Young Drivers and Their Passengers

Crash Risk and Group Processes

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Preface

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1. Introduction

Background

Almost everything we do in life, we do together with other people. We belong to many different types of groups. For example, we can be members of a family, a school class, a football team, and a workplace group, as well as citizens of a country. Some of these groups are persistent, and some of them are more temporary in nature in the sense that you belong to them for a while, and then you leave them or they cease to exist. A group that consists of people riding together in a car can be assigned to the latter category.

In traffic psychology, theories are created to explain and anticipate the behaviour of road users and the knowledge obtained in this way is used to help lower crash risks. This work takes into account aspects such as experience, maturity, ability, processing information, and decision-making, as well as personality, attitudes, and social factors. The field of traffic psychology also considers the human–machine interaction. Most of the theories concern car drivers, and those individuals are usually divided into different age groups (most often simply younger and older drivers) due to various age-related disparities in crash risks. In addition to car drivers, there are categories of "unprotected" road users, such as motorcyclists, bicyclists, and pedestrians.

This thesis is about the potential of the in-vehicle group to promote traffic safety for young drivers. For those of us who are drivers, many of the journeys undertaken in life are done with passengers. The passengers can be people we know, like family members, friends, and colleagues, or they can be people with whom we are less well acquainted. Regardless of their identities, passengers will somehow affect the drivers they accompany, in either a positive or a negative way.

Passengers are often regarded as a problem that can increase the risk of accidents, and this is especially noticeable when it comes to young drivers, which is reflected by the restrictions that the licensing systems in some countries place on learners. The objective is to ensure

traffic safety while learners are gaining driving experience. The restrictions used in different countries vary, although some are more common than others. Examples of such limitations are when learners are not allowed to drive at specific times of the day or night, or with passengers in the vehicle, especially at the beginning of the behind-the-wheel training period (Preusser & Tison, 2007). But why are passengers looked upon as a problem during that period? In other contexts, for instance workplace teams, the group is seen as a resource, so why shouldn't the group of people in a vehicle (the passengers) be regarded as a resource in traffic?

This introduction is divided into two parts. The first deals with the high crash risk of young drivers and the reasons for that problem, and it also consider the effects of passengers on young drivers. The second part is about group processes and how they apply to young drivers and their passengers.

Overrepresentation of young drivers in traffic crashes

Traffic accidents constitute a major global health problem. In the European Region of the World Health Organization (WHO), about 127,000 people are killed and more than two million are injured in road crashes each year. Young people 15 to 29 years old are overrepresented in that group, and indeed traffic accidents are the most common cause of death in people of that age (Racioppi, Eriksson, Tingvall & Villaveces, 2004). In the OECD countries, road crashes represent the primary cause of death among 18–24-year-olds, and they account for 35% of all deaths among 15–24-year-olds (Organisation for Economic Co-operation and Development, 2006). According to Nyberg (2007), from 1994 to 2005 in Sweden, 19% of all those who were killed and 21% of those who were severely injured in traffic crashes involving private vehicles were young novice (recently licensed) drivers (18–24 years of age). That is noteworthy when considering that young (18–24-year-old) drivers represented only 8% of all licensed drivers during the mentioned period.

Nyberg (2007) also found that, for young drivers aged 18–24, the probability of being killed (per 100 000 licence holders) was on average 2.95 times higher than for drivers aged 25–64, and it was 1.96 higher compared to the oldest group of drivers (over 65 years).

Furthermore, the odds of being severely injured were on average 2.92 times higher for the young drivers compared to the 25–64-year-old counterparts and 4.11 times higher compared to the oldest drivers. In addition, compared to middle age drivers, young drivers of both sexes are overrepresented in traffic crashes, although there are fewer young females in that category than young males. Data from some OECD countries have shown that young (18–24-year-old) male drivers are involved in fatal road crashes three times more often than young female drivers (per million population; OECD, 2006). In a study conducted in the United States (Kweon & Kockelman, 2003), the overrepresentation of young male drivers was apparent even after exposure was taken into account: the crash risk per million miles was found to be 1.2 times higher for male drivers under the age of 20 than for female drivers of the same age. Moreover, Lynam et al. (2006) observed that in some European countries (the Netherlands, Sweden, and the United Kingdom), male drivers aged 18–24 had over three times more fatal crashes per million kilometres driven compared to female drivers in the same age group.

Young drivers are overrepresented in traffic crashes, and they are a risk not only to themselves but also to their passengers and other road users. Research has shown that for every 10 young drivers killed in the Netherlands, six passengers in the young drivers' cars and over seven other road users died in the same crashes. This means that for every young driver that is killed, approximately 1.33 other people also die (OECD, 2006). In Sweden from 1994 to 2005, an average of 518 people was killed (excluding crash deaths caused by illnesses) and 4,102 people were severely injured annually in road crashes. During the same period, 18–24-year-olds suffered on average 82 traffic deaths (42 as drivers, and 20 as passengers), and 756 were severely injured (336 as drivers, and 191 as passengers). This indicates that a little over 75% of all deaths and almost 70% of all severe injuries among 18–24-year-olds occurred in crashes involving a private motor vehicle. Almost 25% of the young people who died and more than 25% of the young people who were severely injured had been passengers (Nyberg, 2007; Brüde, 2005). This problem can also be shown in another way: for every young driver that was killed in a crash, an average of 1.38 other road users died. Correspondingly, for every young driver that was severely injured in a road crash, on average 1.75 other road users were severely injured.

The mentioned findings demonstrate that young drivers do represent a problem in traffic, and that they harm not only themselves, but also many other people, in the road crashes they cause. But what kind of crashes and related circumstances are of significance for young drivers, and why is this group overrepresented in road accidents?

Young drivers

Factors underlying the overrepresentation of young drivers in road crashes

The knowledge base about factors underlying the overrepresentation of young drivers in car crashes is relatively good, whereas there is insufficient information about what measures need to be taken to promote traffic safety in this group. It can be said that that the driving behaviour and accident involvement of young drivers are affected primarily by two different processes, which can be referred to as the learning process (related to experience) and the process involving individual and social circumstances (related to age) (Gregersen, 1996). In short, the learning or "experience-related" process comprises the procedure of learning how to drive a car. The "age-related" process on the other hand is more about the aspects of life that have an impact on driving, that is, different social influences and individual circumstances (Gregersen, 1996; Engström, Gregersen, Hernetkoski, Keskinen & Nyberg, 2003). Both age and experience affect the crash risk during the learner period as well as under the time as a novice driver. Gregersen (2003) has suggested that factors related to age account for 30–50% of the crash reduction during the first period of independent driving and that factors related to experience account for 50–70%. These processes influence motives, attitudes, and decision-making, which in turn affect driving behaviour, as for example reflected in driving style and choice of safety margins (Engström et al., 2003).

The learning process progresses through education, training, and acquisition of experience, and it helps the aspiring driver to achieve better understanding of traffic regulations and increased skills in handling a vehicle in a safe way, and also to realize the risks that are

involved in traffic (Engström et al., 2003). This process is associated with three problems related to a) level of experience, b) overestimation of abilities, and c) perceiving the probability of an accident. Experience is a quality that takes time to acquire, and it is a prerequisite of achieving automated driving behaviour. A new driver goes through several phases to attain such performance. In the beginning, all situations and statements are new, and the demands on mental resources are substantial, and hence it can easily be "too much" for the driver. As time passes, the driving behaviour will become more automated, which is important to decrease the mental workload on the driver (Gregersen, 1996). Rasmussen (1986), among others, has given a more detailed description of this automatization. The second problem related to the learning process applies to drivers, especially young males, who overestimate their abilities behind the wheel, because they have an unrealistic idea of their objective skills and think that they can handle more than they actually can. This overestimation of capacity can lead to underestimation of risks in traffic (Engström et al., 2003). The third and last problem is that drivers do not perceive any real risk that they themselves will be involved in an accident, even if they break the law, for example by exceeding the speed limit. This assumption is based on the knowledge that in most cases people come back from driving safe and sound, and this promotes a false sense of security (Gregersen, 1996).

By comparison, the age-related process entailing individual and social circumstances is more about life itself and how it affects drivers. It includes variables such as social norms, lifestyle, personality, socio-economic factors, and reasons for driving, all of which are influenced by age. One problem for learners and young novice drivers is simply the fact that they are young. Teenagers are often in the process of freeing themselves from their parents, and other people are becoming more important to them as they approach adulthood and independence. They test limits and free themselves from values and norms that have previously been of significance in their lives. Furthermore, both decision-making and driving behaviour are affected by peer group norms and media portrayal of the way young people ought to be (Engström et al,. 2003). Even if young people are in the midst of liberation from parents when they start practicing driving for their licence, the parents still have a strong impact at their way of driving. In addition, there are studies showing that the parents' driving behaviour

is passed on to the children (Bianchi & Summala, 2004; Taubman-Ben-Ari, Mikulincer & Gillath, 2005). There is also evidence that young drivers who have poor relationships with their parents or other adults (e.g., teachers) are overrepresented in car crashes (Beirness & Simpson, 1991), whereas living with both parents appears to be a protective factor (Shope, 1997).

