deviation in parenthesis.

	Young driver clusters (n = 643)							
	1 (n = 87)	2 (n = 84)	3 (n = 106)	4 (n = 115)	5 (n = 115)	6 (n = 136)	F	η^2
Satisfaction with: (1 = very dissatisfied, 7 = very satisfied)								
The campaign in general	5.00 (1.28)	4.44 (1.28)	5.31 (1.17)	4.97 (1.16)	4.83 (1.19)	4.63 (1.33)	6.2***	0.05
Posters and videos	4.86 (1.31)	4.12 (1.37)	5.07 (1.25)	4.79 (1.23)	4.55 (1.37)	4.54 (1.37)	5.8***	0.04
Information during the visit at the school	5.53 (1.31)	4.80 (1.32)	5.68 (1.12)	5.47 (1.21)	5.17 (1.32)	5.02 (1.42)	6.8***	0.05
The way you own school have prioritised the campaign	4.40 (1.62)	4.17 (1.30)	4.51 (1.44)	4.72 (1.52)	4.04 (1.48)	4.39 (1.42)	3.0**	0.02
Did you find the campaign:								
Uninteresting– Interesting	5.94 (1.25)	4.92 (1.56)	6.21 (.98)	5.86 (1.19)	5.71 (1.29)	5.39 (1.39)	12.0***	0.09
Meaningless– Meaningful	6.17 (1.18)	5.36 (1.46)	6.30 (.94)	6.16 (1.00)	5.91 (1.14)	5.74 (1.38)	7.9***	0.06
Boring – Funny	4.40 (1.28)	3.79 (1.48)	4.31 (1.22)	4.19 (1.41)	4.10 (1.35)	4.33 (1.43)	2.3*	0.02
Disappointing – Giving	5.42 (1.27)	4.46 (1.48)	5.60 (1.18)	5.27 (1.29)	5.12 (1.30)	5.02 (1.23)	8.1***	0.06
Negative – Positive	6.13 (1.28)	5.39 (1.33)	6.49 (.94)	6.09 (1.28)	6.01 (1.11)	5.74 (1.31)	8.6***	0.07
Did not concern me at all – Concerned me highly	5.41 (1.45)	4.67 (1.50)	5.29 (1.45)	4.95 (1.47)	4.94 (1.50)	4.61 (1.59)	4.4**	0.04

* $p < .05$, ** $p < .01$, *** $p < .001$. All scores have a range from 1 – 7. A high score on all measures reflects a positive evaluation of the campaign.

Evaluation of the campaign by cluster

The second stage of the analysis was to examine how the different clusters evaluated the campaign. The following analyses are based on only a small group of the respondents (n = 643), who were asked to evaluate the campaign after they had been visited by the campaign team at their school.

Table 3 presents ratings of different aspects of the safety campaign. In general, the drivers in the different clusters seemed to be fairly satisfied with the campaign. They were most satisfied with the information they had received during the campaign's visit at the school. On the other hand, they were least satisfied with the way their own school had prioritised the campaign. That is, the respondents were least satisfied with the traffic safety projects that were carried out at their respective schools after the campaign team had visited them (see Introduction for the description of the campaign).

The respondents were also asked to report their reactions pertaining to the content of the campaign. On the whole, they seemed to rate the campaign favourably. The majority considered it to be meaningful, interesting and positive. However, the scores indicate that not all of the drivers felt that the campaign concerned them highly.

Although the η^2 values indicate that in general there were small differences between the clusters, the analysis detected significant differences in mean scores between the clusters. Post hoc tests revealed that Cluster 2 (one of the high-risk groups) had significantly lower scores than the other clusters on eight of the ten ratings. This suggests that the individuals in Cluster 2, on average, were less satisfied and evaluated the campaign less favourably than the others. In particular, they were more likely to find the campaign "boring", "disappointing", and felt that the campaign did not concern them. Even though Cluster 2 gave the campaign lower ratings than the other clusters, this does not mean that the drivers within this cluster were dissatisfied and evaluated the campaign negatively. The mean scores of Cluster 2 were generally between 4 and 5, which imply that the individuals within this cluster in general were moderately satisfied with the campaign.

Cluster 1 and 3 (the low risk groups) together with Cluster 4 gave consistently higher ratings than the other clusters. Thus, the campaign seemed to appeal most to drivers who were least at risk. Although the scores of Cluster 5 and 6 were not as low as for Cluster 2, the ratings indicate that the campaign did not reach out to

these two groups to the same extent as for Cluster 1, 3 and 4. It is also interesting to note that the drivers in Cluster 2 and 6 felt that the campaign did not concern them to the same extent as for the other clusters.

A one-way analysis of covariance was also carried out in order to examine whether controlling for driving experience would affect the differences in mean scores between the clusters. The results of the analysis demonstrated that this did not happen. Thus, this strengthens the belief that the cluster differences were not caused by differences in driving experience. To sum up, the low-risk groups seemed to be most satisfied and evaluated the campaign more positively than the high-risk groups.

Evaluation of the campaign – gender differences by cluster

Finally, males and females within each cluster were compared on how they responded to the campaign. In short, independent sample t-tests detected significant gender differences within five of the six clusters. No significant differences were found on Cluster 3. In the other clusters female drivers were, on average, more satisfied and more likely to evaluate the campaign positively than males. In particular, this seemed to be the case for Cluster 4, 5 and 6, where females scored higher than males on nine out of the ten ratings ($p < .01$). Cluster 1 and 2 also demonstrated the same pattern in gender differences, females scoring significantly higher on five out of the ten ratings ($p < .05$).

To exemplify this further, a mean score of all six items measuring the respondents' reactions to the campaign were constructed ($\alpha = .901$). Figure 3 pictures gender differences by cluster on this mean score. The pattern in Figure 3 was very similar to the pattern presented in Figure 2. That is, women had on average, higher ratings than men within their respective cluster. However, the profile of the six clusters was very similar for both men and women. That is, both men and women in Cluster 2 tended to give the least positive evaluation of the campaign. On the other hand, Cluster 1, 3 and 4 tended to give the most positive evaluation. Figure 3 also indicates a strong main effect of gender– five of the six clusters of men had a lower mean score on their reactions to the campaign than all of six clusters of women ($p < .01$). No significant difference was found for Cluster 3. The figure also demonstrates that cluster differences were most prominent between the male clusters. Thus, the campaign seemed to appeal most to the women within the different clusters.

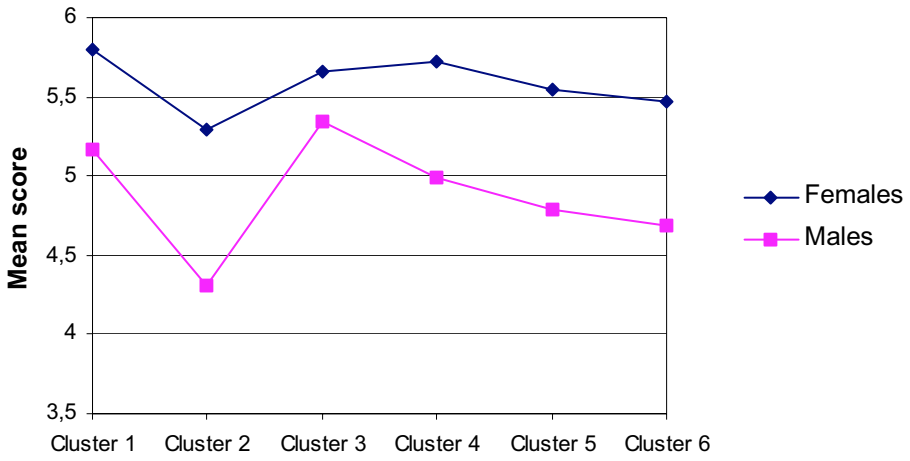

Figure 3. Mean score on respondents' reactions to the campaign. Gender differences by cluster.

Discussion

The cluster analysis found six separate sub-groups of young novice drivers. The clusters were found to differ on several traffic related measures, which indicates that young drivers should not be treated as a homogenous group pertaining to risky driving and accident involvement. Two of the clusters (2 and 5) were characterised as high-risk groups in traffic. It is probably most interesting to review and focus on these groups in the discussion. The first high-risk group (Cluster 2) consisted of mostly men, characterised by low levels of altruism and anxiety, and high levels of sensation-seeking, irresponsibility, and driving related aggression. The members of this cluster reported the most risky driving style, demonstrated risk-taking attitudes and perceived the risk of being injured in a traffic accident as relatively low. In contrast to their relatively high degree of accident involvement, they had high confidence in their own skills as drivers. The second high-risk group reported high sensation seeking, aggression, anxiety, and driving anger, a profile that indicates low levels of emotional adjustment. This group was also labelled as high-risk due

to accident involvement, risky driving behaviour and risk-taking attitudes towards traffic safety. However, the drivers within this cluster did not rate their skills as drivers as particularly good, and perceived the risk of being involved in an accident as rather high. There were also more women than men within this cluster.

The proportion of gender was found to differ within the six clusters, for example, there were 81 % males within Cluster 2 and 84 % females within Cluster 3. Based on this, one of the reviewers of the present paper suggested separate cluster analysis for males and females to examine whether the profiles of the clusters replicate. This is a good point, however, it has not been comprised by the analysis. The main reason is that gender mean scores on the personality variables differ. Such differences make it difficult to interpret the results of the analysis, because it is recommended to standardise the variables prior to the cluster analysis. To standardise the scores for males and females separately, meaning to compare the scores of males and females to the mean and the standard deviation of their respective groups, would cause identical standard scores for males and females to have a different interpretation.

Nevertheless, the inclusion of both males and females in the cluster analysis makes it inevitable to ask whether the differences between the six clusters on the driving related variables were largely attributed to gender. Although the scores indicated that female drivers were, on average, more safety oriented than male drivers within their respective clusters, the clusters had the same profile on the traffic related measures for males and females. This suggests that the same personality characteristics may underlie both male and female risk taking. The risk taking tendencies seemed, however, to be more suppressed among the female drivers. One reason may be that the male drivers assessed their driving ability higher than the female drivers did, which in turn may cause more risk taking among male drivers. Another reason can be differences in gender roles. Simon and Corbett (1996) have suggested that women's traditional gender-role is non-competitive and passive, and that they are expected to avoid risks, while men are encouraged to express competitiveness, anger, and to take risks. This would explain why men engage in risky driving more frequently than women.

The six clusters found in this study have not been named, since it is difficult to obtain an agreed upon definition of the clusters profiles. However, it is tempting to see the resemblance between some of the clusters and the sub-groups the campaign targeted. The profile of Cluster 2 is very similar the campaign's description of the

"normless" group. Cluster 4 and 5 are on some aspects similar to the hypothesised "sensation-seeking" group. Although the campaign especially targeted these sub-groups, the low-risk clusters (1 and 3) were found to be most satisfied with the campaign. In addition, the campaign seemed to appeal to female drivers, especially those in the low-risk groups. Thus, the campaign seemed to appeal most to those who already demonstrated safe driving and ideal attitudes. This is, however, not surprising, since efforts made to persuade others are thought to be most effective when the message tend to reinforce already established attitudes (see, e.g. Sherif & Hovland, 1961).

One may ask oneself whether campaigns of this type are meaningless, since they seem to appeal most to those least at risk. Although the high-risk groups evaluated the campaign less favourably than the low- risk groups, they still seem to evaluate the campaign in a more favourable than unfavourable way. This indicates that the campaign after all may have appealed to the high-risk groups to some extent. The effect of the campaign on attitudes, behaviour, risk perception, and accident reduction is however difficult to determine, since we were not able to follow the same sub-groups over time.

The finding that those who need it most (i.e. Cluster 2 and Cluster 5) are least responsive to safety messages provides a challenge for traffic safety. This result suggest that one should consider alternative measures in addition to the traditional campaign in order to promote safe driving among these high-risk groups. One type of interventions may be rooted in sanctions, such as graduated licensing. That is, restricting driving for adolescents in situations where risky driving is most likely to manifest, for instance at weekend nights. Other sanctions may be increased police surveillance in traffic. However, such sanctions are probably very difficult to enforce. Moreover, it is unlikely that such sanctions reduces the underlying motivation of engaging in risky driving (see e.g. Wilde, 1994).

According to Jessor (1987), interventions should be aimed at the level of lifestyle instead of merely risky driving behaviour in itself. As mentioned in the introduction, studies have concluded that those most likely to display risky driving behaviour are also the ones most likely to engage in other types of risky behaviours (Beirness & Simpson, 1988; Jessor, 1987). Thus, risky driving seems to be related to the syndrome of problem behaviour (Jessor, 1987, Wilson & Jonah, 1988), which in turn is thought to be an aspect of general lifestyle. The profile of the personality variables of the high-risk groups found in this study, especially Cluster

2, is very similar to variables central in Jessor's (1987) problem behaviour theory. According to this view, interventions targeting the level of lifestyle may hold the key to reducing accidents and injuries in traffic for this subtype of drivers. However, the personality traits and lifestyle of this subtype makes it a hard to reach group, which was also demonstrated by their less positive evaluation of the campaign compared to the other subtypes. Moreover, changing adolescents' lifestyles is probably very difficult, and one may ask oneself whether one has the right to change the general lifestyle of others towards a more socially desirable direction. However, one of the reviewers of the present paper made a good point pertaining to this issue. Cars and risky driving is for some young people so central that it can be regarded as the essence of their lifestyle. It is basically such a lifestyle that results in large accident costs for the drivers themselves, for other road users, and for the society in general. These consequences should justify attempting to change their lifestyle more or less radically through interventions.

Traditionally, the strategy for traffic safety campaigns has been to get different kinds of authorities to tell young drivers to drive safe. An alternative intervention strategy is to let young drivers themselves find out the need for behavioural change, and to let them draw their own conclusions about how they could change. This strategy has been used for professional drivers (Brehmer, Gregersen & Morén, 1993). In this study, a group following this strategy reduced their accidents by 50 % compare to a control group. Gregresen & Berg (1994) have suggested that a similar strategy could be used in relation to different high-risk groups of young drivers, that is, identify sub-groups of high- risk adolescents and tailor group discussions according to their preferences. Ideally, this will end up with individual decisions about what and how to change.

This strategy of self-produced, individual decisions has probably the advantage of placing young drivers decisions under personal control, which in the next turn could make them more motivated for behavioural change. This may be especially relevant pertaining to authority defeating adolescents. Moreover, this strategy may also help adolescents to enhance their self-efficacy. That is, to perceive that they have the necessary opportunities and personal resources to perform the behaviour, a perception that is thought to facilitate behavioural change (see, e.g. Ajzen, 1991). Although the campaign the present study is based on included traffic safety projects completed in classes, the manual for this project had been developed by others than the adolescents themselves. Thus, the project may have addressed issues that the adolescents regarded as unimportant.