Socio-economic factors and personality

It is also important to elucidate socio-economic factors when attempting to understand why young drivers are overrepresented in road accidents (Murray, 1998; Hasselberg & LaFlamme, 2003). For example, it has been observed that young drivers that had poor grades in school, especially in academic subjects, had a higher level of crash involvement (Murray, 1998), and higher crash involvement has also been noted for young drivers who were members of farming or blue-collar families as compared to those from white-collar families (Berg, Eliasson, Palmkvist & Gregersen, 1999). Berg and co-workers also found that fewer youngsters in blue-collar families than in white-collar families obtained a learner's permit, and they concluded that this was due to unfair effects of the cost of driving practice. Furthermore, Hasselberg and LaFlamme (2003) discovered that young drivers whose parents were lower-income white-collar workers, blue-collar workers, farmers, or entrepreneurs had more injuries than those whose parents were middle- and high-income white-collar workers.

Much research has been focused on finding a relationship between personality and crash involvement, and some studies have shown that driving behaviour, and along with that the crash risk, can be influenced by the driver's personality (Gregersen, 2003; OECD, 2006). Factors such as social deviance, aggression, impulsiveness, hostility, emotional liability, and low altruism have been found to be related to dangerous driving and crash involvement, although these associations have proven to be weak. Nevertheless, it has been demonstrated that one personality factor in particular is strongly related to driving style and crashes, and that is sensation-seeking (Jonah, 1997), although that aspect has been shown to have a greater impact on the propensity to commit driving violations (Rimmö & Åberg, 1999; OECD, 2006).

Significant others

The norms of a significant group have a marked effect on how a young person drives. Ajzen (1991) has compared this concept with subjective norms in the model known as "the theory of planned behaviour," because it includes what the driver believes that significant others think about his/her driving. In general, such a situation can make a person feel compelled to acting in a specific way that is common to a group of people who are important to that individual. This implies that drivers might exceed the speed limit whether they want to or not, simply because they are closely associated with a group that likes fast driving. Subjective norms can have a substantial impact on young drivers in that their driving behaviour is highly susceptible to the social influence of friends or peer groups (Berg, 2001; Møller, 2004). Peer pressure can also be exerted in the form of passenger influence on the driver's behaviour. Several studies have revealed a relationship between the presence of passengers and driving behaviour or crash involvement.

The experienced-related and age-related processes affect young drivers' motives and attitudes, as well their driving behaviour and style. Wahlquist (1996) has observed that both driving behaviour and the risk of being involved in crashes are influenced by the different motives and goals of the driving, and that certain motives are correlated with certain driving styles. Drivers who drove more often for pleasure, to seek adventure, or to get rid of frustrations had a more aggressive driving style with smaller safety margins and higher speed, and they also had a higher rate of crash involvement. On the other hand, the drivers who felt responsible and wanted to perform safely on the road had a more observant and tolerant driving style and were also involved in fewer crashes. According to Gregersen and Berg (1994), a lifestyle that includes showing off and sensation-seeking is more characteristic of high-risk drivers than other drivers. Risk-taking behaviour can also be a way of achieving status and position in the peer group (Møller, 2004).

Driving style and the risk of crash involvement are affected by many different factors that are not always directly related to the driving situation. This was demonstrated and reported by Hatakka, Keskinen, Gregersen, Glad and Hernetkoski (2002) in the work they performed to develop the Goals for Driver Education (GDE) matrix. These

investigators felt that traditional driver training in many countries has focused on knowledge or skills in things like vehicle manoeuvring, traffic rules, and driving-related risks, and that not enough attention has been paid to different social aspects. They meant that driving also is affected by a person's skills in handling different situations in life in general, including the associated goals and motives. Therefore, Hatakka et al. (2002) suggested that, in addition to the basic skills and knowledge about vehicle manoeuvring and risk factors, a driver should be proficient in self-evaluation, which is a process whereby individuals try to give themselves feedback on their personal actions. This will entail being able to realistically perceive one's own role in the success of a driving situation (Hernetkoski & Keskinen in Engström et al., 2003).

Types and circumstances of crashes involving young drivers

Young drivers are overrepresented in all kinds of road accidents, but especially in single-vehicle (Gregersen & Nyberg, 2002; Ballesteros & Dischinger, 2000) and loss-of-control (Clarke, Ward & Truman 2002; Laapotti & Keskinen, 1998) crashes. Gregersen and Nyberg (2002) found that in 1994–2000 in Sweden, 27% of all traffic accidents were single-vehicle crashes involving 18–19-year-old drivers, while the corresponding rate for other age groups was 14%. Similarly, Clarke, Ward and Truman (2001) observed that 22% of all road accidents involving 17–19 year-old drivers in the United Kingdom were *single-vehicle crashes*. Young male drivers are responsible for a majority of all single-vehicle accidents, which are often the result of loss of control; in contrast, among young females loss-of-control accidents usually entail collision with another vehicle (Laapotti & Keskinen, 1998).

Young drivers are also overrepresented in road crashes that occur at *night and on weekends* (Laapotti & Keskinen, 1998; Gregersen & Nyberg, 2002; OECD, 2006), especially in the company of passengers (Doherty, Andrey & MacGregor, 1998). A study has shown that in Sweden in 1994–2000, 32% of the crashes that involved 18–19-year-old drivers happened in darkness compared to 22% for all other age groups (Gregersen & Nyberg, 2002). Similarly, Clarke, Ward, Bartle

and Truman (2006) noted that a disproportionately large number of drivers aged 17–25 years were involved in loss-of-control crashes that occurred on curves and in darkness.

Speeding is a factor that increases the risk of losing control of a vehicle. It has been shown that young people drive at higher speeds compared to those who are older (Waylen & McKenna, 2002), and they also exceed the legal speed limit more often (Goldenbeld, 1999). Notably, speeding has been found to account for 20% of all crashes in the US states of California and Maryland (McKnight & McKnight, 2000). Speeding is principally a problem related to male drivers, particularly those who are young (OECD, 2006).

Young drivers are also overrepresented in *alcohol-related crashes*, which are usually combined with high speed, night-time driving, and the presence of passengers (OECD, 2006). A study in Sweden has shown that in 63 crashes with fatal outcome, the drivers had been drinking alcohol; 35% of those drivers were young (18–24 years old), even though only 7% of all licensed drivers in the country at that time were young people (Swedish Road Administration, 2004). Despite these findings, there are no results demonstrating that young drivers are more inclined to drive under the influence of alcohol compared to drivers in other age groups (Forsman & Gustafsson, 2004). It just seems that the crash risk increases more rapidly for young drivers than for older ones upon consumption of alcohol (Keall, Frith & Patterson, 2004).

An overrepresentation of young persons is also seen in the group of drivers that *do not use seat belts*. In Sweden, a study showed that 40% of 18–24-year-olds killed in car crashes had not worn seat belts (SRA, 2004), although the average general rate of usage by 18–25-year-olds was 82% for males and 93% for females in 2000–2006 (Cedersund, 2007). Similar results have been obtained in other countries (Goldenbeld, 1999; Williams, McCartt & Geary, 2003). Seat belts represent one of the most effective types of safety equipment for minimizing the severity of injuries in road crashes. Therefore, non-use of seat belts will no doubt lead to more serious injuries and overrepresentation in crash statistics.

According to Horne, Reyner, Baulk & Flatley (2002), *tiredness* is an important cause of road accidents involving young male drivers. Also, the crash risk for 18–24-year-old drivers is 5–10 times higher at night compared to before noon (Åkerstedt & Kecklund, 2001). A

plausible explanation for these observations is that young drivers have little experience and knowledge of how to cope with fatigue compared to older, more experienced drivers (Summala & Mikkola, 1994). In addition, it has been reported that the difference between the amount of sleep required and/or desired and the actual amount of sleep obtained is largest in the youngest age group (Groeger, 2006).

The *presence of passengers* is often referred to as a risk for young drivers, especially if the passengers are of the same age as the driver. Furthermore, it has been shown that the risk increases with every extra passenger in the vehicle (Preusser, Ferguson & Williams, 1998; Williams, 2000; Chen, Baker, Braver & Li, 2000), although the opposite has also been reported, that is, that passengers have a protective effect with regard to the crash risk, even for the young drivers (Vollrath, Meilinger & Krüger, 2002; Rueda-Domingo et al., 2004). The influences of passengers and psychological processes that may arise are discussed further in subsequent sections of this thesis.

Young drivers and their passengers

As mentioned, it is not just drivers that are killed or injured in traffic crashes, passengers and other road users are also affected. In the United States, approximately 25% of the people who died in road accidents in 1990 were passengers (Soderstrom, Dischinger & Kerns, 1996), and almost half (46%) of the teenagers killed in such calamities in 1999 were passengers (Insurance Institute for Highway Safety, 2000). From 2000 to 2006 in Sweden, an average of 314 people died annually in road crashes, 221 as drivers and 93 as passengers. By comparison, on average 67 people aged 18–24 died annually, 45 as drivers and 22 as passengers. Thus, about one-third of the fatalities in road crashes were passengers. The proportions were found to about the same for severely injured vehicle occupants: approximately one-third were passengers (Swedish Institute for Communication Analysis, 2006).

Several studies have shown that passengers influence driver behaviour, although in some cases the effect was found to be positive (Vollrath et al., 2002; Rueda-Domingo et al., 2004) and in others negative (Doherty et al., 1998; Chen et al., 2000; Lam, Norton, Woodward, Connor & Ameratunga, 2003). This is determined by

several different factors, for example the number of passengers present, the socially mediated personal characteristics of the driver and the passengers (Regan & Mitsopoulos, 2001). To facilitate the discussion, these factors are considered separately in the text below, although they do not necessarily exert independent effects.

Effects of the characteristics of the driver

The age of the driver

There seems to be no doubt that passengers have an effect on drivers, the question is how drivers perceive such influence. In an interview study conducted in the United States (Ingham, 1991), it was found that 90% of the young drivers (aged 17–20 years) and 60% of the older drivers (aged 31–40) reported being affected by the presence of passengers. Although the extent of the impact varied, most of the young drivers said that they drove differently with and without passengers, and there were two main reasons for this (Rolls & Ingham, 1992): (a) they felt that the passengers expected them to drive in a certain way, and (b) they felt a greater responsibility with passengers in the vehicle and therefore modified their driving behaviour.

Young drivers carry passengers more often than middle-aged and older drivers do (Laapotti, Keskinen, Hatakka & Katila, 1998; Isaac, Kennedy & Graham, 1995), and the young drivers' passengers are more frequently the same age as themselves, which is not as common for middle-aged and older drivers (Isaac., et al, 1995). Furthermore, one of the cited investigations was performed in Finland (Laapotti et al., 1998), and it showed a difference in the extent to which young (19-year-old) and middle-aged (35–45-year-old) drivers had passengers with in the vehicle: 61% and 50% of the driving distance (kilometres travelled), respectively. Thus young people (especially males) were those that most often drove with passengers. In addition, comparison of the mentioned percentages with the number of accidents that occurred with passengers in the vehicle showed that there was an underrepresentation of driving with passengers (50% for the young drivers and slightly over 40% for the middle-aged group).

In studies by Vollrath et al. (2002) and Rueda-Domingo et al. (2004), passengers were found to have a protective effect on drivers of all ages, which implies that driving alone entails an increased risk of being involved in a crash. However, Rueda-Domingo and co-workers also noted that this effect was less positive for young drivers aged 18–24 and more positive for those older than 45. It was suggested that the less beneficial effect on young drivers might be the result of passengers distracting the driver and thereby detracting attention from the task of driving, which drivers normally compensate for by doing things like slowing down. It is more difficult for young drivers to make such adjustments, because they are less experienced and need to focus more of their resources on accomplishing their driving (Vollrath et al., 2002).

A detrimental effect of passengers has also been reported for young drivers (Doherty et al., 1998; Preusser et al., 1998; Chen et al., 2000; Lam et al., 2003), whereas no such influence (Doherty et al., 1998; Lam et al., 2003) or a positive impact (Doherty et al., 1998; Preusser et al., 1998; Williams, 2003) has been observed for older drivers. Preusser et al. (1998) analysed all fatal crashes registered in the Fatality Analysing Reporting System (FARS) from 1990 to 1995 and found that young drivers, especially 16-year-olds, to a larger extent had passengers in the vehicle at the time of a fatal crash. Drivers aged 16–19 had at least twice the risk of a fatal crash with passengers compared to when they were alone, whereas the presence of passengers decreased the risk for drivers aged 60 and over. It was also shown that young people (≤ 24 years), especially 16- and 17-year-olds, who drove with passengers were proportionately more at fault for the crashes. This declined with age: for drivers aged 25–29, passengers were a neutral factor; for drivers 30 years and older, passengers had a positive influence (i.e., were associated with fewer at-fault crashes). Doherty et al. (1998) also observed that drivers aged 16–19 had a higher crash risk compared to those who were 20–24 or 25–59 years old, and the two older age groups were either not affected or were beneficially impacted by the presence of passengers.

The sex of the driver

Several studies have shown that young drivers are at increased risk of being in a crash when there are passengers in the vehicle, and this effect is especially pronounced for young male drivers (Doherty et al., 1998; Chen et al., 2000). Ingham (1991) found that more men (86%) than women (65%) reported being influenced by passengers, and Laapotti et al. (1998) noted that passengers were present during 64% and 59% of the driving done by young males and young females, respectively. Thus it seems that, compared to young women, young men more often drive with passengers, and they also say they are more extensively affected by the other vehicle occupants.

According to Chen et al. (2000), both male and female drivers in the age group 16–19 years have an increased crash risk in the presence of passengers, but young males are at higher risk than young females, regardless of the number of passengers that accompany them. By comparison, Williams and Wells (1995) noted that the crash risk for both sexes was greater for younger than for older drivers, and they also found that the death rate in the presence of passengers was 1.5 times higher for younger than for older male drivers and was 1.8 times higher for younger than for older female drivers.

McKenna, Waylen and Burkes (1998) studied drivers and passengers under the age of 25 to determine whether young males and females differ with regard to their driving behaviour when accompanied by peers. The results showed that, when alone in the vehicle, young males drove in a riskier manner than young females did, that is, they drove faster and with shorter headway. Furthermore, when there were young male passengers, both young males and females drove more dangerously than they did when they were alone (i.e., faster and with shorter gap acceptance at junctions, but no difference in headways). The presence of female passengers resulted in safer driving (i.e., lower speed and greater following distance) by males but had no effect at all on female drivers. Simons-Morton, Lerner and Singer (2005) also observed riskier driving performance of young male drivers accompanied by male passengers, and such a negative effect was seen for female drivers as well. In contrast, the presence of female passengers had a positive impact on young drivers of both sexes, leading to less risky driving behaviour.

Effects of characteristics of the passengers

Young drivers are affected most extensively (positively or negatively) by the presence of passengers in the vehicle, and the size of the impact depends on who the passengers are. Aldridge, Himmler, Aultman-Hall and Stamatiadis (1999) studied 16–20-year-old drivers and found that the propensity to cause an accident (especially a single-vehicle crash) was low in the presence of a child and/or an adult passenger, whereas it was increased if same-age peers were passengers. This pattern was seen for both male and female young drivers. Arnett, Offer and Fine (1997) also found that young drivers (aged 17–18) drove faster when they had friends in the vehicle than they did in the presence of parents. This can be explained by peers causing greater pressure and distraction, whereas an adult or a child can make a driver feel more responsible (Aldridge et al., 1999). Moreover, there are results showing that young drivers (aged 19 years) most often have friends as passengers, whereas middle-aged drivers usually have a family member with them in the vehicle (Laapotti et al., 1998).

Chen et al. (2000) found that young drivers were at greater risk of dying in a crash when one or more passengers were males than when only females were passengers. Those investigators also noted that the risk of death rose with an increasing number of male passengers, and that the more male passengers there were, the higher the crash risk. Furthermore, for both male and female drivers, the death rate per 1,000 crashes was almost doubled by the presence of one male passenger and was more than doubled by two or more male passengers. The idea of a young-male-passenger effect is strengthened by the results of Rueda-Domingo et al. (2004) demonstrating that passengers of both sexes under the age of 15, female passengers of all ages, and older passengers (over 45) had the most positive influence on young male drivers. Simons-Morton et al. (2005) found that young licence holders also exhibited a more risky driving style (i.e., drove closer to the vehicle in front and faster) when there were young male passengers in the vehicle, whereas they (especially males) drove more safely with female passengers. The combination with the highest crash risk consisted of young male drivers with young male passengers.

The number of passengers in the vehicle is an important factor affecting the risk of young drivers being injured in road crashes, and the risk increases with each added passenger (Lam et al., 2003;

Aldridge et al., 1999; Doherty et al., 1998; Preusser et al., 1998), especially when they are of the same age as the driver (Lam et al., 2003; Aldridge et al., 1999). No such effect has been found for older drivers (over 25 years of age) (Lam et al., 2003). This difference can be explained by the findings that young drivers are more susceptible to risk-taking, distractions (e.g., talking to people in the back seat), physical interference (e.g., a passenger grabbing the steering wheel), and inducements to takes risks (e.g., trying to get the driver to overtake another vehicle) (Preusser et al., 1998).