One of the high-risk groups (cluster 5) reported high levels of aggression, anxiety and driving anger. This suggests that emotional factors and probably lack of control over these are related to risky driving style. For instance, becoming frustrated and angry in traffic situations can easily trigger responses such as speeding and rule violations. Other responses may be self-assertion when driving with other teenagers. Information about the risk of accidents or to tell them to change attitudes and behaviour is probably not the best intervention strategy for this cluster. A more relevant intervention for this group may be to focus on the control on emotions in traffic situations, and factors that can trigger such emotional reactions. For instance, a driver training program in Germany has focused on how to deal with emotional responses in traffic, like self-assertion when driving with others, and dealing with impatience and frustration in traffic (Heinrich, 1993, cited in Williams, 1998). Although this program has not been formally evaluated, it represents an alternative way of thinking in traffic safety promotion. A related intervention strategy has recently been applied by Deffenbacher et al. (2000), who applied physical and cognitive relaxation interventions to reduce driving anger among high-anger drivers. The results showed significant reduction in both driving anger and risky driving behaviour among these drivers, whereas a control group showed no reduction.

All of the above mentioned suggestions for road safety interventions have, however, focused on measures aimed at influencing the adolescent driver directly. An alternative strategy is to influence the driver indirectly through focusing the role of social environment surrounding the driver. Since the attitudes and behaviour of high-risk drivers seems difficult to reach directly trough traditional campaigns, an alternative way to change their behaviour can be to exercise social control, for instance by encouraging passengers to reduce the risk taking of the driver. Some traffic safety campaigns have aimed at encouraging peer influence in order to promote safe driving. For instance, the "Peer Intervention Program" (McKnight & McPerson, 1985) aimed at motivating and enabling US high school youth to intervene in the drinking and driving of their peers. Another example is the "Let it be known!" (Norwegian: "Si i fra!") campaign carried out among Norwegian adolescents (Amundsen, Elvik & Fridstrøm, 1999). The primary aim of the campaign was to encourage teenage car passengers to let the driver know that they felt unsafe in the car, that is, verbally try to prevent unsafe driving.

The present study identified six separate sub-groups of young drivers based on cluster analysis. Cluster analysis has, however, been criticised of testing no specified hypothesis, and being too subjective and depended on the researcher's choice of variables, as well as on different clustering methods. For instance, Cormarck consider that "Cluster analysis has lead to waste of more valuable time than any other statistical innovation" (Cormarck, 1971, cited in Everitt, 1993). However, it is important to note that even though cluster is based on a set of rules, it is not aimed at giving an "objective" representation of reality. It is largely judged on the usefulness of the results, interpretability, replicability, and stability. The analysis intends to generate rather than testing hypotheses (Everitt, 1993). Thus, the clusters found in this study should not be regarded as an objective classification of young drivers.

Nevertheless, the different clusters identified were interpreted as meaningful and useful, especially since the clusters differed on several traffic related measures. Different clustering methods also demonstrated almost identical profiles of the six-cluster solution. Moreover, the profiles of the high-risk clusters were very similar to high-risk groups found in previous studies aimed at identifying subtypes of drivers (Deery & Fildes, 1999; Donovan et al., 1988; Wilson, 1991). This is also encouraging, since the cluster analysis was not based upon variables identical to the ones used in the previous studies. This also indicates that the high-risk groups have similar profiles in different cultures. One major difference is, however, the relatively high proportion of female drivers in the high-risk group characterised by high aggression and driving anger (Cluster 5). This is, however, not so surprising since driving anger was the only traffic related measure used to classify the drivers into clusters. Lajunen, Parker & Stradling (1998) have found no gender difference on driver anger among younger drivers, which suggests that gender differences regarding aggression and anger on the road are not so prominent, at least among young drivers. Still, the female drivers with these characteristics seemed to suppress their aggressive tendencies in relation to driving behaviour to a greater extend than the male drivers. Thus, the female drivers were not high-risk drivers to the same extent as males within this cluster.

To sum up, the results of the present paper indicate that specific combinations of personality traits are related to young drivers' risky driving and accident involvement. In particular, this seems to be the case for young male drivers. The results also suggest that different intervention strategies may be needed for the different subtypes of young drivers. Further research aimed at evaluating

intervention strategies most efficient to reach these different subtypes might be desirable, as well as further suggestions for alternative road safety intervention strategies.

References

Ajzen, I. (1991). The theory of planned behaviour. *Organizational Behaviour and Human Decision Processes*, 50, 179-211.

Aldenderfer, M.S. & Blashfield, R.K. (1984). *Cluster Analysis*. Newbury Park, CA: Sage Publications.

Amundsen, A., Elvik, R. & Fridstrøm, L. (1999*). "Virkninger av "Sei i frå" kampanjen i Sogn og Fjordane på antall skadde og drepte i trafikken [Effects of the "Let it be known!" campaign in Sogn and Fjordane on the number of injured and killed persons in traffic]"* (Rep. No. 425). Oslo, Norway: Institute of Transport Economics.

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.

Beirness, D.J. & Simpson, H.M. (1988). Lifestyle correlates of risky driving and accident involvement among youth. *Alcohol, Drugs and Driving, 4*, 193-204.

Bjørnskau, T. (2000). *Road Traffic Risk in Norway 1997/98.* (Rep. No. 483). Oslo, Norway: Institute of Transport Economics.

Brown, I.D. & Groeger, J.A. (1988). Risk perception and decision taking during the transition between novice and experienced driver status. *Ergonomics, 31*, 585-597.

Brehmer, B., Gregersen, N.P. & Morén, B. (1993). *Group Methods in Safety Works.* Uppsala: Department of Psychology, University of Uppsala.

Cormarck, R.M. (1971). A review of classification. *Journal of Royal Statistical Society, 134*, 321-367.

Costa, P.T.jr., McCrae, R.R. (1992). *Revised NEO Personality Inventory (NEO-PI-R) and NEO Five Factor Inventory (NEO-FF-I). Professional Manual*. Odessa: Psychological Assessment Resources Inc.

Deery, H.A. (1999). Hazard and risk perception among young novice drivers. *Journal of Safety Research, 30*, 225-236.

Deery, H.A. & Fildes, B.N. (1999). Young novice driver subtypes: relationship to high-risk behaviour, traffic accident record, and simulator driving performance. *Human Factors, 41*, 628-643.

Deffenbacher, J. L., Huff, M. E., Lynch, R. S., Oetting, E. R. & Salvatore, N.F. (2000). Characteristics and treatment of high-anger drivers. *Journal of Counseling Psychology, 47*, 5-17.

Deffenbacher, J.L., Oetting, E.R., Lynch, R. (1994). Development of a driving anger scale. *Psychological Reports, 74*, 83-91.

Donovan, D.M., Umlauf, R.L., Salzberg, P.M. (1988). Derivation of personality subtypes among high-risk drivers. *Alcohol, Drugs and Driving, 4*, 233-244.

Elander, J., West, R., French, D. (1993). Behavioural correlates of individual differences in road-traffic crash risk: An examination of methods and findings. *Psychological Bulletin, 113*, 279-294.

Evans, L. (1991). *Traffic Safety and the Driver*. New York: Van Nostrand Reinhold.

Everitt, B. S. (1993). *Cluster Analysis*. (3.ed). London: Edward Arnold.

Gregersen, N. P. & Berg, H. Y. (1994). Lifestyle and accidents among young drivers. *Accident Analysis and Prevention, 26*, 297-303.

Gregersen, N.P. & Bjurulf, P. (1996). Young novice drivers: Towards a model of their accident involvement. *Accident Analysis and Prevention, 28*, 229-241.

Groeger, J.A & Brown, I.D. (1989). Assessing one's own and others' driving ability: Influence of sex, age, and experience. *Accident Analysis and Prevention, 21*, 163-168.

Jessor, R. (1987). Risky driving and adolescent problem behaviour: Theoretical and empirical linkage. In Benjamion, T. (Ed.), *Young drivers impaired by alcohol and other drugs* (pp.97-110). London: Royal Society of Medicine Services.

Jonah, B.A. (1986). Accident risk and risk-taking behaviour among young drivers. *Accident Analysis and Prevention, 18*, 255-271.

Jonah, B.A. (1997). Sensation seeking and risky driving: A review and synthesis of the literature. *Accident Analysis and Prevention, 29,* 651-665.

Kohn, M., Schooler, C. (1983). *Work and Personality: An Inquiry into the Impact of Social Stratification*. New York: Norwood Ablex.

Lajunen, T., Parker. D. & Stradling, S.G. (1998). Dimensions of driving anger, aggressive and highway code violations and their mediation by safety orientation in UK drivers. *Transportation Research Part F, 1*, 107-121

Lajunen, T. & Summala, H. (1995). Driving experience, personality, and safety-motive dimensions in drivers' self-assessments. *Personality and Individual Difference, 19*, 307-318.

McKnight, A. J. & McPerson, K. (1985). Evaluation of peer intervention training for high school alcohol safety education. *Accident Analysis and Prevention, 18*, 339-347.

Milech, D., Glencross, D., Hartley, L. (1989). *Skill Acquisition by Young Drivers: Perceiving, Interpreting and Responding to the Driving Environment* (Rep. No. MR4). Canberra: Federal Office of Road Safety.

Millstein, S.G. (1993). Perceptual, attributional, and affective processes in perceptions of vulnerability through the life span. In Bell, N.J. & Bell, R.W. (Eds.), *Adolescent Risk Taking* (pp 55-65). London: Sage Publications.

Moe, D. (1986). *Young Drivers. Relation Between Perceived and Real Ability. Behavioural Studies* (Rep. No. STF63 A92002). Trondheim, Norway: SINTEF Samferdselsteknikk.

Milligan, G. W. & Sokol, L. M. (1980). A two-stage clustering algorithm with robust recovery characteristics. *Educational and Psychological Measurement*, 40, 755-759.

Rundmo, T., Ulleberg, P. (2000). *"Var Det Vært Det? Evaluering av 18-40 Aksjonen. Resultatrapport [Evaluation of the 18-40 Campaign. Main report]"* (Rep. No. 43). Trondheim. Norway: Rotunde publications.

Simon, F., & Corbett, C. (1996). Road traffic offending, stress, age, and accident history among male and female drivers. *Ergonomics, 39*, 757-780.

Sherif, M. & Hovland, C.I. (1961). *Social Judgement: Assimilation and Contrast Effects in Communication and Attitude Change*. New Haven, CT: Yale University Press.

Summala, H. (1987). Young drivers accidents: Risk taking or failure of skills*? Alcohol, Drugs and Driving, 3*, 79-91.

Ulleberg, P., & Rundmo, T. (in press a): Personality, attitudes and risk perception as predictors of risky driving behaviour among young drivers. *Safety Science*, in press.

Ulleberg, P., & Rundmo, T. (in press b). Risk-taking attitudes among young drivers: The psychometric qualities and dimensionality of an instrument to measure young drivers' risk-taking attitudes. *Scandinavian Journal of Psychology*, in press.

Underwood, G., Chapman, P., Wright, S., & Crundall, D. (1999). Anger while driving. *Transportation Research Part F, 2*, 55-68.

West, R. & Hall, J. (1997). The role of personality and attitudes in traffic accident risk. *Applied Psychology: An International Review, 46*, 253-264.

Wilde, G.S. (1994). *Target Risk: Dealing with the Dangers of Death, Disease and Damage in Everyday Decisions*. Toronto, Canada: PDA publications.

Williams, A. F. (1998). Risky driving behaviour among adolescents. In Jessor, R. (Ed.), *New Perspectives on Adolescents Risk Behaviour* (pp. 221-237). New York: Cambridge University Press.

Wilson, R.J. (1991). Subtypes of DWIs and high risk drivers: Implications for differential intervention. *Alcohol, Drugs and Driving, 7*, 1-12.

Wilson, R.J. & Jonah, B. (1988). The application of problem-behaviour theory to the understanding of risky driving. *Alcohol, drugs and Driving, 4*, 173-191.

Wishart, D. (1999). *Clustan Graphics Primer: A Guide to Cluster Analysis*. Edinburgh: Clustan limited.

Wishart, D. (2000). *FocalPoint Clustering User Guide*. Edinburgh: Clustan limited.

Yagil, D. (1998). Gender and age differences in attitudes toward traffic laws and traffic violations. *Transportation Research Part F, 1*, 123-135.

Zuckerman, M. (1979). *Sensation Seeking: Beyond the Optimal Level of Arousal*. New York: John Wiley & Sons.

Paper IV: Social influence from the back seat

Transportation Research Part F, Traffic Psychology and Behaviour,

submitted for publication

Paper IV

Social influence from the back-seat: Factors related to adolescent passengers' willingness to address unsafe drivers

Pål Ulleberg
Department of Psychology
Norwegian University of Science and Technology
7491 Trondheim
Norway

Abstract

The aim of the present paper was to examine factors that may affect the likelihood of adolescent passengers asking a driver to driver more carefully when they feel unsafe as a car passenger. The paper is based on a questionnaire survey carried out among 4397 Norwegian adolescents. The respondents were asked how often they requested the friend they most frequently rode with to drive more carefully when they felt unsafe in the car. The results showed that the factors influencing adolescents' willingness to address unsafe driving were several. Female passengers were most likely to report that they spoke out to the driver when feeling unsafe in the car. This could to some extent be explained by gender differences in certain beliefs. That is, males seemed to perceive more negative consequences of addressing unsafe drives, to be less confident in their ability to influence an unsafe driver, to be more likely to accept risk taking from other drivers, and perceive less risk than females. In turn, these beliefs affected the likelihood of confronting an unsafe driver. Passengers disposed to experience anxiety felt most unsafe in their friend's car, an experience that increased the tendency of addressing unsafe driving. The results also demonstrated that a relatively large proportion of the adolescents thought that it was acceptable to ride with an unsafe driver. This kind of belief lessened the likelihood of passengers addressing unsafe driving, as well as being most prominent among those who rode with friends who displayed the most risky driving style. Possible implications for traffic safety promotion are discussed.

Introduction

The negative effect of teenage passengers on young drivers' accident involement and risk taking in traffic

It is well known that young drivers are more frequently involved in traffic accidents compared to drivers more of age (Bjørnskau, 2000; Laapotti, Keskinen, Hatakka, & Katila., 2001). The pattern typical for adolescent traffic accidents is also different from that of other age groups. Driving off the road and head-on collisions with meeting vehicles are the most common accidents. Typically, these accidents are caused by speeding and loss of control over the vehicle (Michels & Schneider, 1984; Tränkle, Gelau & Metker, 1990). Furthermore, the crash risk tends to increase when young drivers are accompanied by passengers their own age, especially during night-time driving in weekends (Drummond & Triggs, 1991; Williams & Wells, 1995). Studies have estimated the accident risk to be doubled with one passenger present, and further augmented as the passenger number is increased (Doherty, Andrey, & MacGregor, 1998; Preusser, Fergurson & Williams, 1998; Chen, Baker, Braver & Guohua, 2000). This negative effect of driving with passengers has not been found for other age groups (Preusser, Fergurson & Williams, 1998; Reiβ & Krüger, 1995).

The question is thus why this finding is particular for this young age group. It may be claimed that as young drivers are inexperienced, the presence of passengers as such causes a distraction of the driver, and hence, driver errors. However, studies indicate that young drivers are affected differently pertaining to the passengers' age and sex. Arnett, Offer and Fine (1997) found that young drivers tended to drive faster and take more risk in traffic when they were accompanied by peers than when their parents were present. As a result, Chen et al. (2000) concluded that drivers aged 16-17 were more likely to die in traffic accidents when accompanied by passengers aged 16 to 29 years than when carrying passengers 30 years of age or older. The risk of being killed was further doubled when the young passenger was male.