In a study by Laapotti et al. (1998), it was found that whether the driver had been alone or had had a passenger in the vehicle was not related to the type of crash that occurred, whereas the presence of a group of peers more often led to a loss-of-control crash. In addition, driving had been done at higher speeds and more unsafely when there were peers as passengers (Laapotti et al., 1998; Aldridge et al., 1999). Rolls and Ingham (1992) conducted an interview study and found that young drivers aged 17–25 drove differently depending on who their passenger were. For example, they said they drove more carefully if a parent was a passenger, because they wanted to make a good impression so that it would later be easier to borrow the car, or they just wanted to show that they could drive well. The interviews also revealed a difference between safe and unsafe drivers; the unsafe drivers more often had peers in the vehicle, whereas safe drivers more frequently had a spouse or cohabitant/partner as a passenger or drove alone. The unsafe drivers behaved differently in the presence of different kinds of passengers. They tended to drive faster when there were male peers in the vehicle, because they thought that that was what their friends wanted, and sometimes the male passengers even encouraged them to accelerate. The safe drivers did not change their behaviour in relation to the identity of their passengers; they treated all passengers in the same way with the goal of providing a slower, more comfortable ride. In some cases, the safe drivers were also encouraged by their friends to drive faster, but they were better at ignoring such requests. Drunken passengers were more likely to call for unsafe driving, and the interviewed drivers said they had different ways of coping with this: some chose to ignore the exhortations, and some stopped the vehicle and told inebriated passengers to walk home. The interviewees also indicated that they drove more carefully if a passenger was a parent, a spouse/partner, or some other adult.

Thus it seems that the worst combination includes a young driver with more than one passenger, and the passengers are all males and of the same age as the driver (Lam et al., 2003; Chen et al., 2000; Aldridge et al., 1999; Doherty et al., 1998; Preusser et al., 1998).

Driving and crash circumstances

In an investigation carried out by Laapotti et al. (1998), the most typical journey for middle-aged drivers entailed driving alone to and from work on weekdays in the morning or the daytime. About one third of their driving was of this kind, and it was done in both rural and urban areas. By comparison, that sort of journey constituted only about 10% of the driving done by the youngest group. The most typical journey for young men were to just ride around for fun with friends in the vehicle (15% of their driving). That kind of driving was very rare in the older group.

Ingham (1991) found that a majority of young male drivers felt that having friends in the vehicle prompted them to drive faster or less carefully, whereas being accompanied by parents encouraged slower or more cautious driving. By comparison, the majority of young female drivers in that study reported that they drove more slowly and more prudently in the presence of passengers, and that they did so because they knew that passengers could be a distraction. In unsure situations, for example when necessary to decide whether to stop for a traffic light that has changed to yellow (amber), it was found that young men were more prone to take risks if there were friends in the vehicle, whereas older men were more likely to take risks when driving alone. Young female drivers were least apt to take risks with friends as passengers. Results published by Baxter, Manstead, Stradling, Campbell, Reason & Parker (1990) indicate that, in the presence of passengers, drivers adjust their behaviour according to their passengers or, more specifically, according to what they perceive as the social expectations of the passengers. Those investigators also observed that young males drive much faster when there are male passengers in the vehicle.

The overrepresentation of young drivers with passengers in traffic accidents is more evident under certain circumstances. The crash risk is higher at night than during the daytime (Doherty et al., 1998; Preusser et al., 1998; Williams & Wells, 1995) and greater on

weekends (Friday to Sunday) (Doherty et al., 1998), in small cars (Williams & Wells, 1995), and with an increasing number of passengers (Doherty et al., 1998; Preusser et al., 1998), especially if the passengers are same-aged peers (Preusser et al., 1998). Young drivers are also overrepresented in single-vehicle accidents, driver errors and speeding with passengers in the vehicle. For example, considering all crashes with fatal outcomes that occurred in 1999 in the United States, for 16–17-year-old drivers with three or more passengers 56% were single-vehicle crashes, whereas 32% involved people driving alone. In the same comparison, it was found that 90% of the driver errors and 48% of the speeding done by young drivers occurred when there were three or more passengers in the vehicle; the corresponding proportions for lone drivers were 75% and 27%, respectively (Williams, 2001). Simons-Morton et al. (2005) reported that young drivers take greater risks in the presence of passengers, and they drive too close to the vehicle in front compared to other age groups and faster than the general traffic. Ingham (1991) also found that young drivers themselves reported driving faster when they had passengers in the vehicle. This was true at least when they felt safe because the weather was good, and they had plenty of time and were on a motorway and the passengers were friends rather than family members. The older drivers in that study drove faster when they were alone than in the presence of passengers.

A passenger can constitute a distraction and induce risk taking by doing things like urging the driver to speed or by interfering physically with the driver, and these behaviours can be strengthened by one or several vehicle occupants who have been drinking. It has been shown that, compared to lone drivers, a greater number of drivers who had passengers that died in crashes have had measurable blood alcohol levels (Preusser et al., 1998). A study performed in the United States analysed all traffic accidents that occurred in 1989–1990 and involved an intoxicated driver (Isaac et al., 1995). The results showed that 86% of those drivers were men and two-thirds were under the age of 35, and it was also found that there had been passengers in the vehicle in one third of the crashes. In alcohol-related accidents, it is important to determine the blood alcohol concentration (BAC) of the passengers. This is motivated, considering that in the study by Isaac et al. (1995) it was found that 80% of the fatally injured passengers in such accidents had measurable BACs, and only 24% of those individuals had a BAC

lower than .05% (0.5‰). In other words, more than 75% of the passengers had a BAC greater than .05% (0.5‰). It was also noted that of all fatally injured drivers, 92% had a BAC of more than .05% (0.5‰), and 83% had level higher than .08% (0.8‰). This means that both drivers and passengers had very high BACs. However, the passengers usually had lower values than the driver, and in only 20% of the cases did they have higher BACs. This can be compared with the findings of Keall et al. (2004) showing that the group with the highest crash risk comprises teenaged drivers who drink and have two or more passengers in the vehicle.

The different roles of drivers and passengers

Ulleberg and Must (2003) conducted focus group interviews with young people to discern the roles of drivers and passengers. He found that passengers can influence a driver's behaviour both positively and negatively. Furthermore, he identified four types of drivers: (a) responsible drivers, (b) insecure drivers, (c) tough drivers, and (d) drivers that want to demonstrate their power. *Responsible drivers* pay attention, obey the laws, and are cautious in traffic, especially when there are passengers in the vehicle. They want their passengers to get a good impression of them and feel secure, and they also consider the consequences of their driving behaviour. *Insecure drivers* drive slowly, do not give clear signals to other people in traffic, brake late and hard, and hesitate in many situations. They seem to be afraid, which is probably true since they do not have much driving experience. These drivers are even more apprehensive when they have passengers in the vehicle. By comparison, *tough drivers* like having passengers, because they want to impress them. They want to drive in a "cool" way, which makes them take risks like violating the laws and driving too fast to attract the attention of the group. This risky driving behaviour is strengthened by the presence of passengers. Lastly, the *drivers that want to demonstrate their power* achieve that goal by taking control over both the situations that arise and the vehicle. They like to challenge themselves and display their power over the passengers, for example by not listening to admonitions to slow down.

Ulleberg and Must (2003) also defined some different types of passengers: (a) stable and safe passengers, (b) anonymous and insecure

passengers, (c) controlling passengers, (d) goading passengers, and (e) scared passengers. *Stable and safe passengers* are self-confident and have high integrity, and they dare to say when they do not feel safe and comfortable while riding in a vehicle. Such persons are not afraid of the reactions of the driver or fellow passengers, and the other vehicle occupants regard them as brave for daring to say what they think, and the driver heeds their advice. The *anonymous and insecure passengers* are the opposite type, people who do not say what they think or want to show their fear openly, but their silence and body language indicate what they want. Such passengers are usually not very well acquainted with the other vehicle occupants. In the presence of this kind of passenger, a responsible driver will be affected, an insecure driver will become even more insecure, and the other two types of drivers will be negatively influenced, that is, they will want to be impressive and flaunt their power even more.

Controlling passengers are people who want to act like a co-pilot and tell the driver how they want her/him to operate the vehicle. Such passengers are often more experienced drivers or are very aware of safety. They will make insecure drivers more insecure by their comments and might make power drivers even more eager to show who is in charge. Controlling passengers are experienced irritators and nags. *The goading passengers* are also irritating vehicle occupants that have a negative effect on drivers. Such passengers try to get drivers to speed and take more risks. They are often men, and they are worse when drunk than when sober. Their negative influence is greatest on the tough and the insecure drivers, and the most common effect is to reduce the concentration of the driver. The group designated *scared passengers* comprises people who do not like riding in a car, and they express their fears verbally, perhaps by screaming, and by doing thing like grabbing the driver's arm. Most passengers of this type are females, because it is not considered masculine to act that way; males who are frightened are more prone to joke about it. Scared passengers have a negative effect on drivers. These different roles make the driver and the passengers act in different ways in different situations.

Mitsopoulos and Regan (2001) also analysed the roles of passengers but did not define them in the same way as Ulleberg and Must (2003) did. Mitsopoulos and Regan concluded that the varying actions of passengers determine whether a driver will engage in *risky driving behaviour* (e.g., driving too close to the car in front), in *anti-*

social driving behaviour (e.g., spinning the wheels or drink driving), or in *responsible driving behaviour* (e.g., notifying the driver of approaching hazards). All these roles can be enacted either implicitly (the passengers affect the driver simply by their physical presence) or explicitly (the passengers tell the driver what to do). The passenger roles that cause drivers to adopt risky or anti-social driving behaviour have a negative effect on safety, whereas the passenger roles that promote responsible driving have a positive influence on the driver and thereby also on safety, but only if they have been adopted before the event occurs.

Mitsopoulos and Regan (2001) also deduced that much of the passenger activity entails talking to the driver, for instance to be social or to keep the driver awake. The effect of the talking is unclear; it might be positive for the driver and safety, but it might also distract attention from the task of driving and result in unsafe behaviour. Reis and Krüger (1995) suggested that the impact of the talking on drivers' behaviour can be explained by social facilitation. The talking takes resources away from the driver, resources that are needed for other simultaneously performed tasks, and the driver tries to compensate for this by slowing down whenever possible. The reduction in speed lowers the risk and hence represents a beneficial effect of passengers, which is merely a reaction to increased task demands. In difficult traffic situations that involve low vehicle speed, and there is no possibility of decreasing the speed any further, passengers will increase the accident risk. Mitsopoulos and Regan (2001) also noted that friends talked to drivers more than drivers' spouses/cohabitants did. In addition, it was found that young passengers (16–24 years) were more likely to talk to their drivers than other passengers in any other age group. This might represent a special risk for young drivers, since they do not have very much experience and need to focus their attention solely on the task of driving and not partly on talking to their passengers. Mitsopoulos and Regan reported that young participants in their study also said that as passengers they would be more likely than people in other age groups to intervene with a driver. Moreover, the young males indicated that they would never discourage male peers from engaging in risky driving behaviour, and they could even consider encouraging them to act in such a manner. However, compared to people of other ages, they were not less apt to adopt roles that led to safe driving behaviour, although they were more inclined to

assume roles that resulted in negative driving behaviour. The young male participants also said that as drivers they would show off, even if they were not asked to do so by passengers. In addition, compared to other participants, young people (both male and female) stated that as drivers they were more likely to accept advice, especially from parents (not from friends).

Acquaintanceship with passengers

Other factors that affect the driver-passenger interaction have also been identified (Ulleberg & Must, 2003). One important aspect concerns how well the driver and passengers know each other. If they are not very well acquainted, the passengers will avoid saying anything in situations they regard as risky. Passengers can also be unsure about what a driver will say and do, for example, feeling that if you get a ride you should be grateful and not aggravate the driver by criticizing him/her. Such a situation will also be affected by how well acquainted the vehicle occupants are and what status one has in the group; it is not desirable to become too conspicuous by acting imprudently and as a result being shut out of the group. It is also possible that the individual in the mentioned situation would not want to start a conflict. In some cultures it is not polite to criticise other people, and therefore it would be better not to say anything to the driver, even if he/she is a friend, or if the individual does dare to say something it would be very important not to make it sound like criticism. Ulleberg and Must (2003) surmises that it is possible to admire people who are bold enough to say what they think. By comparison, Dillon and Dunn (2005) have studied couples with regard to the effect of complaining on driving behaviour. The results showed that both the driver and the passenger in a couple riding together reported that riskier behaviour of the driver led to more complaints from the passenger than a safer behaviour did, but they also reported that the more the passenger complained the less it helped. Neither the driver nor the passenger partners felt that the driver's ability to operate a vehicle was related to that person's risky behaviour, whereas only the passenger partners considered riskier behaviours to be less safe. Speeding was the behaviour that induced the largest amount of complaining by female passenger partners.

Summarizing the overrepresentation of young drivers in car crashes

The discussion above indicates that certain factors are more extensively associated with young driver's overrepresentation in car crashes. Besides age, sex has an impact: young men are more frequently involved in crashes than young women. Other typically negative circumstances include speeding, not using seat belts, tiredness, drink driving, and causing or being involved in single-vehicle crashes occurring at night, on weekends, and with passengers in the vehicle. The effects of passengers depend on the age and sex of both the driver and the passengers, the number of passengers present, and how well the vehicle occupants know each other. The worst combination seems to be a young male driver with more than one male passenger. It is also apparent that drivers and the passengers adopt different roles that have an impact on the driving behaviour.

Group processes

As indicated thus far, passengers can affect the behaviour of drivers in both positive and negative ways. Regardless of the type of influence, various social interactions and group processes develop between the vehicle occupants, but, to my knowledge, no studies have focused on this issue which is therefore the topic of discussion in this section.

The research field of group and group processes is very broad and includes aspects such as group formation, group development, group structure, and group interaction, all of which have an effect on what happens in a group and how it will act. It is not possible to consider all of these here, and thus this part of the thesis will focus on group interactions that may help explain the dynamic processes that occur within a vehicle: social influence and group pressure on the group members, and how cohesiveness influences the group interactions. However, it will first be necessary to clarify what it is that makes a group a group. (Do four people riding together in a car constitute a group?) Thereafter, a number of aspects of group dynamics will be elucidated by reviewing both classical studies and more recent follow-ups. Moreover, different types of group processes will be related to driving situations in order to illustrate the relevance of applying

experimental findings to conditions in real life, such as driving a car with passengers.

Defining the term "group"

The present research concerned small groups—but what makes a group a group, and what defines a small group? Considering the latter, obviously the first factor to consider is the *number of persons* included in a group. According to Hare, Blumberg, Davies and Kent (1995), a small group has two to 30 members, but there is no definite cut-off point that determines when a small group becomes a large group. One of the earliest definitions of a small group was offered by Bales (1950), who said that a group is small if each member can remember some contribution from every other member after a face-to-face interaction. Forsyth (1983) also gave a definition that emanated from the interaction perspective, stating that a group is "two or more individuals who influence each other through social interaction" (p. 81). Granström (1992) included both of the mentioned aspects, suggesting that a small group is characterized by each member having a personal relation with every other member, which means that they must be able to distinguish and communicate with each other. This definition usually results in a group comprising two to 10 members.

There are some other characteristics that illustrate what makes a group a group, and not just a collection of individuals (Hare et al., 1995). *A group has a goal* or several goals that the members want to achieve. They develop resources and skills for the activity to reach the goal/goals, and they share values that help them maintain their activity. They have different roles in the activity and norms that define these roles, as well as a sufficient level of morale to provide cohesiveness. Leadership is also necessary to coordinate the roles and resources so that the goal/goals will be attained (Hare et al., 1995).

Brown (2000) has mentioned the same aspects: the group members have a common fate, and the group has a social structure and involves *face-to-face interaction*. The last two aspects were considered to apply solely to small groups, such as families or work teams, and not to larger groups like social classes or nationalities. However, inasmuch as the larger groups were considered to have the same influence on the individual members as the small groups do, Turner

(1982) presented a more subjective definition, which entails a *self-categorization* stating that a group exists when two or more individuals define themselves as belonging to the same assemblage or social category. Brown regarded this definition as subjectivist and felt that it lacked one important aspect, namely that *a group is known by others*, and thus he extend Turner's definition, resulting in the following explanation: "a group exists when two or more people define themselves as members of it and when its existence is recognized by at least one other" (Brown, 2000, p.2).

Thus it seems that four people riding together in a vehicle can be considered to be a group, based on agreement with the following six important criteria: (a) it is a small group, since it comprises only *four persons*; (b) it is a concrete group, because the members are in a *face-to-face* situation and therefore interact with each other; (c) the members have a *personal relationship* and can communicate with each other; (d) they have *a goal* to achieve, which is to reach the destination, and hence (e) they also have a *common fate* in the sense that they have the same destination, and, if an accident does occur, all of them will be involved in it; (f) they are also *known by others*, since they are moving in traffic together with the people in other vehicles. Consequently, the vehicle occupants are targets of group processes, which involve different types of social influence.

Social influence on group members

In everyday life, we often find ourselves in ambiguous situations that make us feel uncertain about what to think and how to act. We have insufficient knowledge to make proper choices, and therefore we look at the way that other people think and act to find guidelines. Upon becoming a member of a group, we try to conform to the group settings, and in some cases that goal is so important that we abandon our own assumptions and opinions. The influence of the group can be so strong that the individuals included deny the most obvious evidence that is right in front of their eyes (Brown, 2000). There are many classical studies and theories explaining this phenomenon of conforming, some of which are discussed here.