In sum, several studies indicate that young drivers are more prone to risky driving and its consequences when accompanied by passengers their own age. One possible reason is the social influence from the passengers. This type of peer influence may be explicit or implicit. Through explicit influence, passengers may urge the driver to speed up, to overtake, or to conduct other risky acts in traffic.

Implicit influence works through the process of normative social comparison. This means that people tend to compare their attitudes and own behaviour to the perceived norms of a reference group of other persons (Festinger 1950, 1954). Perceived discrepancies tend to motivate a change towards consistency with the norms of the reference group, creating a pressure to conform to the norms of the peer group. According to the Theory of Planned Behaviour, this type of normative belief is thought to exert most influence on behaviour when the individual is motivated to comply with these referents (Ajzen, 1991).

Explicit as well as implicit social influence may be particularly problematic for young drivers. Adolescents, especially males, usually show preferences towards risk-taking behaviour in traffic (Harré, Field & Kirkwood, 1996; Jessor, 1987). Moreover, Näätänen and Summala (1976) has found that young men's assessment of a person's driving skills is not so much related to safe driving as to the willingness to drive fast and overtake. This provides an outlet for so called "extra motives" while driving, such as showing off one's driving skills to one's peers or one's girlfriend. Papadakis and Moore (1991) have suggested that young men use the trying out of manoeuvres beyond their skills (speeding etc.) as an aid in the building of their identities. This is probably especially relevant in cultures where risk taking is part of the construction of manliness. Similarly, Keskinen (1996, cited in Laapotti et al., 2001) have propose that drivers usually get their driver license at an age where adult identity still is under construction, and that feedback and appreciation therefore is of higher importance at this time. Young drivers, particularly males, may for this reason experience an implicit pressure to conform to the peer group's presumed risk-taking preferences, therefore attempting to impress their peer passengers by driving recklessly. This assumption is supported by Harré et al. (1996), who found that compared to young females young males were more likely to conform to the perceived unsafe driving norms of their friends.

The potential positive effect of teenage passengers on young drivers risk taking in traffic

Although young drivers in general seem to be more prone to risk taking when accompanied by peer passengers, the social influence of peers can also motivate safe driving practices. Brown (1998) found that drivers who believed that their friends would disapprove of drinking and driving, were less likely to drive under the influence of alcohol. Corresponding results have been found in a study of Swedish male drivers (Åberg, 1993). Furthermore, Parker, Manstead, Stradling, Reason and Baxter (1992) concluded that normative beliefs plays a key role in

drivers' intention to commit driving violations such as speeding, dangerous overtaking, close following, and driving under the influence of alcohol. They found that drivers who believed that significant others would disapprove of them committing violations, and at the same time, felt motivated to comply to these referents, reported less intentions to commit violations. They also found that younger drivers felt less disapproval from others from committing violations compared to drivers more of age. However, younger drivers were at the same time more motivated to comply with the perceived wishes of their referents. The authors concluded that publicity campaigns aiming to reduce the risky driving of young drivers should highlight the disapproval of their peers and referents.

Thus, highlighting the role of peers involved in the driving situation may be beneficial in order to promote safe driving. Based on the observation that people tend to trust others who are similar to themselves, several studies and literature reviews emphasise the use of social influence to motivate people to change their attitudes and behaviour (Bandura, 1986; Edwards, Tindale, Heath & Posavac, 1990). According to Tindale (1995), peers are particularly suited for reaching young people. They usually regard peers as more credible, since peers are more capable of understanding the thoughts of young people. They also tend to model the peers' behaviour more easily as compared to adults (and authorities in general). The latter notion is also supported by social cognitive theory, which suggests that people more easily tend to imitate a behaviour if a model appears to be a realistic figure for self comparison (Pervin, 1989).

Some traffic safety campaigns have focused on this type of positive peer pressure. For example, the "Peer Intervention Program" (McKnight & McPerson, 1985) employed role-playing to motivate and enable US high school to intervene in the drinking and driving of their peers. An evaluation of the program concluded that it had lead to a significant increase in self reported intervention behaviour (McKnight & McPerson, 1985).

Another example is the "Speak Out!" (Norwegian: Si i Fra!") campaign carried out among Norwegian adolescents. The primary aim of the campaign was to encourage teenage car passengers to let the driver know that they felt unsafe in the car, that is, verbally try to prevent unsafe driving. Alternatively, they were encouraged to choose other means of transportation. An evaluation of the campaign carried out five years after its implementation, concluded that it had resulted in a 30 % reduction of adolescent passengers injured or killed in car accidents (Amundsen,

Elvik & Fridstrøm, 1999; Elvik, 2000). However, the number of young car drivers injured or killed was not reduced (the campaign did thus not succeed in reducing risky driving among young drivers, although it did reduce young passengers putting themselves at risk). A possible explanation is that the campaign had not helped the teenage passengers to prevent unsafe driving by voicing their opinion in a driving situation, but rather to choose the alternative strategy of choosing other means of transportation. From this, one may conclude that future campaigns need to avoid this pitfall in order to reach the goal of reducing risky driving.

Factors hypothesised to influence adolescent passengers' willingness to address unsafe driving

The primary aim of this study is to examine both factors that act as barriers against, as well as factors that may enhance adolescent passengers' willingness to confront unsafe drivers. To the author's knowledge there have been no studies within this area. Most studies focus upon the adolescent driver rather than the passenger. Nevertheless, the theories of driving behaviour, as well as findings from neighbouring research areas can be a basis when starting to identify such passenger factors.

The principle of behavioural adaptation has been the focus of two major theories of driver behaviour, the zero-risk theory proposed by Näätänen and Summala (1974, 1976) and the risk homeostasis theory developed by Wilde (1982). In their zero-risk theory, Näätänen and Summala (1974, 1976) introduced the concept of a subjective risk monitor, meaning a monitor that can generate different degrees of subjective risk or fear depending on the risk experienced in the traffic situation. The driver is normally thought to be motivated to escape or avoid this experience (e.g. by reducing speed while driving), in order to feel no risk.

Contrary to the zero-risk theory, Wilde's risk homeostasis theory (Wilde, 1982) suggests that a driver has an accepted a level of optimal risk (i.e. target risk), which guide his or her behaviour. This target risk is dependent upon the driver's knowledge of the accident rate. Whenever there is a discrepancy between the target risk and the risk experienced, this will lead to behavioural changes reducing this discrepancy.

Although the two theories thus provide somewhat different explanations of driving behaviour, both predict that a feeling of risk may motivate passengers to address unsafe driving. Based on the risk homeostasis theory, a passenger is expected to be most likely to address unsafe driving when he or she perceives that the driver is taking risks greater than the target risk of the passenger. Based on the zero-risk theory, it is expected that a passenger will be more likely to address unsafe driving when experiencing risk and fear. This feeling of risk is expected to be more prominent among car passengers than drivers, because being a passenger implies having lower control over potentially risky traffic situation than the driver. Low control will, according to the zero-risk theory, easily result in an experience of risk (Näätänen & Summala, 1974,1976). This is supported by studies that have found subjects to perceive the risk of being involved in traffic accidents to be greater when being a passenger than when driving themselves (Bragg & Finn, 1982, McKenna, 1993).

Adolescents are found to differ in their safety orientation in traffic (Harré, Field & Kirkwood, 1996). This kind of safety orientation can be expected to reflect itself in adolescent passengers' acceptance of riding with unsafe drivers, as well as the willingness to address such drivers. Passengers who themselves think that it is acceptable to ride with a driver who violates traffic rules can therefore be expected to be more likely to refrain from addressing an unsafe driver than a passenger who belives the opposite.

The experience of risk, as well as safety orientation in traffic, is expected to be influenced by personality characteristics. Personality characteristics are of interest in the present study because they, through influencing perceptions, cognitions, and behaviour, can have both direct and indirect effects on a passenger's motivation to address unsafe driving. The most relevant personality characteristics in this context include sensation seeking, social deviance, and anxiety, characteristics that are associated with drivers' risk-taking and accident involvement (see, e.g. Jonah, 1997; Ulleberg & Rundmo, in press a; Wilson & Jonah, 1988; West & Hall, 1997). Sensation seeking is of interest because some passengers may be motivated to seek out the excitement unsafe driving causes. Social deviance is of importance because passengers scoring high on such measures imply that they have a general acceptance of rule-violating behaviour. The interest of anxiety is primarily due to the emotional nature of a person's subjective feeling of risk, as assumed in the zero-risk theory.

Although a passenger may be motivated to eliminate or reduce his or her experience of risk while driving, this is no guarantee for the passenger to actually request a driver to drive more safely. It is likely that some passengers may refrain from confronting an unsafe driver due to the perceived cost of such an action. Such cost can be understood as the expectation of negative social sanctions from others, in this case, the driver and others passengers in the car. The passenger may thus fear that his or her attempts to address unsafe driving may result in personal rejection, such as becoming unpopular or being regarded as a coward. Perceived costs of this kind motivate the passenger to conform to the norms of the driver or the peer group. Several studies have found the perceived costs of action to reduce the likelihood of a person performing various health related behaviours (see Harrison, Mullen & Green, 1992, for a meta-analysis).

Another barrier may be a low confidence in the ability to influence the driver. Such a feeling of powerlessness is thought to derive from beliefs about low personal control over the outcomes of one's actions. This has been labelled a belief in an external locus of control by Rotter (1966). Similarly, low confidence in one's ability to carry out an action in order to reach a desired outcome, or low sense of personal self-efficacy (Bandura, 1986), may underlay such passivity. Backing up such hypotheses is research finding external locus of control, or low sense of self-efficacy, to decrease the likelihood of performing the behaviour in question (see e.g. Schwarzer & Fuchs, 1996, for a review).

The gender of the passenger is also thought to be of importance in defining the likelihood of a passenger speaking out to unsafe drivers. A range of studies have found young females to be more safety oriented, less prone to risk taking in traffic, and less involved in traffic accidents as compared to young males (see e.g. Harré et al., 1996; Laapotti et al., 2001; McKenna, Waylen & Burkes, 1998). The greater tendency of young females to be more safety orientated in traffic can thus be expected to be reflected in a greater tendency to confront unsafe driving. Attempts to address unsafe driving may also be more problematic for young males because they, as previously mentioned, may feel an implicit pressure to conform to the presumed risk-taking preferences their male peer group.

Aims of the study

To sum up, the present study aims at examining whether:

- The experience of risk or fear while driving will result in passengers asking drivers to drive more carefully
- Passengers finding it acceptable to ride with drivers who violate traffic rules will be likely to refrain from addressing unsafe driving
- The expectation of negative sanctions from peers will reduce the likelihood of passengers addressing unsafe driving
- Passengers' confidence in their ability to influence drivers will increase the likelihood of them confronting unsafe drivers
- Personality characteristics of the passenger will influence the likelihood of addressing unsafe driving
- Young female passengers will be more likely to speak out to unsafe drivers than young males

Method

Sample

A questionnaire survey was carried out among 5970 adolescents in Norway in the period between 1998-2000. A total of 5075 respondents returned the questionnaire, yielding a response rate of 85 %. The survey was conducted in relation to a road safety campaign initiated by the Norwegian Authorities of Public Roads (Statens Vegvesen) in cooperation with the Police department, the Norwegian Society of Road Safety (Trygg Trafikk) and the Traffic Safety Committees of two Norwegian counties. The sample consisted of randomly selected high school classes from within these two Norwegian counties. The questionnaires were completed individually at the participating schools.

Since the present paper focuses on adolescent passengers, adolescents who reported that they never rode with peer drivers (n = 644) were excluded from further analyses. Furthermore, 34 respondents were removed due to implausible answers. The present study does thus rely on the remaining 4397 respondents. Of these, 56 % were women and 44 % were men. The mean age of the respondents was 18,5 years of age (modal 18 years of age) and the age ranged from 16 to 23 years.

Measures

The questionnaire included several sections measuring attitudes, behaviour, risk perception, and personality. Only the parts of the questionnaire relevant to the research question of the present paper are described here. For a further description of the total questionnaire, see Rundmo and Ulleberg (2000).

Measures related to the peer driver whom the respondents most frequently rode with

One section of the questionnaire consisted of questions pertaining to the friend whom the respondents most frequently caught a ride with (all items are listed in Table 2). First, the respondents were asked how often they were passengers in this friend's car, ranging from never to very often. This question was included in order to exclude the respondents who did not ride with another driver from the study. It was also used as to control for the exposure the remaining respondents had as a passenger in this friends' car in further analyses.

Second, the respondents were asked how much stress they felt as a passenger when they were riding with this friend. A seven-point scale ranging from no stress to very much stress was applied for this purpose. This measure was included as an indicator of how uncomfortable and fearful the passengers felt when riding with this friend, hence, an estimate of subjective risk.

Third, they were asked how often this friend took various risks in traffic when they accompanied him or her as a passenger. The risks included speeding, dangerous overtaking, close following, running red lights, and running yellow lights. These items were used in order to construct a measure of the friend's risk-taking behaviour in traffic.

Finally, three items were included to measure how frequently the respondent's addressed the friend's driving when they felt unsafe as a passenger. These included how often they addressed the friend when he or she was speeding, following too closely, and how often they refrained from addressing unsafe driving when they felt unsafe in the car. The response formats of the questions were never, seldom, sometimes, often, and very often.

Passengers' acceptance of riding with an unsafe driver, perceived barriers against addressing unsafe drivers, and risk perception

Four items measured the respondents' general acceptance of riding with drivers who violate traffic rules. This measure was previously developed by Ulleberg and Rundmo (in press b, see also Rundmo & Ulleberg, 2000). All items were answered on five point Likert scales, and are listed in Table 2.

Two measures were applied to assess the respondents' perceived barriers against addressing unsafe drivers. The first measure consisted of four items, all focusing the perceived cost of asking a driver to drive more carefully. This measure was previously developed by Ulleberg and Rundmo (in press b). The second measure intended to assess the respondents' confidence in their ability to influence other drivers' behaviour. This measure was labelled "powerlessness" since it was constructed through a rewriting of four items from Seeman's Powerlessness scale (1974, in Robinson, Shaver & Wrightsman, 1991). All items were answered on five point Likert scales, and are listed in Table 2.

The respondents were also asked to rate their subjective judgement of the risk of being injured in a traffic accident. Two items were applied for this purpose, one pertaining to how unsafe they felt, and one related to how worried and concerned they felt of being injured in a traffic accident. Both evaluations were made on a scale ranging from 1 to 7, a high score indicating that the respondents felt unsafe or worried.

Personality measures

Sensation-seeking and anxiety were assessed using facets from the NEO-Personality Inventory (Costa and McCrae, 1992), each facet consisting of eight items. Normlessness, which is a measure of social deviance, was measures using Kohn and Schooler's (1983) Normlessness scale. This scale consisted of four items. All items were answered on five point Likert scales ranging from "strongly agree" to "strongly disagree". As recommended by the developers of these measures, a mean score was constructed on the basis of the items within each facet or scale.

Statistical analyses

Descriptive statistics was used to picture the respondents' ratings on the various traffic related measures. In order to examine possible gender differences on these measures, the mean scores of men and women were compared using t-tests. Cohen's d (Cohen, 1988) was estimated to give an indication of how large the gender differences were on the traffic related measures,. The d-value is an indication of effect size; in this case the effect of gender on the various traffic related measures. According to Cohen (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.

The impact of the different predictor variables hypothesised to influence passengers' willingness to speak out against unsafe driving was estimated using structural equation modelling. The covariance matrix of the variables was analysed by means of the LISREL 8.30 Program (Jöreskog and Sörbom, 1993). Missing cases were deleted listwise. 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), the root mean square error of approximation (RMSEA), and the expected cross-validiation index (ECVI). Traditionally, a GFI, an AGFI, and a CFI above .90 have been an agreed cut-off criteria, indicating a close fit between the model and the data (Hu and Bentler, 1995; Loehlin, 1998). However, Hu and Bentler (1999) later concluded that the CFI should be close to .95 in order to claim a good fit between the hypothesized model and the observed data. An RMSEA of .05 or less is also thought to indicate a very good model fit, and the lower ECVI value the better the fit (Browne and Cudeck, 1993¸ Loehlin, 1998).

Results

Table 1 shows descriptive statistics and gender differences on the various driving related measures. Both males and females reported being a passenger in their friend's car relatively often, particularly the female respondents. The measure of stress had a low mean score and was positively skewed, indicating that the majority of the respondents reported low levels of stress when they were riding with their friend. Males were slightly more prone to experience this type of stress than females, but the difference was rather small (d = -0.12). Male respondents were also most likely to report that their friend violated traffic rules while driving.

The mean score on powerlessness indicated that most of the respondents felt moderately confident in their ability to influence other drivers. In general, they also perceived the cost of addressing unsafe driving as relatively low. Gender differences on these two measures indicated that males, on average, felt less confident in their ability to influence other drives and perceived more costs if doing so than females did. The majority of the respondents seemed to think that it was fairly acceptable to get into a car with an unsafe driver. This belief was most prominent among the male respondents.

A sizeable gender difference was found on subjective risk ($d = 0.57$). Most females seemed to perceive the risk of being injured in a traffic accident as relatively high, whereas males in general were less concerned about this risk. A large gender difference was also found on how frequently the respondents addressed their friends driving ($d = 0.65$). Females' reported that they more often confronted their friend's unsafe driving than males did. It is, however, important to note that there were relatively large individual differences in this reported frequency. In order to investigate factors that may explain the differences in the frequency of addressing unsafe driving, a structural equation modelling analysis was performed.

Figure 1 shows the structural model, illustrating factors hypothesised to influence passengers' willingness to speak out to unsafe drivers. In order to make Figure 1 clearer, only the structural relationships between the variables are presented. The measurement model of the latent variables is instead presented in Table 2. Only the standardised path coefficients of significant paths ($p < .01$) are shown in Figure 1.

The hypothesised causal relationship between the different variables can be described as follows. Gender and the personality variables were hypothesised to have both direct and indirect effects on how often the passengers addressed their friend's unsafe driving. The indirect effects were thought to occur through influencing perceived costs, confidence in ability to influence a driver, attitude towards riding with unsafe drivers, and subjective risk. These were in the next turn hypothesised to affect the passengers' likelihood of addressing unsafe driving. The friend's risk-taking behaviour in traffic was also hypothesised to have both indirect and direct effects. If the friend frequently violated traffic rules, this was hypothesised to contribute to experience of stress, as well as to how often the respondents were passengers in their respective friend's car. In turn, stress and passenger frequency were expected to increase the likelihood of addressing the friend's unsafe driving.

Table 1. Descriptive statistics of respondent's ratings of themselves and the friend they most frequently ride with. Means with standard deviation in parenthesis.

	Number of items	*Mean score*	*Skew-ness*	*Kurt-osis*	*Women – mean score n= 2462*	*Men – mean score n =1935*	*t-value (diff. men-women)*	*Effect size (d-value)*
Passenger frequency [a)]	1	3.66 (0.92)	-.26	-.45	3.81 (0.93)	3.48 (0.89)	12.20*	0.36
Experience of stress [b)]	1	2.54 (1.60)	.97	.18	2.45 (1.56)	2.64 (1.63)	-4.10*	-0.12
Friend's risk behaviour [a)]	4	3.01 (0.85)	.18	-.27	2.83 (0.80)	3.24 (0.86)	-16.39*	-0.41
Powerlessness[a)]	4	2.85 (0.61)	.19	.64	2.74 (0.57)	2.99 (0.63)	-14.04*	-0.41
Perceived costs of addressing unsafe driving [a)]	4	2.30 (0.71)	.42	-.29	2.16 (0.65)	2.47 (0.74)	-14.78*	-0.44
Acceptance of riding with an unsafe driver [a)]	4	3.42 (0.72)	-.23	-.25	3.27 (0.69)	3.61 (0.71)	-16.13*	-0.47
Subjective risk[b)]	2	4.70 (1.54)	-.39	-.51	5.09 (1.41)	4.19 (1.56)	20.14*	0.58
Address unsafe driving[a)]	3	3.00 (0.86)	-.02	.00	3.25 (0.83)	2.69 (0.80)	22.74*	0.65

* $p < .001$. [a)] Range 1-5. High scores indicate high degree of the construct the scores are thought to represent. [b)] Range 1-7. High scores indicate high experience of stress or perceiving the risk of being hurt in a traffic accident as high.

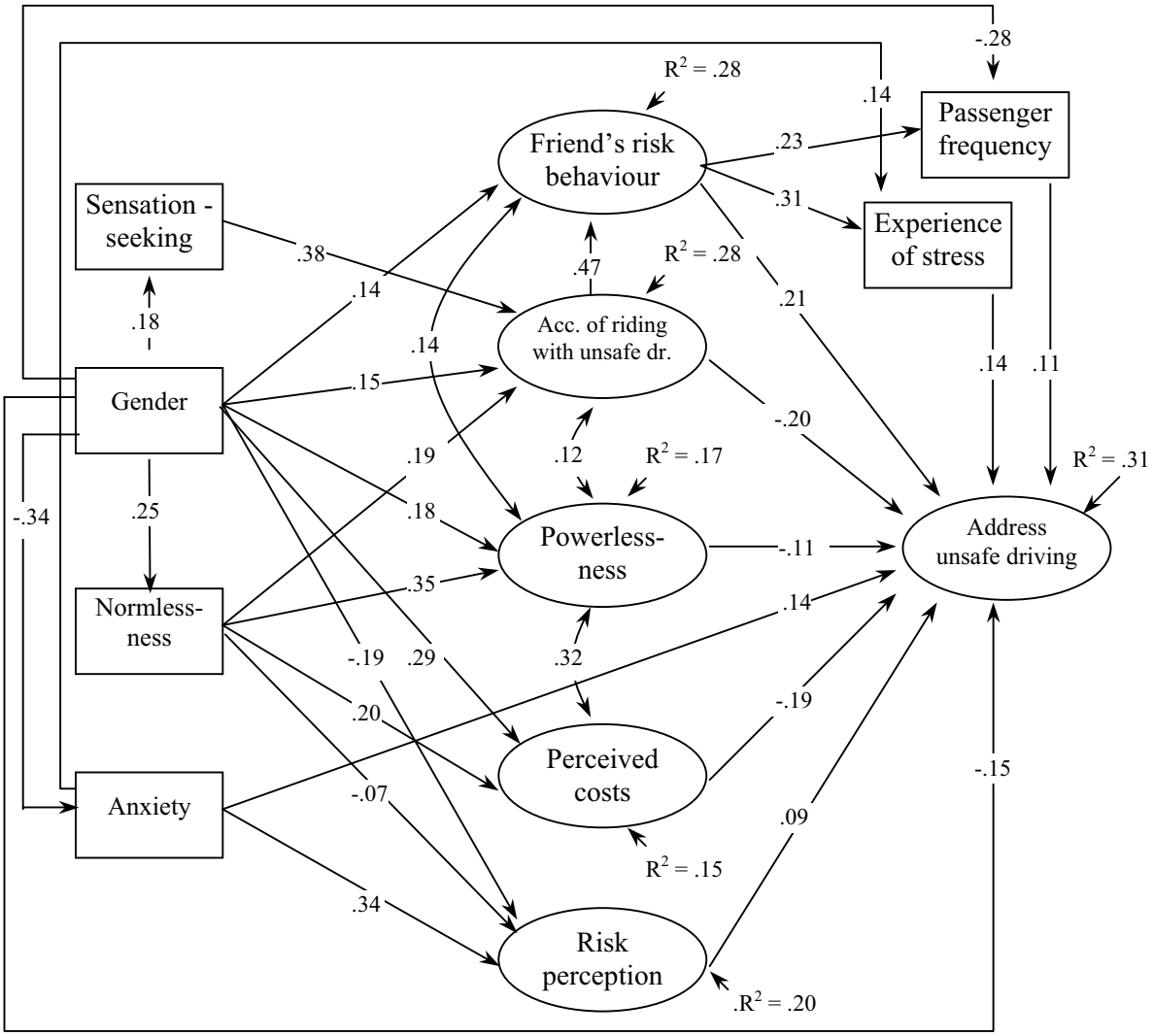

Figure 1: The structural model illustrating factors hypothesised to affect the frequency of passengers addressing their friend's unsafe driving.

Table 2: The measurement model for the latent variables in Figure 1. Standardised factor loadings

Powerlessness in influencing drivers	
It is only wishful thinking to believe that one can influence others to drive more slowly	.65
More and more, I feel helpless to prevent reckless driving	.46
There is very little I can do to prevent others from driving recklessly	.65
It cannot be my duty to influence how others drive	.53
Acceptance of riding with an unsafe driver	
I might get into the car with friends who I know are unsafe drivers.	.73
I would get into the car with a reckless driver if I had no other way to get home.	.67
I might get in the car with an unsafe driver if my friends did.	.61
I would rather walk a hundred miles than get into a car with an unsafe driver	.58
Perceived costs of addressing unsafe driving	
A driver who is speeding is a more attractive person than a driver who always follow the rules	.58
I would be very unpopular I should ask the person I am driving with to drive more carefully	.57
Boys prefer girls who dears to get into a car when you are speeding	.72
If I should ask my friends to drive more carefully, it would be perceived as an unnecess. Hassle	.55
Risk perception	
Feeling unsafe from being hurt in a traffic accident	.88
Feeling worried and concerned from being hurt in a traffic accident	.87
Friend's risk behaviour in traffic (How often does your friend..)	
Exceed the speed limit in build-up areas (more than 10 km/h)	.77
Exceed the speed limit on country roads (more than 10 km/h)	.84
Drive on a yellow light when it is about to turn red	.44
Overtake the car in front when it is driving at the speed limit	.71
Drive on a red light[*)]	-
Speaking out behaviour (How often does it happened that You..)	
Speak out when You think he or she is driving too fast	.92
Speak out when You think he or she is overtaking dangerously	.75
Refrain from speaking out when You think he or she is speeding or driving recklessly	.31

Correlations between the latent variables are presented in Figure 1. [*)] Excluded due to low factor loading (below .30) and reducing the fit of the measurement model

The hypothesised model showed a moderate fit to the data, χ^2 (297) = 3007.0, RMSEA = 0.046, GFI = 0.95, AGFI = 0.94, CFI = 0.91. In order to improve model fit, several modifications were carried out. The largest improvement in model fit would be obtained by adding a path from the latent variable "Acceptability of riding with an unsafe driver" to "Friend's risk behaviour". This modification was complemented, since the path was evaluated as theoretical meaningful - it is reasonable to believe that those finding it acceptable to ride with an unsafe driver frequently will get into the car with an unsafe driver. This modification resulted in a chi-square value of 2384.60 (296), and a RMSEA value of 0.041.

The second modification concerned a direct path form Gender to item 3 measuring the latent variable "Perceived costs". This path was also evaluated as theoretical meaningful, since this item directly addressed how boys perceived girls as car passengers (see Table 2). This modification further reduced the chi-square value to 2265.10 (295), as well as lowering the RMSEA value to 0.040. The other measures of model fit also suggested that the modified model fitted the data well, GFI = 0.96, AGFI = 0.95, CFI = 0.94, ECVI = 0.58.

The third suggested modification concerned within-factor correlated residuals for two of the items measuring the latent variable "Address unsafe driving". It is, however, important to note that this source of common variance between the residuals should be theoretically justified before implemented in the model (see e.g. Bagozzi, 1983; Gerbing & Anderson, 1984). To allow the two residuals to correlate was regarded as a meaningful modification. This is because both items concerned how often the respondents addressed unsafe driving, whereas the third item measuring this latent variable concerned how often they refrained from doing so (see Table 2). Thus, the wording of the questions was probably the source of the systematic of covariance between the two residuals. However, allowing the residuals of the two items to correlate resulted in a significant alteration of the direct effects of the various predictor variables on "Address unsafe driving", that is, the effects increased in strength. Correspondingly, the amount of explained variance in the latent variable "Address unsafe driving" almost doubled, from 31 percent to 59 percent. According to Fornell (1983), within-factor correlated residuals should not be implemented if such a modification significantly alter the of structural parameter estimates in the total model. Thus, this modification was not carried out.

Figure 1 shows that the structural model explained 31 per cent of the total variance in the passengers' reported frequency of addressing their friend's unsafe driving. As shown in the figure, several factors had indirect effects on the passengers' willingness to confront unsafe driving through affecting the variables mentioned above. In order to determine the total effects for these factors, both direct and indirect effects were estimated (Table 3).

Table 3: Direct, indirect and total effects on adolescents' frequency of addressing unsafe driving. Standardised coefficients.

	Gender *(females = 0 males = 1)*	*Anxiety*	*Normless-ness*	*Sensation-seeking*	*Acc. of riding with an unsafe driver*	*Friend's risk behaviour*
Direct effect	-.15	.14	-	-	-.20	.21
Indirect effect	-.18	.05	-.10	-.03	.13	.07
Total effect	-.33	.19	-.10	-.03	-.07	.28

Table 3 demonstrates that gender had both indirect effects and a direct effect on how often the respondents addressed unsafe driving. The negative sign of the standardised coefficients signify that females addressed their friend's unsafe driving more often than males did. The indirect effects were caused by females perceiving lower costs against speaking out, feeling less powerlessness, finding it less acceptable to ride with unsafe drivers, and perceiving the risk of being injured higher than males did. In turn, these variables affected the frequency of addressing unsafe driving.

Table 3 shows the personality variables had primarily indirect effects on how often the respondents addressed their friend's driving. As illustrated in Figure 1, the indirect effects took place through influencing perceived costs, powerlessness, accept of riding with an unsafe driver, and risk perception. The indirect effects suggested that respondents with high scores on sensation seeking and normlessness were less likely to address unsafe drivers than those scoring low on these traits. Normlessness and sensation seeking turned, however, out to be weak predictors of the likelihood of addressing unsafe driving, as shown by the sizes of their standardised total effects. On the other hand, anxiety seemed to be of greater importance in this context. In addition to indirect effects, anxiety had a direct effect signifying that respondents with high scores on anxiety were most likely to speak out to unsafe drivers.

The friend's risk behaviour had also significant indirect effects. First, by contributing to experience of stress, which in turn increased the likelihood of addressing the friend's unsafe driving. Second, through being positively related to riding frequency, which in turn amplified the possibility of addressing unsafe driving. It is, however, a bit surprising that the respondents who were riding with drivers who frequently violated traffic rules, chose to ride with such drivers relatively often. This result may, however, not be so unexpected since the majority of the respondents found it acceptable to ride with an unsafe driver (as previously shown in Table 1).