To be able to compare our abilities and opinions with those of others, we must consider other individuals who are like us (Festinger,

1954). Therefore, status differentiation within a group is important, because it ranks people according to their various abilities or attributes and helps them choose comparable others. The standing of the comparable others should be just about the same as (i.e., not higher or lower than) our own standing, because otherwise the comparison will be negative. Festinger meant that we, at least people in Western cultures, choose others who are slightly better than ourselves for the comparison, since we want to improve our standing in the group. If, after considering the information from others, we conform to the group, it may be because we genuinely believe that the group's estimation is correct, and thus the influence of the group has led to *private acceptance*. However, it may instead entail *public compliance*, which means that we conform to the group in public, but we do not really believe in what it is doing or saying.

Whether or not an individual in a group will yield to the group pressure depends on several different factors, such as the status relationships, the personalities of those in the group, and the nature of the task that the group has to undertake (Brown, 2000). Asch (1956) conducted another classical experiment to determine whether people would conform to a group when carrying out an unambiguous task. It was shown that the participants did conform to the group (the majority), regardless of whether or not it was right, because they wanted to "fit in". This experiment has been replicated in many studies in different countries, and most of them have found some conformity (Mann, 1980). The desire of individuals to conform to and be liked by everybody else leads to consensus, which appears to be a highly social variable. Consensus determines what kinds of behaviour will be regarded as normal, expected, or fashionable (Prislin & Wood, 2005).

Martin, Martin, Smith and Hewstone (2007) also found that people conform to the majority because they want to be a part of it. A consequence of this could be that attitudes that change due to the influence of the majority can easily be "weak," since such compliance is often done without elaboration of the arguments (i.e., they are not processed very much by the individual). This is illustrated by cases when there is no change in behaviour. On the other hand, if agreement with the minority is not very "popular" (i.e., is seen as deviant), the arguments will be processed to a greater extent, which will more often lead to a change in behaviour as well. However, if the topic of interest

has personal relevance people will process the arguments more extensively regardless of a majority or minority influence.

Asch performed further experiments in which he tested what effect the size of the group had on conformity. He found that when there was just one other person included besides the subject, there was very little effect, but the presence of two and up to four or five confederates led to a steep increase in conformity, which levelled off with additional confederates. He further concluded that fifteen persons in the majority did not have more effect than about four, and indeed even led to less conformity than when there were four confederates (Asch, 1955). In similar experiments, Milgram (1969) also found an increasing conformity when the majority comprised up to about five persons, and furthermore he observed that the effect levelled off when there were more than five in the majority, but that effect was not as clear as in Asch's experiment. So the conclusion drawn from these studies was that larger majorities induce a higher degree of conformity but that influence levels off at a majority size of only about four individuals.

Gardikiotis, Martin & Hewstone (2005) have studied how changes in the influence and attitudes of a group are affected by how well the group's consensus is reflected by descriptions of its size presented in numbers or percentages as compared to words. It was found that the words *majority* and *minority* had a greater effect on the influence than the actual numbers did. It was also important whether a majority or minority was large or small: the word *large* always had a greater impact than *small* (i.e., a large minority was better than a small majority).

In driving situations, there will always be uncertain and ambiguous situations in which the driver and the passengers seek "the right information" to achieve the appropriate behaviour and thereby conform to the group. Thus it seems that the passengers in a vehicle can constitute a group of optimal size to exert a social influence, which means that a driver could very well be affected by three misleading passengers.

Informational social influence

There are two kinds of social processes that are aimed at getting people to conform to the group, and these are designated informational and

normative social influences (Deutsch & Gerard, 1955), which can be real and/or imagined. *Informational social influence* affects us when we need to know what is right in order to know how to act. In an ambiguous situation, we can think that other people's interpretations are more accurate than our own, because they have correct information that has led them to the right choice and therefore we conform to their ideas and to the group (Cialdini, 1993; Cialdini & Trost, 1998; Deutsch & Gerard, 1955).

Informational social influence occurs when some situations and factors that induce people to conform are more effective than others. Most important are situations that are ambiguous: people who are unsure of a correct response or appropriate behaviour will rely more on other individuals and the greater their uncertainty, the higher the degree of their reliance (Baron, Vandello, Brunsman, 1996; Tesser, Campbell & Mickler, 1983). Furthermore, if the situation is a crisis, people will be more susceptible to informational social influence, because there is no time to stop and think of their own solutions. If we feel uncertain of what to do and at the same time are frightened and panicky, we are even more likely to act in the same way as others do. Unfortunately, the other people are probably also scared and do not know exactly what to do, and thus may behave irrationally (Cialdini & Trost, 1998). However, if there are experts present among the others when we are seeking information, we will be more apt to conform in order to allow those authorities to guide us in the ambiguous situation (Cialdini & Trost, 1998). It has also been found that the more important a decision is to us under confusing circumstances, the more we rely on other people for guidance and information (Baron et al., 1996). Informational social influence often seems to lead to private acceptance, since people use group members as a source of information, and they regard the information that they receive from that source as correct (Rohrer, Baron, Hoffman and Swander, 1954).

It is possible to resist conforming to informational social influence by evaluating the information available in the situation at hand. Is it really plausible that others have more and better information than we do ourselves? Drivers will always be confronted with uncertain situations, and they can easily become victims of informational influence if they do not appraise the available information on their own. This is probably more likely to affect drivers that lack confidence and rely on their passengers, and the passengers in turn may not always

have the best ideas about proper driving behaviour, even though they sound very convincing.

Normative social influence

People sometimes conform to a group and engage in its risky behaviour, even if they understand that it is not safe. This indicates that there are more reasons to conform to a group than simply to obtain the right information. It has been shown that we conform to the social norms of a group (i.e., its rules for acceptable behaviour, values, and beliefs), and we do so because we want to be liked and accepted by the group (Miller & Prentice, 1996). Receiving things like love, affection, and emotional support are basic human needs that we satisfy through social interactions (Baumeister & Leary, 1995). Consequently, it is not surprising that we conform to others in order to be accepted, a phenomenon called *normative social influence*. For example, such influence occurs when people do not want to get into trouble or be rejected or ridiculed. The conformity that is induced can lead to public compliance but not necessarily to private acceptance of the group's beliefs and behaviours (Nail, McDonald & Levy, 2000).

Similar to informational social influence, there are specific conditions that make people more prone to conform to normative pressure. One variable in this context concerns strength, referring to how *important* the group is for the individual. The more important the group is to us, the more we conform to it, because we cherish the friendship, love, and respect it offers, which we risk losing if we do not conform—a price that is too high to pay (Abrams, Wetherell, Cochrane, Hogg & Turner, 1990; Guimond, 1999). Another variable is *immediacy*, meaning how close the group is to the individual members in space and time during the informational social influence. If the immediacy increases, the conformity will also increase. This variable is strongly related to strength in the sense that the more important a group is to us, the more time we will spend with the group, and the more likely we will conform to its normative influence (Crandall, 1988). The last variable is about the number of people in the group, the *group size*. Conformity will increase with an increasing number of members in the group, and this is true up to a certain point, which seems to be around four or five people (Asch, 1955; Campbell &

Fairey, 1989). If an individual feels pressured into conforming, and more persons are added to the majority, the effect will be greater if the majority goes from three to four rather than from fourteen to fifteen persons.

Other factors that have an impact on normative social influence are how collectivistic the group's culture is and the level of self-esteem and the gender of the group members. In some collectivistic cultures, conformity is also highly valued and thus there is a higher rate of conformity (Bond & Smith, 1996). The other two factors, self-esteem and gender, are more about the individual members of a group than the group as a whole. Some studies support the notion that people with low self-esteem are more likely to conform because they have a strong need for approval, and, more than others, they fear rejection and punishment by the group (Asch, 1956; Crutchfield, 1955; Snyder & Ickes, 1985). However, other investigators have found that such a relationship is weak or nonexistent (Marlowe & Gergen, 1970), because individuals with low self-esteem do not always conform in all situations. Indeed, people are affected by the actual situation regardless of whether they do or do not have low self-esteem. Crutchfield (1955) has reported that women are more apt to conform than men. Furthermore, a meta-analysis performed by Eagly and Carli (1981) showed that on average men are less susceptible to influence than women, although that difference they detected was very small and occurred only in situations where there was an audience that could observe the extent to which an individual conformed. Becker (1986) noted that women conformed to a greater degree than men and it was concluded that women are raised to be more agreeable and supportive, and men are taught to be more independent.

To be able to resist normative social influence, individuals must be aware that that process exists so that they do not do things that they themselves consider to be inappropriate. To be able to resist conformity in action, it is important to have an ally in the group, someone who is also set on not doing the same things as the rest of the group (Morris & Miller, 1975; Nemeth & Chiles, 1988). With or without an ally, an individual that has conformed to the normative influence of the group most of the time must earn to deviate occasionally without suffering consequences such as rejection and embarrassment (Hollander, 1960). This is called gaining idiosyncrasy credits, and it works like putting money in a bank: by conforming to a

group over time, one can be allowed to deviate from the interests of the group without getting into too much trouble.

Considering this discussion in the context of a driving situation including passengers, it can be assumed that the passengers will have a strong influence. The reason for this is that the driver will want to be liked and accepted by the rest of the group, and the specific circumstances that make people more prone to conform are obvious in the vehicle situation. Accordingly, the driving will probably be safe if that is what the passengers want, or vice versa, because otherwise the driver will risk being rejected.

Compliance

Regardless of whether people conform as the result of informational or normative social influence, there are different ways or techniques to bring about a desired behaviour. Almost every day we change our behaviour to accommodate the requests of others, and this is called *compliance*. The mentioned techniques are used in ordinary life and can induce people to act in ways that they never thought they would, and sometimes even in opposition to their own wishes (Cialdini, 1993). All the methods that are applied in this context have the following basic principles in common (Cialdini, 1994): *friendship/liking*, which means that we are more willing to comply with requests from people we know and like than the opposite; *commitment/consistency*, indicating that when we have complied with a position or action, we are more willing to comply with further requests for behaviours that are consistent with this position/action than the opposite; *scarcity*, implying that we are more willing to comply with requests that focus on some sparse commodity or results than the opposite, because we want to secure those objects or outcomes; *reciprocity*, signifying that we are more willing to comply with requests from people who have done something good or nice for us or complimented us, because we like them and want to do the same in return; *social validation*, pointing out that we are more willing to comply with people we think are like us, because we want to be correct; *authority*, saying that we are more willing to comply with an expert or some other important person.

The first way of getting another person to comply is to use what is called the door-in-the-face technique (Cialdini et al., 1975). This

indicates that the individual who receives the request regards it as too great and refuses to concur—he/she wants to "slam the door shut in the requester's face." If the person subsequently gets a second request that is more reasonable, he/she will be more inclined to agree (Cialdini & Trost, 1998; Patch, Hoang, Stahelski, 1997). This technique works because of the reciprocity norms, which means that if we do something nice for someone they will later do the same in return. When a requester backs down from an initial more rigid position and makes a second more moderate appeal, he or she is acting nice, which makes the respondent feel pressured into doing something in return and thus accepts the second less extreme request (Cialdini & Trost, 1998; Whatley, Webster, Smith & Rhodes, 1999). The disadvantage of this door-in-the-face technique is that it is often short-lived, because when respondents have met requesters halfway, they think that they have been nice and are not interested in further requests.

To achieve more longstanding compliance, what is known as "the foot-in-the-door technique" (Seligman, Bush & Kirsch, 1976) can be applied, which is the opposite of the door-in-the-face technique. The idea is to make a small request, and after the respondent concurs with that, to make gradually increasing demands, and hopefully the respondent will continue to agree with the various requests. This strategy works for other reasons than the door-in-the-face technique. Once we have agreed with a request, it would be inconsistent behaviour not to go along with subsequent requests (Beaman, Cole, Preston, Klentz & Steblay, 1983). Moreover, informational social influence is involved because people gain information about themselves by complying with the first request. After doing that, they see themselves as kind persons, and thus it will be easier to get them to accept the next request, even if it is larger. To achieve real, long-term compliance, it is important that the responders have a relevant self-image of themselves in relation to the actual question (Cialdini, 1993; Gorassini & Olson, 1995).

In a driving situation, the mentioned techniques could lead to both safe and unsafe behaviour, depending on the type of requests. An example of use of the door-in-the-face technique could be when a passenger asks the driver to see how fast the car can go, but the driver declines because the request is too large. However, after a while the passenger asks the driver to go just a little bit faster, and then the driver agrees. Using the same example but with the foot-in-the-door

technique, we could say that the passenger starts by asking the driver to speed up, and the driver probably complies. After they have gotten used to the higher speed, the passenger asks if they can see how fast the car can go, and that step is not too big. Thus, passengers may, unconsciously, induce the driver to adopt unsafe driving behaviour.

Obedience

When confronted with different request techniques aimed at changing their behaviour, the responders still have options and alternatives other than compliance. Even if they might feel forced to concur, they can resist the requests, and the consequences will not be all that severe. However, the concept of obedience is different. It means that a person using various requests to try to get someone else to conform has power over that other individual. The requester is often an authority, and if the responder fails to obey, the consequences can be very severe (Napier & Gershenfeld, 1999), and thus it can be difficult to say no to an authority (Blass, 1996; Hamilton, Sanders & McKearney, 1995). It might lead to negative sanctions such as being disliked and labelled a bad person, or even more serious consequences like demerits, demotions, fines, imprisonment, or even death. This social influence is very explicit and direct, and we have all been exposed to it as children in relations with our parents and teachers, and many adults, especially men, have experienced it in military service (Napier & Gershenfeld, 1999).

This phenomenon has been demonstrated in a number of classical experiments. For example, Milgram (1963) found that people sometimes obeyed an authority even if the authority did not have any sanctioning power, and that effect was even more prominent when more than one person was being obedient. Milgram (1965) concluded that this could induce extremely adverse actions in a group, for instance it could cause the members to inflict bodily harm on other people, and therefore this investigator went on to address the question of what might encourage subjects to defy the authority if they had conformed to “the wrong norms.” It is possible that, in the beginning of a conforming process, everything can seem to be all right, but things gradually change over time. In a situation like that, it can be difficult for people to discern such a change or to know when an action is no

longer appropriate and should be stopped (Collins & Brief, 1995). Another possible explanation concerns self-justification. Every time we make a difficult decision, it creates dissonance that we feel we must reduce, and, when we have done so, we think we have to defend the decision. If we then receive the same request again, a way of justifying the action could be to repeat it (Miller, Collins & Brief, 1995).

People learning to drive a car have to obey the instructor or else the training will be stopped. By comparison, it is plausible that a high-status passenger could induce a licensed driver to carry out both correct and risky manoeuvres. In such a case, the driver obeys the passenger as an authority, and after a while it is difficult for the driver to break the behaviour.

Deviant behaviour

As soon as there is a deviant in a majority, the conformity decreases, and the majority puts pressure on the deviant to reaccept conformity (Asch, 1955). A theory proposed by Festinger, Schachter and Back (1950) indicates that the majority directs its communication towards the deviant in an attempt to get that person back into the group again, and, as soon as the deviant returns to the group, the pressure will stop. The greater the discrepancy is between the majority and the deviant, the more extensive the communication. If the majority fails to get the deviant to once again accept the group's opinion, it will probably punish that person by disliking or even expelling him/her from the group.

Nevertheless, things will be different if the deviant is a high-status member of the group, and there are different ways of dealing with that. For example, the behaviour of the deviant can be purposely misinterpreted, or group members can pretend not to hear what the deviant says (Napier & Gershenfeld, 1999). Furthermore, according to Hollander (1960), the other group members can accept the deviant because he/she has "idiosyncrasy credits," which means that something the person did in the past was good for the group, and therefore he/she will be allowed to behave differently without being punished. This can be seen as a kind of reward.

The group's attempts to get the deviant to once again conform can also be a matter of self-regulation. A deviant induces dynamic

processes in the group that are handled through the group's social identity, which means that, depending on the group's norms, the members will deal with the deviant by acting like him/her or by refusing to tolerate his/her actions. For example, if the group has peaceful norms and it is being bothered by some aggressive actions, the process could be stopped by self-regulation. However, if the mood of the group is aggressive, self-regulation could mean that appeals to calm down will not have any effect. This phenomenon has been widely observed in crowds (Reicher, Stott, Cronin & Adang 2004).

Another study has shown that there is a strong correlation between the group's tendency to conform and the rejection of deviants (Mann, 1980). Miller, Jackson, Mueller and Schersching (1987) found that people in a majority ranked each other higher than they did a deviant, even if they not had to agree on a common decision in an experimental situation. In investigations of work groups, deviant colleagues were rated less favourably than normative colleagues (Abrams, Marques, Bown & Dougill, 2002; Marques, Yzerbyt & Leyens, 1988), and this action has been described as a protection mechanism whereby the deviant has less impact on the group (Marques et al., 1988). In contrast to this, Schachter et al. (1954) showed that it is not unusual for someone in a group to agree with the suggestion of a deviant, which shows that the minority can also have an effect.

A passenger in a vehicle who tries to get the driver to speed up can be regarded as a deviant, and the rest of the group can put pressure on him/her to rejoin the group, representing self-regulation (Reicher et al., 2004). If they do not succeed, they will probably punish the deviant, for instance by disliking or ignoring him/her. In such cases, the driver will resist the urging and not speed up. However, the deviant might instead gain an ally, and than a minority group may evolve. If this happens, the situation will be different, and it might be difficult for the driver to resist the requests. Furthermore, it could just as well be the driver who exhibits a deviant behaviour, for example by driving faster than desired by the passengers. That might result in passengers intervening to somehow punish the driver.