The passengers' acceptance of riding with an unsafe driver had contradictory effects upon their willingness to address unsafe driving. As expected, the direct effect indicated that this kind of acceptance decreased the likelihood of addressing the friend's unsafe driving. However, the indirect effect through friend's risk behaviour suggested the opposite. That is, passengers finding it acceptable to ride with unsafe drivers were most likely to ride with friends with risky driving habits. In turn, riding with a friend with risky driving habits increased the likelihood of addressing the driver's unsafe driving.

It seems rather puzzling why such conflicting effects should occur. It would therefore be important to examine whether the effect of the friend's risk behaviour upon the willingness to address unsafe driving was dependent upon how acceptable the respondents fond it to ride with unsafe drivers. That is, whether an interaction effect was present. In order to test this hypothesis, an interaction term between "Acceptability of riding with an unsafe driver" and "Friend's behaviour" was computed by multiplying the scores of the two latent variables, a strategy recommended by Jöreskog (2000). The interaction term was then included in the total model. Table 4 shows the standardised direct effects of the different independent variables on the frequency of addressing the friend's unsafe driving.

The interaction effect was significant ($p < .001$). The negative sign of the interaction effect indicates that a passenger who rides with a friend who often violate traffic rules is less likely address the friend's unsafe driving when he or she (the passenger) think that it is acceptable to ride with unsafe drivers, compared a passenger who does not think that it is acceptable to ride with an unsafe driver. This seems to make more sense of the contradictory effects of the passengers' acceptance of riding with an unsafe driver upon the willingness to address risky driving.

Table 4: Direct effects and interaction effect upon passengers' frequency of addressing unsafe driving. Standardised coefficients.

	Standardised beta	t-value
Gender	-.15	-8.15*
Accept. of riding with an unsafe driver	-.20	-9.40*
Perceived costs of speaking out	-.19	-8.21*
Friends' risk behaviour	.21	9.51*
Subjective risk	.09	4.50*
Powerlessness	-.11	-4.58*
Experience of stress	.14	8.80*
Anxiety	.14	7.99*
Passenger frequency	.11	6.74*
Interaction Accept.* Friend's risk behaviour	-.06	-3.92*

* p <. 001. GFI = 0.96, AGFI = 0.95, CFI = 0.94, ECVI = 0.58, RMSEA = 0.039. χ^2= 2245.60, df = 321

Discussion

The results showed that the factors influencing adolescents' willingness to address risky driving are several. In particular, strong effects of gender were found; females were in general most likely to report that they spoke out to the driver when feeling unsafe in the car. This could to some extent be explained by gender differences in certain beliefs affecting the likelihood of addressing unsafe driving. That is, males perceived more costs against addressing unsafe drivers, felt less confident in their ability to influence drivers, were more likely to accept the risk taking of other drivers, and perceived less risk than females.

These results are in line with previous studies finding relatively large gender differences in traffic safety orientation (Harré, Field & Kirkwood, 1996; Jessor, 1987). One explanation may be differences in gender roles. Simon and Corbett (1996) have suggested that women's traditional gender-role is non-competitive and passive. As a result, females are expected to avoid risks, while men are encouraged to express competitiveness, anger, and to take risks. Accordingly, this causes young men to be less safety oriented in traffic and to engage more frequently in risk-taking actives compared to young females. It is, however, important to note gender role expectations of this type are most dominant in masculine cultures, such as in the USA and Germany (Hofstede, 1991, 1998). Thus, explanations based on

gender role differences do probably not apply to the same extent in more feminine cultures, such as Scandinavian countries. It may still be reasonable to believe that this is one of the main explanations of the gender differences in passengers' willingness to confront unsafe drivers.

As a consequence, efforts made to encourage adolescent passengers to address unsafe driving could especially focus on the beliefs of young males. Such encouragements may, however, be difficult to fulfil if gender role expectations causes males to refrain from speaking out. This assumption is supported by the finding that most males seemed to fear possible negative consequences of voicing their opinion to unsafe drivers, for instance, to be labelled as "a sissy" when doing so. One way of changing such beliefs may be to portray actions to address unsafe driving as "tough", that is, you are a "chicken" if you do not dare to speak your mind about unsafe driving.

The results indicated that passengers who were confident in their ability to influence drivers were more likely to address unsafe driving than those with low confidence. This suggests that promoting confidence of this kind may increase the likelihood of passengers speaking out to unsafe drivers. According to Bandura (1985), the most effective way of developing confidence of this kind is to experience successful performance of behaviour. One way of obtaining such experiences can be through role-playing exercises. Positive results of exercises of this type has been found in the "Peer Intervention Program" (McKnight & McPerson, 1985), where the development and practicing of special intervention techniques was found to increase the likelihood of adolescents intervening against their friends' drinking and driving.

Bandura (1985) also suggests that experiences of successful can be provided vicariously through observing social models, or alternatively through social persuasion, meaning to strengthen peoples' belief in that the have what it takes to succeed. Examples of the former may include adolescents observing persons similar to themselves succeed in addressing unsafe driving. Examples of the latter may be to persuade adolescents verbally that they have what it takes by means of campaign materials etc. The success of applying vicarious experiences and social persuasion in order to encourage adolescent passengers to address unsafe driving has, however, been limited (Elvik, 2000). This stresses the importance of not merely telling adolescents what to do, but also to help them developing practical skills, for instance, by using role-playing exercises.

The results demonstrated that a large proportion of the adolescents think that it was acceptable to ride with an unsafe driver. One explanation of the rather large proportion finding it acceptable to ride with an unsafe driver may be that the sample included both respondents from urban, as well as from rural areas in Norway. In rural areas, the car is the important mean of transportation, since public transport is usually very limited, especially at nighttime. If no alternative means of transportation exists, this may obviously make it attractive to ride with an unsafe driver. Likewise, the cost of asking a driver to drive more carefully may be perceived as high (e.g. to have to get out of the car and to walk home). If this explanation is valid, this illustrates an important point; encouraging passengers to address unsafe driving is probably not enough in itself to help them overcoming the perceived barriers to speak out. One way of lessening such barriers may be to increase alternative means transport, for instance increased public transport, cheaper taxis, or organised "pick-up" services. This may also be especially relevant at night-time in weekends, when the accident rate is particularly high for adolescent drivers and their passengers. However, the impact of the availability of alternative means of transportation was not focused in the present study, and it is therefore recommended that future studies examine the importance of this factor.

It is important to question whether passengers speaking out against unsafe driving actually will obtain the goal of reducing drivers' risk-taking. Although studies indicate that normative compliance affect drivers' intention to commit driving violations (Parker, Manstead, Stradling et al., 1992), this type of compliance is usually performed implicit. That is, the drivers comply on the basis of the perceived preferences of their peers or passengers. Telling drivers explicitly (directly) how to behave can, however, create the opposite effect. Brehm (1972) has found that people can react strongly against explicit social pressure, because this may threatened their behavioural and attitudinal freedom. This may lead a "boomerang effect" causing the recipient of the pressure to either maintain his or her behaviour or attitude, or to change in these in the opposite direction of the intention of the pressure. As a consequence, Brehm suggests more subtle pressure than overt pressure in order to facilitate attitude or behavioural change. Brown (1998) has found some evidence for this hypothesis in a study focusing peer' influence on drinking and driving. The results of this study indicated that the perceived norms of peers, meaning implicit social pressure, seemed to influence driving under the influence of alcohol. However, explicit peer influence, e.g. friend

actually showing disapproval of drink driving, was not related to actual drink driving.

It is, however, uncertain whether a "boomerang" effect will occur. Asking a driver to drive more carefully may not cause an immediate change in behaviour, but may nevertheless have the intended effect in the long run. This is in accordance with the sleeper effect, meaning that the change measured immediately after the message is received is smaller than the change measured at some later point in time (Hovland, Lumsdaine & Sheffield, 1949). Whether or not a "boomerang" effect can occur can also depend on personal characteristics of the driver. For instance, drivers with a hostile/aggressive personality can be expected to be less open to criticism than others. Such drivers may also cause passengers to perceive the cost of addressing unsafe driving as high, due to a fear of aggressive feedback from the driver. Drivers with such characteristics have been found to violate traffic rules frequently, and do probably constitute a group of drivers causing passengers to feel unsafe (Deery & Fildes, 1999; Donovan, Umlauf & Saltzberg, 1988; Ulleberg, 2002; Wilson, 1991). Age and sex of the driver may also be of importance in this context. For instance, passengers who are younger than the driver, and perhaps of the opposite sex, may perceive the barriers against speaking out as particularly high. Driver characteristics were not included in the present study, and it is therefore recommended that future studies should focus the interaction between the use of explicit social influence and driver characteristics.

The present study did include personality measures related to the passengers. In particular, passengers disposed to experience anxiety seemed to feel unsafe and uncomfortable in their friend's car, as well addressing unsafe driving more frequently than passengers with low anxiety. This result is hardly surprising, since anxious persons usually tend to appraise situations as threatening and risky (see e.g. Lerner & Keltner, 2001). This result illustrates how a stable emotional predisposition may shape the individual's appraisal of the traffic situation, as well as the interaction with other drivers. This may also be interpreted as support for the assumed emotional nature of the experience of risk, as suggested by the zero-risk theory (Näätänen & Summala, 1974, 1976). The finding that sensation seeking and normlessness were only weakly related to the willingness to confront unsafe driving is, however, surprising since these traits usually demonstrate a strong relation to risk-taking behaviour in traffic (see, e.g. Jonah, 1997; West & Hall, 1997; Ulleberg & Rundmo, in press a). A possible explanation is that these

characteristics are not so important as motivators for influencing the risk taking of other drivers, but more relevant pertaining to own risk-taking behaviour.

The respondents' frequency of addressing unsafe driving was measures by three items, which probably are too few for constructing a reliable measure. The suggested modification of the measurement model reflects this problem; two of the items had more in common than accounted for by the latent variable they were thought to reflect. The consequences may be an underestimation of the relation between the different predictor variables and how frequent the passengers addressed unsafe driving. Another problem is that the measure only concerned the friend the respondents most frequently were riding with. Lau, Quadrel and Hartman (1990) have found that people self-select into peer groups with similar attitudes and behaviour. As a result, risky drivers do probably carry passengers with similar preferences towards risk taking. The finding that passengers who accepted the risk taking of other drivers were more likely to actually ride with unsafe drivers supports this assumption. Thus, it is uncertain whether the measure applied reflects the respondents' tendency to address unsafe drivers in general, or whether this only relates to the friend the most frequently ride with.

The proposed self-selection into peer groups with similar characteristics also suggest that it may be difficult to reach out to the most risky drivers through the use of social influence from their passengers. If passengers approve the risk taking of the driver, it is not likely that the driver will be requested to drive more carefully. However, being a passenger involves having low personal control when driving. Low personal control over a potential risky situation can be expected to increase the experience of risk (Näätänen & Summala, 1974, 1976), which may be intolerable for the passenger. Low personal control may also explain the finding that passengers who accept the ride with an unsafe driver nevertheless seemed to address their friend's driving when he or she was driving very risky. This may justify attempts to promote passengers to address unsafe driving, even among passengers with preferences towards risk taking.

A general problem of cross-sectional studies is that the causal relationships are difficult to determine. Even tough the hypothesised path model demonstrated a good fit to the observed data, there is no guarantee that the model describes the true causal relationship between the variables. For instance, the one-directional relation between powerlessness and the respondents' willingness to address unsafe driving can be questioned. It may be reasonable to believe that these two constructs

influence each other mutually, since performance of behaviour is believed to affect self-efficacy and vice versa (Bandura, 1985).

Another methodological problem is the influence of social desirability responding. Previous studies have found that drivers declaring a concern for safety tend to score high on measures of social desirability (Lajunen & Summala, 1995; Lajunen et al., 1998). The present study did not control for such effects, and it is therefore likely that some respondents may be motivated to present themselves as more safety-oriented than they are, as well as reporting that they address unsafe drivers more frequently than they actually do. However, other studies indicate that the use of self-reports may provide a good indication actual behaviour in traffic (West, French, Kemp & Elander, 1993; Hattaka, Keskinen, Katila & Laapotti, 1997).

Since it to the author's knowledge has been no previous studies pertaining to passengers' willingness to address unsafe driving, the suggestions for future research are several. One suggestion is to examine how the presence of several passengers affects the willingness to speak out to unsafe drivers. As mentioned in the introduction, the accident risk of young drivers raises when the number of passengers increases. Is this because the unresponsive bystander effect occurs (Latané & Nida, 1981), in this context meaning that the likelihood of intervening against unsafe driving decreases when several passengers are in the car. If so, how could this effect be accounted for in effort made to encourage passengers to voice their opinion against unsafe driving?

It is also recommended that future studies should focus the importance of cultural differences. Cultural background is thought to influence people's cognitions, attitudes, and behaviour (Berry, Poortinga, Segall & Dasen, 1992), and can therefore be expected to influence safety orientation in traffic. This assumption is supported by studies finding considerable cross-cultural variations in driver risk taking (Sivak, Soler & Trankle 1989), driver risk perception (Sivak, Soler, Trankle & Spagnhol, 1989), as well as in accident statistics. Such cultural differences may also apply for passenger willingness to address unsafe driving. For instance, people from collectivistic cultures usually wish to maintain harmony, meaning that embarrassment and a loss of face should be avoided (Hofstede, 1991). On the other hand, to be honest and speaking one's mind is seen as an ideal in individualistic cultures, and direct confrontations are thus frequent (Hofstede, 1991). Members of individualistic cultures can therefore be expected to be more likely to ask a driver

to drive more carefully than members of collectivistic cultures, who may be more likely to refrain from addressing unsafe driving to in order to maintain harmony.

The present study focused adolescent passengers and drivers. Although efforts made to encourage passengers to speak out may be particularly relevant for reducing young drivers' risk taking in traffic, this does not mean that promoting social influence of this type should be restricted to adolescent passengers. Efforts made promote social influence may also be relevant for passengers in other age groups in order to reduce the risk taking of drivers in all age groups.

References

Åberg, L. (1993). Drinking and driving: Intentions, attitudes, and social norms among Swedish male drivers. *Accident Analysis and Prevention, 3*, 289-296.

Ajzen, I, (1991). The theory of planned behaviour. *Organizational Behaviour and Human Decision Processes, 50* 179-211.

Arnett, J.J, Offer, D. & Fine, M.A. (1997). Reckless driving in adolescence. "State" and "trait" factors. Accident Analysis and Prevention, 29, 57-63.

Amundsen, A., Elvik, R. & Fridstrøm, L. (1999). *Virkninger av "Sei i frå" kampanjen i Sogn og Fjordane på antall skadde og drepte i trafikken [Effects of the "Let it be known!" campaign in Sogn and Fjordane on the number of injured and killed persons in traffic]* (Rep. No. 425). Oslo, Norway: Institute of Transport Economics.

Bagozzi, R.P. (1983). Issues in the application of covariance structure analysis: a further comment. *Journal of Consumer Research, 9,* 449-450.

Bandura, A. (1986). *Social Foundations of Thought and Action. A Social Cognitive Theory*. Englewood Cliffs; NJ: Prentice Hall.

Berry, J.W., Poortinga, Y., Segall, M. & Dasen, P. (1992). *Cross-Cultural Psychology.* Cambridge, Cambridge University Press.

Bjørnskau, T. (2000). *Road traffic risk in Norway 1997/98*. (Report no. 483), Oslo, Institute of Transport Economics.

Bragg, B.W.E. & Finn, P. (1982). *Young Driver Risk-Taking Research: Technical Report of an Experimental Study*. Report prepared for national Highway Safety administration, U.S. Dot, HS-806-375.

Brehm, J.W. (1972). *Responses to Loss of Freedom. A Theory of Psychological reactance*. Morristown, NJ: General Learning.

Brown, S. (1998). Associations between peer drink driving, peer attitudes to drink driving, and personal drink driving. *Journal of Applied Social Psychology, 28*, 423-436.

Browne, M.W. & Cudeck, R. (1993). Alternative ways of assessing model fit. In: Bollen, K.A., Long, J.S. (Eds.), *Testing Structural Equation Models*. Sage Publications, Newbury Park, pp. 136-162.

Chen, LH., Baker, S.P., Braver, E.P. & Li, G. (2000). Carrying passengers as a risk factor for crashes fatal to 16- and 17-year-old-drivers. *Journal of American Medical Association, 283*, 1578-1582.

Cohen, J. (1988). *Statistical Power Analysis for the Behavioural Sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.

Costa, P.T.jr., McCrae, R.R. (1992). *Revised NEO Personality Inventory (NEO-PI-R) and NEO Five Factor Inventory (NEO-FF-I). Professional Manual*. Odessa: Psychological Assessment Resources Inc.

Deery, H.A. & Fildes, B.N. (1999). Young novice driver subtypes: relationship to high-risk behaviour, traffic accident record, and simulator driving performance. *Human Factors, 41*, 628-643.

Donovan, D.M., Umlauf, R.L., Salzberg, P.M. (1988). Derivation of personality subtypes among high-risk drivers. *Alcohol, Drugs and Driving, 4*, 233-244.

Doherty, S.T., Andrey, J.C. & MacGregor, C. (1998). The situational risks of young drivers: The influence of passengers, time of day and day of week on accident rates. *Accident Analysis and Prevention, 30*, 45-52.

Drummond, A.E. & Triggs, T.J. (1991). *Driving as Skilled Performance: a Perspective for Improving Young Driver Safety*. Monash University, Accident Research Centre.

Elvik, R. (2000). Evaluating the effectiveness of Norway's "Speak Out!" road safety campaign. The logic of causal inference in road safety evaluation studies. *Transportation Research Record 1717*, 66-75.

Fornell, C. (1983). Issues in the application of covariance structure analysis: a comment. *Journal of Consumer Research, 9*, 443-447.

Festinger, L. (1950). Informal social communication. *Psychological Review, 57*, 271-282.

Festinger, L. (1954). A theory of social comparison processes. *Human Relations, 7*, 117-140.

Grasmick, H.G. & Bursik, R.J. Jr. (1990). Conscience, significant others and rational choice. Extending the deterrence model. *Law and Society review, 24*, 837-861.

Gerbing, D. W., & Anderson, J.C. (1984). On the meaning of within-factor correlated measurement errors. *Journal of Consumer Research, 11*, 572-580.

Harré, N., Field, J. & Kirkwood, B. (1996). Gender differences and areas of common concern in the driving behaviours and attitudes of adolescents. *Journal of Safety Research, 27*, 163-173.

Harrison, J.A. , Mullen, P.D. & Green, L.W. (1992). A meta-analysis of studies of the health belief model with adults. *Health Education Research,* 7, 107-16.

Hattaka, M., Keskinen, E., Katila, A. & Laapotti, S. (1997). Self-reported driving habits are valid predictors of violations and accidents. In I T. Rothengatter & E. Carbonell Vaya (Eds.), *Traffic and Transport Psychology: Theory and application* (pp. 295-303). Oxford: Pergamon.

Hofstede, G. (1991). *Culture and Organisations*. London: McGraw-Hill.

Hofstede, G. (1998). Masculinity/femininity as a dimension of culture. In G. Hofstede (Ed.): *Masculinity and Femininity: The Taboo Dimensions of National Culture*. Thousand Oaks, CA: Sage Publications

Hovland, C.I.; Lumsdaine, A.A. & Sheffield, F.D. (1949). *Experiments on Mass Communication*. Princeton, NJ: Princeton University Press.

Hu, L. & Bentler, P.M. (1995). Evaluating model fit. In: Hoyle, R.H. (Ed.), *Structural Equation Modeling: Concepts, Issues and Applications*. Sage Publications, London, pp. 76-99.

Hu, L. & Bentler, P.M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, 6 (1), 1-55.

Jessor, R. (1987). Risky driving and adolescent problem behaviour: Theoretical and empirical linkage. In Benjamion, T. (Ed.), *Young drivers impaired by alcohol and other drugs* (pp.97-110). London: Royal Society of Medicine Services.

Jonah, B.A. (1997). Sensation seeking and risky driving: A review and synthesis of the literature. *Accident Analysis and Prevention, 29*, 651-665.

Jöreskog, K.A. & Sörbom, D. (1993). *LISREL 8: Structural Equation Modeling with the SIMPLIS Command Language.* Chicago: Scientific Software.

Jöreskog, K. G. (2000). *Latent Variable Scores and Their Uses*. http://www.ssicentral.com/lisrel/column6.htm.

Kohn, M., Schooler, C. (1983). *Work and Personality: An Inquiry into the Impact of Social Stratification*. New York: Norwood Ablex.

Laapotti, S., Keskinen, E., Hatakka, M. & Katila, A. (2001). Novice drivers' accidents and violations – a failure on higher or lower hierarchical levels of driving behaviour. *Accident Analysis and Prevention, 33*, 759-769.

Lajunen, T. Corry, A., Summala, H. & Hartley, L. (1998). Cross-cultural differences in drivers' self-assessment of their perceptual-motor and safety skills: Australians and Finns. *Personality and Individual Differences, 24*, 539-550.

Lajunen, T. & Summala, H. (1995). Driving experience, personality, and safety-motive dimensions in drivers' self-assessments. *Personality and Individual Difference, 19*, 307-318.

Latané, B. & Nida, S.A. (1981). Ten years of research on group size and helping. *Psychological Bulletin, 89*, 308-324.

Lau, R.R., Quadrel M.J., & Hartman, K.A. (1990). Development and change of young adults' preventive health beliefs and behaviour. *Journal of Health and Social Behaviour, 31*, 240-259.

Lerner, J.S. & Keltner, D. (2001). Fear, anger, and risk. *Journal of Personality and Social Psychology, 81*, 146-159.

Loehlin, J.C. (1998). *Latent Variable Models. An Introduction to Factor, Path and Structural Analysis*. 3rd ed., London: Lawrence Erlbaum Associates.

McKenna, F.P. (1993). It won't happen to me: Unrealistic optimism or illusion of control? *British Journal of Psychology, 84*, 39-50.

McKenna, F.P., Waylen, A.E. & Burkes, M.E. (1998). *Male and Female Drivers: How Different are They?* AA Foundation for Road Safety Research. The University of Reading, Hampshire, UK:

McKnight, A.J. & McPerson, K. (1985). Evaluation of peer intervention training for high school alcohol safety education. *Accident Analysis and Prevention, 18*, 339-347.

Michiels, W. & Schneider, P. (1984). Traffic offences: another approach to description and prediction. *Accident Analysis & Prevention, 16*, 223-238.

Milech, D., Glencross, D. & Hartley, L. (1989). *Skill Acquisition by Young Drivers: Perceiving, Interpreting and Responding to the Driving Environment.* (Report no. MR4), Canberra, Federal Office of Road Safety.

Näätänen, R. & Summala, H. (1974). A model for the role of motivational factors in drivers' decision making. *Accident Analysis and Prevention, 6*, 243-261.

Näätänen, R. & Summala, H. (1976). *Road User Behaviour and Traffic Accidents*. Amsterdam: North Holland.

Parker, D., Manstead, A.S.R, Stradling, S.G., Reason, J.T. & Baxter, J.S. (1992). Intention to commit driving violations: An application of the theory of planned behaviour. *Journal of Applied Psychology, 77*, 94-101.

Papadakis, E. & Moore, A. (1991). Drink-driving and adolescents lifestyles: rethinking policy. *Australian Journal of Social Issues, 25*, 83-106.

Preusser, D.F., Ferguson, S.A. & Williams, A.F. (1998). The effect of teenage passengers on the fatal crash risk of teenage drivers. *Accident Analysis and Prevention, 30*, 217-222.

Reiβ, J.A. & Krüger, H.P. (1995). Accident risk modified by passengers. Paper presented at *the 13th International Conference on Alcohol, Drugs and Traffic Safety (T'95) Adelaide, Australia 13-15 August 1995*.

Robinson, J.P, Shaver, P.R. & Wrightsman, L.S. (1991). *Measures of Personality and Social Psychological Attitudes*. San Diego, Calif. : Academic Press

Rotter, J.B. (1966). Generalised expectancies for internal versus external control of reinforcement. *Psychological Monographs, 80*.

Rundmo, T., Ulleberg, P. (2000). *Var Det Verdt Det? Evaluering av 18-40 Aksjonen. Resultatrapport.* [Evaluation of The 18-40 Campaign. Main Report]. (Report no 43), Trondheim, Rotunde publikasjoner. (In Norwegian).

Rutter, D.R., Quine,L. & Chesham,D.J. (1995). Predicting safe riding behaviour and accidents: Demography, beliefs, and behaviour in motorcycling safety. *Psychology and Health, 10*, 369-386.

Simon, F., & Corbett, C. (1996). Road traffic offending, stress, age, and accident history among male and female drivers. *Ergonomics, 39,* 757-780.

Schwarzer, R. & Fuchs, R. (1996). Self-efficacy and health behaviour. In M. Conner & P. Norman (Eds.). *Predicting Health Behaviour*. *Research and Practices with Social Cognition Models*. Open University Press, Buckingham, pp.163-196.

Sivak, M., Soler, J. & Trankle, U. (1989). Cross-cultural differences in driver risk-taking. *Accident Analysis and Prevention, 21*, 363-369.

Sivak, M., Soler, J., Trankle, U. & Spagnhol, J.M. (1989). Cross-cultural differences in driver risk perception. *Accident Analysis and Prevention, 21*, 355-362.

Tränkle, U., Gelau, C. & Metker, T. (1990). Risk perception and age-specific accidents of young drivers. *Accident Analysis & Prevention, 22*, 119-125.

Ulleberg, P. (2002). Personality subtypes of young drivers. Relationship to risk-taking preferences, accident involvement, and response to a traffic safety

campaign. *Transportation Research Part F, Traffic Psychology and Behaviou, 4,* 279-297.

Ulleberg, P. & Rundmo, P. (in press a). Personality, attitudes and risk perception as predictors of risky driving behaviour among young drivers. *Safety Science.*

Ulleberg, P. & Rundmo, P. (in press b). Risk-taking attitudes among young drivers: the psychometric qualities and dimensionality of an instrument to measure young drivers' risk-taking attitudes. *Scandinavian Journal Of Psychology*.

West, R., French, D., Kemp, R. & Elander, J. (1993). Direct observations of driving, self reports of driver behaviour and accident involvement. *Ergonomics, 36*, 557-567.

West, R. & Hall, J. (1997). The role of personality and attitudes in traffic accident risk. *Applied Psychology: An International Review, 46*, 253-264.

Wilde, G.S. (1982). The theory of risk homeostasis: implications for safety and health. *Risk Analysis, 2*, 209-225.

Williams, A.F. & Wells, J.K. (1995). Deaths of teenagers as motor-vehicle passengers. *Journal of Safety Research, 26,* 161-167.

Wilson, R.J. (1991). Subtypes of DWIs and high risk drivers: Implications for differential intervention. *Alcohol, drugs and Driving, 7,* 1-12.

Wilson, R.J. & Jonah, B. (1988). The application of problem-behaviour theory to the understanding of risky driving. *Alcohol, drugs and Driving, 4*, 173-191.

Questionnaire

Statens vegvesen

NTNU

Spørreundersøkelse om trafikksikkerhet blant ungdom

Les dette før du besvarer skjemaet

Hva vil vi oppnå?

- Formålet med denne undersøkelsen er å bli bedre i stand til å finne gode tiltak mot trafikkulykker blant ungdom.
- Derfor er det viktig å vite hvordan ungdommen selv vurderer trafikksikkerheten.

Hvem står bak?

- Undersøkelsen er iverksatt av Statens vegvesen i Sør-Trøndelag og Møre og Romsdal i samarbeid med Politiet, Trygg Trafikk og flere andre frivillige organisasjoner.
- Vi arbeider for at du skal komme trygt frem.

Hvem deltar i undersøkelsen?

- Undersøkelsen omfatter ungdom i Norge og gjennomføres i samarbeid med videregående skoler.
- Det er viktig for undersøkelsen at flest mulig besvarer skjemaet. For å kunne gjøre noe med problemene er vi avhengig av ditt svar.
- Svar på spørsmålene i den rekkefølgen de er stilt i skjemaet. Det er ingen rette eller gale svar. Gi uttrykk for dine virkelige oppfatninger uten å gi noe idealbilde av deg selv.

Konfidensialitet

- All informasjon behandles konfidensielt. Du oppgir ikke ditt navn på besvarelsen
- Besvarelsene blir sendt direkte til Norges teknisk-naturvitenskapelige universitet i Trondheim, som analyserer resultatene. Professor, dr.philos. Torbjørn Rundmo, tlf. 73-591656/ 73-591960, er ansvarlig for spørreundersøkelsen.

På forhånd takk for hjelpen.

Statens vegvesen i Sør-Trøndelag og Møre og Romsdal

Skjema A_Q

18-førti

Aksjon fart og utforkjøringsulykker

Du har hatt besøk av 18-førti aksjonen ved din skole. Vi er interessert i hvordan du vurderer den informasjon som du har fått?

	Ja	Nei
Har du sett multimediaspillet «Kjære søster?	☐	☐
Har du sett forestillingen «Ikke tøft å være død»?	☐	☐
Har du sett plakatene med ulike motiver fra 18-førti aksjonen?	☐	☐
Har du hørt CD'en med motiv fra 18-førti aksjonen?	☐	☐
T-skjorte med motiv fra aksjonen?	☐	☐
Har du hatt besøk på skolen fra aksjonen?	☐	☐
Har du hørt om aksjonen andre steder?	☐	☐
Har du selv vært aktivt involvert i aksjonen?	☐	☐

Hvis du har vært aktivt involvert, beskriv på hvilken måte?

Hvor godt synes du du kjenner til denne aksjonen?

Svært godt kjennskap	☐	☐	☐	☐	☐	☐	☐	Ikke kjennskap i det hele tatt

Hvor godt fornøyd er du med aksjonen generelt?

Svært godt fornøyd	☐	☐	☐	☐	☐	☐	☐	Svært misfornøyd

Hvor fornøyd er du med plakater/ videoer?

Svært godt fornøyd	☐	☐	☐	☐	☐	☐	☐	Svært misfornøyd

Hvor godt fornøyd er du med informasjonen du har fått under skolebesøk?

Svært godt fornøyd	☐	☐	☐	☐	☐	☐	☐	Svært misfornøyd

Hvor fornøyd er du med måten din egen skole har prioritert aksjonen?

Svært godt fornøyd	☐	☐	☐	☐	☐	☐	☐	Svært misfornøyd

Hva synes du egentlig om aksjonen?

Interessant	☐	☐	☐	☐	☐	☐	☐	Uinteressant
Meningsfull	☐	☐	☐	☐	☐	☐	☐	Meningsløs
Morsom	☐	☐	☐	☐	☐	☐	☐	Kjedelig
Givende	☐	☐	☐	☐	☐	☐	☐	Skuffende
Den angikk meg i stor grad	☐	☐	☐	☐	☐	☐	☐	Angikk ikke meg i det hele tatt
Positiv	☐	☐	☐	☐	☐	☐	☐	Negativ

Mine oppfatninger om trafikk og bilkjøring
[besvares av alle]

Her følger noen påstander om trafikk og bilkjøring. Vi ber deg ta stilling til om du er enig eller uenig i dem. Det er ingen rette eller gale svar. [Sett ett kryss for hver linje]

	Svært enig	Enig	Både/ og	Uenig	Svært uenig
Når jeg skal kjøpe bil, er pris og utseende mer viktig enn sikkerhetsdetaljene	☐	☐	☐	☐	☐
Jeg føler meg vel når jeg er hensynsfull ovenfor andre trafikkanter	☐	☐	☐	☐	☐
Det er bare idioter som råkjører	☐	☐	☐	☐	☐
Jeg vil aldri ta sjanser i trafikken	☐	☐	☐	☐	☐
Hvis det er en person jeg kan stole på, vil jeg sitte på med han eller henne selv om jeg vet at han eller hun drukket alkohol	☐	☐	☐	☐	☐
Du bør kjøre hensynsfullt og forsiktig fordi du ønsker å leve, ikke fordi du er redd for å bli tatt av politiet	☐	☐	☐	☐	☐
Hvis du er en god sjåfør, er det er helt OK å kjøre litt fort	☐	☐	☐	☐	☐
Jeg liker å vise mine ferdigheter som sjåfør	☐	☐	☐	☐	☐
Jeg sitter på med venner selv om jeg vet at de er kjent for å kjøre uforsiktig	☐	☐	☐	☐	☐
Vanligvis kjører folk litt fortere når de har venner i bilen	☐	☐	☐	☐	☐
Politiet er på utkikk etter fartssyndere fordi de liker å bøtelegge folk	☐	☐	☐	☐	☐
Hvis jeg skulle forårsake en ulykke hvor noen blir skadd, vil det merke meg for resten av livet	☐	☐	☐	☐	☐
Det kan være moro å kjøre fort	☐	☐	☐	☐	☐
Å kjøre bil er moro og spennende	☐	☐	☐	☐	☐
Jeg tenker ikke så mye på andre i trafikken fordi det øker sannsynligheten for en ulykke	☐	☐	☐	☐	☐
Jeg vil ha vanskelig for å leve med meg selv hvis jeg skulle komme til å skade en annen i trafikken	☐	☐	☐	☐	☐
Når jeg stoler på en venn, sitter jeg på med han eller henne selv om han eller hun råkjører	☐	☐	☐	☐	☐
Ingen kan fortelle andre hvordan de skal kjøre bil	☐	☐	☐	☐	☐
Jeg sitter på med en uforsiktig sjåfør hvis det ikke er andre måter å komme seg hjem på	☐	☐	☐	☐	☐
Selv om man ikke blir tatt av politiet, er det galt å kjøre for fort	☐	☐	☐	☐	☐
Man skal alltid overholde trafikkreglene uansett forhold	☐	☐	☐	☐	☐
Jeg ville straks be en venn stoppe bilen hvis han eller hun kjører uforsiktig	☐	☐	☐	☐	☐
Det er vanligvis liten hensikt i å bry seg om andre fordi de fleste andre ikke bryr seg om meg	☐	☐	☐	☐	☐

	Svært enig	Enig	Både/ og	Uenig	Svært uenig
De fleste som kjører ønsker å vise seg frem som unike personer, ikke som ordinære forsiktige sjåfører	☐	☐	☐	☐	☐
Det er helt OK å kjøre for fort så lenge man oppdager politiet før de oppdager deg	☐	☐	☐	☐	☐
Å kjøre 5 til 10 kilometer over fartsgrensa er helt OK fordi alle andre også gjør det	☐	☐	☐	☐	☐
Jeg vil aldri tenke på å sitte på med en person som har drukket alkohol	☐	☐	☐	☐	☐
Det er helt OK å råkjøre så fremt trafikkforholdene gjør det mulig	☐	☐	☐	☐	☐
Hvis min egen dumhet skulle forårsake en ulykke, håper jeg at jeg er den som blir skadd	☐	☐	☐	☐	☐
De fleste liker å vise frem sine ferdigheter som sjåfør ved å kjøre fort	☐	☐	☐	☐	☐
Når jeg har barn i bilen overholder jeg alltid trafikkreglene fordi jeg vil de skal lære seg å ferdes sikkert i trafikken	☐	☐	☐	☐	☐
Jeg sitter av og til på med venner selv om jeg vet at de ikke kjører sikkert i trafikken	☐	☐	☐	☐	☐
Hvis man alltid kjører sikkert, mister man mange venner	☐	☐	☐	☐	☐
Det kan ikke unnskyldes å ta et annet menneskes eller dyrs liv på grunn av uvettig kjøring	☐	☐	☐	☐	☐
Jeg håper jeg aldri kommer ut for en ulykke der noen blir skadd og hvor feilen er min	☐	☐	☐	☐	☐
Hvis jeg skulle komme til å skade noen i trafikken, vil jeg aldri kjøre bil igjen	☐	☐	☐	☐	☐
Sikre førere er vanligvis noen «pyser»	☐	☐	☐	☐	☐
Det kan tenkes at jeg sitter på med en person som har drukket lite grann	☐	☐	☐	☐	☐
Det kan tenkes at jeg sitter på med en sjåfør som bryter det som kan brytes av trafikkregler	☐	☐	☐	☐	☐
Hvis mine venner gjør det, sitter jeg på med en som råkjører	☐	☐	☐	☐	☐
Av og til er det nødvendig å bryte trafikkreglene for å komme seg frem i trafikken	☐	☐	☐	☐	☐
Jeg ville heller gå 10 kilometer enn å sitte på med en sjåfør som jeg vet kjører uforsiktig	☐	☐	☐	☐	☐
Det er helt i orden å kjøre mer enn 10 km for fort i en 80 eller 90 km sone hvis en kjører sikkert	☐	☐	☐	☐	☐
Det er helt greit å kjøre i 100 km på en rak strekning når det ikke er andre trafikanter å se på mils avstand	☐	☐	☐	☐	☐
Det er bedre å kjøre på gult lys like før det skifter til rødt, enn å stoppe for å følge en dum trafikkregel som sier at det bare er tillatt å kjøre på grønt	☐	☐	☐	☐	☐

	Svært enig	Enig	Både/ og	+ Uenig	Svært uenig
+ Trafikkreglene er ofte for kompliserte til at de kan følges	☐	☐	☐	☐	☐
Fartsgrensene er først og fremst til for eldre førere med svekkede kjøreferdigheter	☐	☐	☐	☐	☐
Det er fornuftig å kjøre litt for fort for å komme forbi eldre lusekjørere	☐	☐	☐	☐	☐
Det er viktigere å bidra til fremkommelighet i trafikken enn alltid å kjøre lovlig	☐	☐	☐	☐	☐
Jeg beundrer venner som har så gode kjøreferdigheter at de kan kjøre fort og sikkert	☐	☐	☐	☐	☐
Hvis alle alltid skulle kjøre lovlig, stoppet trafikken	☐	☐	☐	☐	☐
Det er bedre å kjøre smidig enn alltid å kjøre lovlig +	☐	☐	☐	☐	☐
Du kjører ikke nødvendigvis mindre sikkert selv om du kjører hurtigere enn fartsgrensen	☐	☐	☐	☐	☐
En person som tar sjanser og bryter noen trafikkregler er ikke nødvendigvis en mindre sikker sjåfør enn en som kjører lovlig	☐	☐	☐	☐	☐
Ofte er det slik at jo bedre ferdigheter en sjåfør har, desto hurtigere kan han/ hun tillate seg å kjøre	☐	☐	☐	☐	☐
Du bør overholde trafikkreglene uansett hvordan trafikkforholdene er	☐	☐	☐	☐	☐
Av og til er det nødvendig å bryte noen trafikkregler for å komme seg tidsnok frem	☐	☐	☐	☐	☐
Det er mange trafikkregler som ikke kan overholdes hvis det skal være «flyt» i trafikken	☐	☐	☐	☐	☐
Ungdommen har behov for fart og spenning i trafikken	☐	☐	☐	☐	☐
Når du kjører bil, hører fart og spenning sammen +	☐	☐	☐	☐	☐
Bilkjøring er mye mer enn bare transport, det er også fart og moro	☐	☐	☐	☐	☐
Jentene liker å kjøre sammen med en gutt som kan «trå til» på gasspedalen	☐	☐	☐	☐	☐
Gutter liker jenter som tør sitte på i 100 km/t bedre enn jenter som sier ifra når en kjører for fort	☐	☐	☐	☐	☐
Det ville være galt av meg å si fra når en jeg sitter på med en som bryter trafikkreglene	☐	☐	☐	☐	☐
Jeg ville bli svært upopulær om jeg skulle be en jeg sitter på med om å kjøre mer forsiktig	☐	☐	☐	☐	☐
En som kjører fort er en mer attraktiv person enn en som alltid holder seg til trafikkreglene +	☐	☐	☐	☐	☐
Trafikkulykker skyldes ofte dårlig veistandard	☐	☐	☐	☐	☐
Egentlig er det bare visse mennesketyper som rammes av ulykker	☐	☐	☐	☐	☐
Den gamle bilparken i Norge gjør ulykker uunngåelige	☐	☐	☐	☐	☐
Ulykker er uunngåelige på grunn av at mennesket er som det er	☐	☐	☐	☐	☐

	Svært enig	Enig	Både/og	Uenig	Svært uenig
Det som skjer på veien skyldes ofte tilfeldigheter	☐	☐	☐	☐	☐
De fleste ulykker kan forhindres bare myndighetene viste litt mer oppfinnsomhet i å utforme veiene som vi skal kjøre på	☐	☐	☐	☐	☐
Hvis du ikke har hellet på din side er det umulig å unngå ulykker	☐	☐	☐	☐	☐
Ulykker vil skje uansett hva myndighetene gjør	☐	☐	☐	☐	☐
Noen ganger kan folk føle seg presset av venner til å kjøre for fort og ta sjanser	☐	☐	☐	☐	☐
De mange påbudene og forbudene gjør det ofte vanskelig å ferdes på veiene	☐	☐	☐	☐	☐
Hvis jeg sier ifra til kamerater at de må kjøre mer forsiktig, kan det lett virke som unødvendig mas	☐	☐	☐	☐	☐
I blant er det nødvendig å ta sjanser i trafikken	☐	☐	☐	☐	☐
Noen ganger er det nødvendig å tøye reglene for at trafikken skal gli	☐	☐	☐	☐	☐
I blant kan den som kjører bil bli presset til å ta sjanser	☐	☐	☐	☐	☐
Å følge trafikkreglene er ikke alltid den sikreste måten å kjøre på	☐	☐	☐	☐	☐
Noen ganger kan det være nødvendig å overse brudd på trafikkreglene	☐	☐	☐	☐	☐
Jeg kan ikke se noe poeng i å bli stående på rødt lys når det ikke er en eneste annen bil å se i nærheten	☐	☐	☐	☐	☐
Av og til kan det være nødvendig å kjøre forbi bilen som ligger foran selv om den kjører etter fartsgrensen	☐	☐	☐	☐	☐
For å komme forbi kan det av og til være nødvendig å kjøre nær bilen foran	☐	☐	☐	☐	☐
Utforkjøringer skjer så sjelden at det er lite grunn til å tenke på at det kan skje	☐	☐	☐	☐	☐
Promillekjøring er ikke så farlig som folk vil ha det til å være	☐	☐	☐	☐	☐
Det er så liten risiko for å dø ung i trafikken at vi kan se bort fra den	☐	☐	☐	☐	☐
Det er ikke alltid at høy fart øker risikoen for trafikkulykker	☐	☐	☐	☐	☐

Hvem bryr seg om din sikkerhet i trafikken?

[besvares av alle]

Hvor mye tror du følgende personer bryr seg om din sikkerhet i trafikken?
[Sett ett kryss for hver linje].

	Svært mye	Nokså mye	Litt	Bryr seg ikke om det	Ikke mulig å besvare
Din kjæreste	☐	☐	☐	☐	☐
Dine venner	☐	☐	☐	☐	☐
Dine foreldre	☐	☐	☐	☐	☐
Din klasseforstander	☐	☐	☐	☐	☐
Lærerne ved skolen din	☐	☐	☐	☐	☐

Min vurdering av risikoen for trafikkulykker
[besvares av alle]

Hvor *sannsynlig* mener du det er at UNGDOM PÅ DIN ALDER skal bli skadd i en trafikkulykke?

Svært sannsynlig ☐ ☐ ☐ ☐ ☐ ☐ ☐ Svært usannsynlig

Hvor *sannsynlig* mener du det er at DU SELV skal bli skadd i en trafikkulykke?

Svært sannsynlig ☐ ☐ ☐ ☐ ☐ ☐ ☐ Svært usannsynlig

Ofte vurderer vi sannsynligheten for en ulykke som forskjellig fra hvor urolig og utrygge vi føler oss. Hvor *urolig og bekymret* er du når du tenker på risikoen for at UNGDOM PÅ DIN ALDER kan bli skadd i en trafikkulykke?

Svært bekymret ☐ ☐ ☐ ☐ ☐ ☐ ☐ Ikke bekymret i det hele tatt

Hvor *urolig og bekymret* er du når du tenker på risikoen for at DU SELV kan bli skadd i en trafikkulykke?

Svært bekymret ☐ ☐ ☐ ☐ ☐ ☐ ☐ Ikke bekymret i det hele tatt

Hvor *utrygg* er du når du tenker på risikoen for at UNGDOM PÅ DIN ALDER kan bli skadd i en trafikkulykke?

Svært utrygg ☐ ☐ ☐ ☐ ☐ ☐ ☐ Svært trygg

Hvor *utrygg* er du når du tenker på risikoen for at DU SELV kan bli skadd i en trafikkulykke?

Svært utrygg ☐ ☐ ☐ ☐ ☐ ☐ ☐ Svært trygg

Hvor mye bryr du deg om farene for trafikkulykker og går og tenker på at det kan skje deg?

Svært lite ☐ ☐ ☐ ☐ ☐ ☐ ☐ Svært mye

Hvor mye bryr du deg om farene for trafikkulykker og går og tenker på at det kan skje andre?

Svært lite ☐ ☐ ☐ ☐ ☐ ☐ ☐ Svært mye

Hvis du ble utsatt for en trafikkulykke, hvor alvorlig skadd tror du at du ville blitt?

Svært alvorlig ☐ ☐ ☐ ☐ ☐ ☐ ☐ Ikke alvorlig i det hele tatt

Hvordan føler du deg når du tenker på de farene du selv og andre du kjenner er utsatt for i trafikken?

Svært bekymret	☐	☐	☐	☐	☐	☐	☐	Ikke bekymret i det hele tatt
Oppstemt	☐	☐	☐	☐	☐	☐	☐	Nedtrykt
I godt humør	☐	☐	☐	☐	☐	☐	☐	I dårlig humør
Rolig	☐	☐	☐	☐	☐	☐	☐	Urolig
Ubekymret	☐	☐	☐	☐	☐	☐	☐	Engstelig
Avbalansert	☐	☐	☐	☐	☐	☐	☐	Irritert
Lykkelig	☐	☐	☐	☐	☐	☐	☐	Trist
Følelsesmessig engasjert	☐	☐	☐	☐	☐	☐	☐	Følelsesmessig uengasjert

Om meg selv
[Besvares av alle]

Vi er nå interessert i hvordan DU er som person. Vi ber deg vurdere hvor godt hver av påstandene nedenfor passer for deg. Vær ærlig når du svarer. [Sett ett kryss for hver linje]

	Svært enig	Enig	Både/ og	Uenig	Svært uenig
Jeg higer ofte etter spenning	☐	☐	☐	☐	☐
Jeg ville ikke like å feriere på et sted med mange spillecasinoer og natteliv	☐	☐	☐	☐	☐
Jeg har av og til bare gjort ting for spenningens skyld	☐	☐	☐	☐	☐
Jeg har en tendens til å unngå filmer som er skremmende og sjokkerende	☐	☐	☐	☐	☐
Jeg liker å være der det skjer	☐	☐	☐	☐	☐
Jeg elsker spenningen på berg og dalbaner	☐	☐	☐	☐	☐
Jeg er tiltrukket av sterke farger og prangende stil	☐	☐	☐	☐	☐
Jeg liker å være en del av tilskuermengden ved sportsarrangementer	☐	☐	☐	☐	☐
Jeg er ikke en person som bekymrer meg	☐	☐	☐	☐	☐
Jeg er lettskremt	☐	☐	☐	☐	☐
Jeg føler meg sjelden redd eller engstelig	☐	☐	☐	☐	☐
Jeg føler meg ofte anspent og urolig	☐	☐	☐	☐	☐
Jeg er sjelden bekymret for fremtiden	☐	☐	☐	☐	☐
Jeg bekymrer meg ofte for ting som kan gå galt	☐	☐	☐	☐	☐
Jeg er redd for færre ting enn folk flest	☐	☐	☐	☐	☐
Noen ganger er hodet mitt fylt av skremmende tanker	☐	☐	☐	☐	☐
Det er helt i orden å gjøre alt du ønsker så lenge du ikke kommer 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	☐	☐	☐	☐	☐
Noen ting kan det være galt å gjøre selv om det er lovlig	☐	☐	☐	☐	☐
Jeg prøver å få litt søvn hver natt	☐	☐	☐	☐	☐
Jeg har liten kontroll over de ting som skjer med meg	☐	☐	☐	☐	☐
Det er egentlig ingenting jeg kan gjøre for å løse de problemene jeg har	☐	☐	☐	☐	☐
Det er lite jeg kan gjøre for å forandre viktige ting i livet mitt	☐	☐	☐	☐	☐
Jeg føler meg ofte hjelpeløs når jeg prøver å løse problemer	☐	☐	☐	☐	☐
Noen ganger føler jeg at jeg blir dårlig behandlet i livet	☐	☐	☐	☐	☐

	Svært enig	Enig	Både/ og	Uenig	Svært uenig
Det som hender meg i fremtiden kommer for det meste an på meg selv	☐	☐	☐	☐	☐
Jeg kan gjøre omtrent alt jeg bestemmer meg for å gjøre +	☐	☐	☐	☐	☐
Folk som meg kan forandre andres oppførsel når vi gjør oss selv harde og sier ifra +	☐	☐	☐	☐	☐
Jeg tror hver av oss kan gjøre mye for å endre folks holdninger til råkjørere	☐	☐	☐	☐	☐
Det er svært lite en person som jeg kan gjøre for å endre andres holdninger	☐	☐	☐	☐	☐
En gjennomsnittlig norsk ungdom kan påvirke myndighetenes avgjørelser	☐	☐	☐	☐	☐
Det er noen få personer som bestemmer, og det er ikke mye jeg kan gjøre med det +	☐	☐	☐	☐	☐
Det er bare ønsketenkning å tro at en kan påvirke andre til å kjøre saktere	☐	☐	☐	☐	☐
Sikker kjøring kan bli en realitet hvis folk begynner å arbeide for det	☐	☐	☐	☐	☐
Oftere og oftere føler jeg at det er lite å gjøre for å forhindre råkjøring	☐	☐	☐	☐	☐
Det er svært lite jeg kan gjøre for å forhindre at annen ungdom råkjører	☐	☐	☐	☐	☐
Uvettig kjøring synes uunngåelig til tross for alle anstrengelser som vi gjør for å hindre dem	☐	☐	☐	☐	☐
Den som er uvitende er mest lykkelig	☐	☐	☐	☐	☐
Det kan ikke være min oppgave å påvirke andres kjøring	☐	☐	☐	☐	☐
Jeg kan ikke bruke min tid på å forsøke å påvirke andre	☐	☐	☐	☐	☐
Hvis folk kjører uvettig har de bare seg selv å takke hvis noe går galt, det er lite jeg kan gjøre med det	☐	☐	☐	☐	☐
Ofte følger jeg ikke så godt med at jeg kan si hva andre burde gjort annerledes +	☐	☐	☐	☐	☐
Hvordan andre har det og hva som skjer med dem, er ikke uten betydning for meg	☐	☐	☐	☐	☐
Andre må få gjøre akkurat som de vil	☐	☐	☐	☐	☐
Jeg kan ikke forstå at ungdommens kjørevaner kan være noe problem	☐	☐	☐	☐	☐
En burde bruke tid og energi på andre ting enn ungdommens kjørevaner	☐	☐	☐	☐	☐
Noen mennesker synes jeg er egoistisk	☐	☐	☐	☐	☐
Jeg forsøker å være høflig mot alle jeg møter	☐	☐	☐	☐	☐
Noen mennesker ser på meg som kald og beregnede	☐	☐	☐	☐	☐
Jeg ser på meg selv som en person som gjerne er positivt innstilt ovenfor andre	☐	☐	☐	☐	☐
Jeg lager alle mine klær og sko selv	☐	☐	☐	☐	☐
Jeg forsøker som regel å være hensynsfull og omtenksom	☐	☐	☐	☐	☐
Jeg er ikke kjent for min gavmildhet	☐	☐	☐	☐	☐
De fleste mennesker jeg kjenner, liker meg +	☐	☐	☐	☐	☐
Jeg strekker meg langt for å hjelpe andre mennesker hvis jeg kan	☐	☐	☐	☐	☐

	Svært enig	Enig	Både/ og	Uenig	Svært uenig
Jeg blir ofte sint over den måten folk behandler meg på	☐	☐	☐	☐	☐
Jeg er en avbalansert person	☐	☐	☐	☐	☐
Jeg er kjent for å være en varmblodig og oppfarende person	☐	☐	☐	☐	☐
Jeg blir ikke oppfattet som en nærtagende eller temperamentsfull person	☐	☐	☐	☐	☐
Jeg får ofte avsky for folk jeg er nødt til å ha med å gjøre	☐	☐	☐	☐	☐
Det skal mye til før jeg blir sint	☐	☐	☐	☐	☐
Til tider har jeg følt meg harm og forbitret	☐	☐	☐	☐	☐
Selv mindre ergrelser kan være frustrerende for meg	☐	☐	☐	☐	☐

Personopplysninger
[besvares av alle]

Kjønn: ☐ Kvinne ☐ Mann **Når er du født?** 19: ☐☐

Hvilket fylke bor du i? ☐☐ **Hvilket klassertinn går du i?** ☐

Har du førerkort? ☐ Nei ☐ Ja, for personbil ☐ Ja, for motorsykkel

Hvis Ja, hvor lenge har du hatt førerkort for personbil? ☐ år og ☐☐ måneder

Hvor ofte kjører du selv bil? ☐ Hver dag ☐ Flere ganger i uka ☐ Én gang i uka eller mindre ☐ Aldri

Har du egen bil? ☐ Ja ☐ Nei **Hvor mye kjører du i året? Ca.** ☐☐☐☐ km

Har du noen gang vært involvert i trafikkuhell hvor du eller en annen ble skadd?

	Aldri	1 gang	Flere ganger
Som bilfører	☐	☐	☐
Som passasjer i bil eller på motorsykkel	☐	☐	☐
Som fotgjenger	☐	☐	☐
Som syklist	☐	☐	☐

Har du hatt kollisjon med skader på kjøretøyet (ikke personskade)?

	Aldri	1 gang	Flere ganger
Som bilfører	☐	☐	☐
Som passasjer	☐	☐	☐

Har du noen ganger vært i situasjoner i trafikken som lett kunne ført til ulykker?

Aldri	1 gang	Flere ganger
☐	☐	☐

Er noen du kjenner godt (kamerater, familie o.l.) blitt alvorlig skadd i en trafikkulykke?

Nei	Ja, en	Ja, flere
☐	☐	☐

Hvordan vil du karakterisere den kameraten du oftest sitter på med? [besvares av alle]

Hvor god sjåfør er han/ hun?	Dårlig	☐	☐	☐	☐	☐	☐	☐	God
Hvor aggressiv er kjørestilen?	Lite aggressiv	☐	☐	☐	☐	☐	☐	☐	Svært aggressiv
Hvor mye stress opplever du vanligvis når du sitter på med han/ henne?	Lite stress	☐	☐	☐	☑	☐	☐	☐	Mye stress

Fra tid til annen bryter alle som kjører bil trafikkreglene eller gjør andre ting som *vanligvis* ikke oppfattes som korrekt. Beskriv hvor ofte det forekommer for den kameraten du oftest sitter på med. [Sett ett kryss for hver linje]

	Svært ofte	Ofte	Av og til	Sjelden	Aldri
Hvor ofte forekommer det at din kamerat:					
bryter fartsgrensen i tettbygd strøk med 50 km sone (mer enn 10 km for fort)	☐	☐	☐	☐	☐
bryter fartsgrensen på landevei med 80-90 km sone (mer enn 10 km for fort)	☐	☐	☐	☐	☐
kjører på gult lys like før det skifter til rødt	☐	☐	☐	☐	☐
kjører på rødt lys når det ikke er noen andre biler å se	☐	☐	☐	☐	☐
kjører forbi bilen foran deg selv om den kjører etter fartsgrensen	☐	☐	☐	☐	☐
Hvor ofte forekommer det at du:					
sier i fra når du synes han eller hun kjører for fort	☐	☐	☐	☐	☐
sier i fra når du synes han eller hun foretar farlig forbikjøringer	☐	☐	☐	☐	☐
lar være å si i fra når du synes han/hun kjører for fort eller uforsiktig	☐	☐	☐	☐	☐
Hvor ofte kjører du sammen med han eller henne?	☐	☐	☐	☐	☐

[De neste spørsmålene gjelder bare for de som har førerkort]

Deg selv som sjåfør
[besvares bare av dem som har førerkort]

Vi er nå interessert i din oppfatning om deg selv som sjåfør. Svar så ærlig som mulig om din egen kjøring. Det er ingen gale eller rette svar. Vi ønsker DIN vurdering. [Vær ærlig]

Hvor god sjåfør er du?	Dårlig	☐	☐	☐	☐	☐	☐	☐	God
Hvor aggressiv er din kjørestil?	Lite aggressiv	☐	☐	☐	☐	☐	☐	☐	Svært aggressiv
Hvor mye stress opplever du vanligvis når du kjører bil?	Lite stress	☐	☐	☐	☐	☑	☐	☐	Mye stress
Hvor fornøyd er du med den føreropplæringen du har fått?	Svært fornøyd	☐	☐	☐	☐	☐	☐	☐	Svært misfornøyd

Fra tid til annen bryter alle som kjører bil trafikkreglene eller gjør andre ting som *vanligvis* ikke oppfattes som korrekt. Beskriv hvor ofte det forekommer for ditt vedkommende. [Sett ett kryss for hver linje]

	Svært ofte	Ofte	Av og til	Sjelden	Aldri
Hvor ofte forekommer det at du:					
bryter fartsgrensen i tettbygd strøk med 50 km sone (mer enn 10 km for fort)	☐	☐	☐	☐	☐
bryter fartsgrensen på landevei med 80-90 km sone (mer enn 10 km for fort)	☐	☐	☐	☐	☐
kjører på gult lys like før det skifter til rødt	☐	☐	☐	☐	☐
kjører på rødt lys når det ikke er noen andre biler å se	☐	☐	☐	☐	☐
kjører forbi bilen foran deg selv om den kjører etter fartsgrensen	☐	☐	☐	☐	☐
kjører for nær bilen foran deg	☐	☐	☐	☐	☐
kjører mot innkjøring forbudt skilt	☐	☐	☐	☐	☐
kjører hurtig fordi det motsatte kjønn liker det	☐	☐	☐	☐	☐
ignorerer trafikkregler for å komme deg smidig frem i trafikken	☐	☐	☐	☐	☐
tøyer trafikkreglene litt for å komme deg frem	☐	☐	☐	☐	☐
bryter trafikkreglene fordi de er for kompliserte å følge	☐	☐	☐	☐	☐
bryter trafikkreglene på grunn av press fra kamerater	☐	☐	☐	☐	☐
kjører litt rått fordi jeg vet at andre forventer det av meg	☐	☐	☐	☐	☐
kjører hurtig for å vise at jeg er «tøff» nok	☐	☐	☐	☐	☐
kjører hurtig for å vise at andre at jeg kan håndtere bilen	☐	☐	☐	☐	☐

Mine egne reaksjoner i trafikken
[besvares bare av dem som har førerkort]

Av og til kan vi alle bli irritert over andres oppførsel i trafikken. Nedenfor vil du finne noen situasjoner som kan forårsake irritasjon. Hvor irritert vil du selv bli i følgende situasjoner? [Sett ett kryss for hver linje]

	Svært irritert	Irritert	Både/ og	Lite irritert	Ikke i det hele tatt
Bilen foran deg kjører ikke videre når trafikklyset blir grønt	☐	☐	☐	☐	☐
En fotgjenger går over veien slik at du må slakke ned farten	☐	☐	☐	☐	☐
Bilen foran deg kjører saktere enn fartsgrensen og slipper deg ikke forbi	☐	☐	☐	☐	☐
Noen kjører saktere enn nødvendig og lager kø i trafikken	☐	☐	☐	☐	☐
En som kjører langsomt på en smal vei slipper deg ikke forbi	☐	☐	☐	☐	☐
Bilen foran deg øker hastigheten når du prøver å kjøre forbi	☐	☐	☐	☐	☐
En annen bilfører som skal parkere sinker trafikken	☐	☐	☐	☐	☐

Takk for at du besvarte skjemaet!