Minority influence

Moscovici (1976, 1985, 1994) focused interest on the minority's effect on groups, suggesting that the minority can influence the behaviour or beliefs of a majority, because otherwise there will be no change and development in any social system. The minority can have an effect, at least if the members act consistently (Moscovici and Lage, 1976). Moscovici (1976) stated that consistency is a multidimensional construct, and "it embraces many forms of behaviour, from persistent repetition or phrase, through the avoidance of contradictory behaviour, all the way up to the elaboration of a system of logical proof" (p.122). Also, in a study by Sigall, Mucchi-Faina and Mosso (2006), the minority was found to be more consistent if the members used abstract language (as opposed to concrete language) when trying to influence the group, at least when the influence was indirect.

Moscovici (1976) has stated that even though *consistency* is a key factor for the minority, it is not sufficient to allow the minority to influence the group, and he listed three other factors that affect the minority's success in that context: *investment*, *autonomy*, and *rigidity*. Investment deals with the extent of the effort made by the minority: members who have made personal or material sacrifices seem to have a greater influence than those who have not. The influence of the minority will be positively affected if the members act with autonomy (i.e., according to their own principles) and not based on ulterior motives. Mugny (1982) has said that people in the minority have to be reasonable and open-minded and at the same time be consistent and maintain their position in order to be successful in the influence process. If they are not, they risk becoming rigid, and the group will experience them as some kind of extremists.

The minority influence is also more effective if its arguments come from several minority sources. This means that if there are multiple sources, they are seen as being independent and more representative of different perspectives than if there is a single source. For example, the minority's influence is stronger if it comes from several departments (minorities) in an organisation with about two persons in each, as compared to just one minority comprising four persons. A minority will also have a greater influence on people, if those individuals know that members of the majority have switched to

the minority and they even know how many people have done so (Russell, 2001).

The influence of a minority is also affected by the decision rules of the group. If majority rule is in force, the minority will not have much say in matters, since the majority does not have to, and therefore does not, bother about the minority especially if the majority has pro-self motivation. However, if unanimity rule prevails, the minority might exert influence by blocking decisions, but that is the case only if the minority also has pro-self motivation, and then there is a risk that the group will be harmed. Which decision rule is chosen will probably not be of importance, if the group members are socially motivated and want the best for the group. However, if the members have their own best in mind, they will no doubt strive for decision rule, which means that a minority could be quite harmless when there is majority rule and yet have good influence under unanimity rule (Ten Velden, Beersma & De Dreu, 2007).

Wood, Lundgren, Ouellette, Busceme and Blackstone, (1994) conducted a meta-analysis to describe how minority influence works, and they found that if minority members want to succeed, they must use informational social influence, not normative social influence. Normative social influence is more dependent on public compliance, and not necessarily on private acceptance, since people conform because they want to be liked and accepted by other members of the group, not rejected or ridiculed. In this case, the majority members would not bother to conform with the minority (i.e., the strange deviant), because then they would risk being looked upon as strange and unusual. Therefore, if the minority wants to influence the group, it must use informational social influence by presenting information that the group has to consider. This might cause the majority to realize that the minority is right and thus adopt the minority's view. In that way, minorities more often cause private acceptance than majorities do (Wood, Pool, Leck & Purvis, 1996; Levine & Moreland, 1998).

Bassili (2003) has shown that minorities give their opinions less quickly than majorities do in different situations, and he concluded that this is probably because the minorities are unsure of what the rest of the group will say about their opinions. This might lead to false consensus, in that the minority agrees with the majority in public, and hence everyone thinks that there is real concurrence, but in private the minority has another opinion. Bassili also indicated that the opinions of

the majority are often more extreme than those of the minority, but that is not the reason why the minority is slower in expressing opinions.

These ideas imply that a single passenger in a vehicle can affect the driver if he/she is consistent (sticks to the same message) and accounts for facts. For example, if a passenger argues in favour of taking "route A" because it is shorter than "route B" and can also show this is true on a map, it can be said that there is a minority and it has a positive effect.

Cohesiveness

The performance of a group is to different extents affected by its cohesiveness, which can be regarded as the "glue" that keeps it together (Mullen & Copper, 1994; Dyaram & Kamalanabhan, 2005), and hence it is important to consider this aspect when studying the impact of the passengers in a vehicle. Festinger (1950) offered one of the first descriptions of cohesiveness, referring to it as "the resultant of all the forces acting on members to remain in the group [, and that] these forces may depend on the attractiveness or unattractiveness of either the prestige of the group, members in the group, or the activities in which the group engages" (p. 274). This definition entails a combination of the types of influence and dynamics presented above. Cohesiveness is the degree to which the group members are attracted to each other and how much they want to be in the group (Dyaram & Kamalanabhan, 2005). Nevertheless, it has been shown that interpersonal attraction (i.e., *social cohesion*) is not a complete measure of cohesiveness, and a more appropriate definition must also include commitment to the task (Zaccoro, 1991; Zaccoro & Lowe, 1988). The attraction is not only to other group members, but also to the goal of the group (i.e., *task cohesion*), the latter may be a reason for wanting to belong to the group and might suffice to create group cohesiveness (Mudrack, 1989).

There are different opinions about whether social or task cohesion is most important for group performance. Langfred (1998) implied that both are needed. However, Mullen and Copper (1994) have stated that task cohesion is a better predictor of performance than social cohesion is (at least regarding work), and they also concluded that a group can perform well even if the members do not like each other, because they

are committed to the same task and regulate their behaviour to achieve that goal.

The association between cohesion and performance is also affected by other factors, such as group size, the nature of the task to be performed, group norms (Dyaram & Kamalanabhan, 2005), and whether the assemblage is indeed a real group (Mullen & Copper, 1994). In a study by Mullen and Copper (1994), it was found that real groups had stronger effects on the relation between cohesiveness and performance, and smaller groups had a stronger effect than larger groups. Also, in an investigation conducted by Gully, Devine and Whitney (1995), it was noted that if the task required more interaction, communication, and coordination, there was a stronger association between cohesion and performance than if the task had few of those aspects (Gully et al, 1995). Guzzo and Shea (1992) also showed that group members were more effective if they shared commitment to the task to be done.

Considering norms, it has been shown that groups with substantial cohesion and high task norms perform better than those with high cohesion and low task norms. Compared to less cohesive groups, those with a large degree of cohesiveness compel their members to conform and adhere to the norms in the group and to conform to the group to a wider extent than less cohesive groups do (Janis, 1971). There is extensive pressure to conform to the norms in groups with high cohesion, which can be regarded as being more interpersonal (i.e., the members try to please each other and avoid confrontations), and it usually occurs at the cost of task productivity (Janis, 1972). If the group is too cohesive, there is a risk for groupthink—the more cohesive a group is, the more pressure there is on members to obey the norms. This is not enough to produce groupthink, although cohesiveness is a strong antecedent to that phenomenon (Mullen, Anthony, Salas & Driskell, 1994).

High group cohesion is correlated with increased performance (Norris & Niebuhr, 1980). Both majorities and minorities can put pressure on the rest of the group, and a cohesive group is one that people want to belong to, whereas a minority has to be consistent to produce an effect (Moscovici & Zavalloni, 1969; Moscovici & Lage, 1976). Wolf (1979) has also shown that the influence of a deviant is stronger in groups with high cohesion than in those with less cohesion. Moreover, groups with high cohesion do not put much social pressure

on deviants, and it seems that they actually show greater acceptance of deviant behaviour (Barnard, Baird, Greenwalt & Karl, 1992).

Wellen and Neale (2006) carried out an experiment in which it was found that a deviant in a working group could affect the cohesion of the group as a whole. A negative deviant resulted in lower levels of task cohesion, whilst the level of social cohesion depended on the self-typicality of the individual group members (i.e., that they regarded themselves as typical group members). The individuals with high self-typicality had a negative relation to social cohesion when there was a deviant present in the group, whereas those with low self-typicality had a positive relation to social cohesion. A plausible explanation for this is that members with low self-typicality are attracted to group members who are odd, because such individuals stand out from the homogeneity of the group (perhaps they also see themselves as odd due to low self-typicality). The reason for lower levels of task cohesion might be that group members are afraid of not reaching their goal because the deviant undermines the work, for example by not finishing what he/she is doing or by being late.

Cohesion seems to affect the performance and actions of a group, and it can be embedded in the group processes discussed above. Therefore, this concept was used as both a theoretical and a practical base in the present investigations and interpretations, and it was measured by administering a questionnaire developed in Sweden by Rosander (2003).

Inasmuch as both social and task cohesion might affect the performance of a group (in this case driving), it would also be interesting to investigate whether a high level of group cohesion leads to safer or more dangerous driving.

Summary of group processes that may arise in a vehicle

Four persons in a vehicle can be regarded as a group that is affected by different social influences. The driver can be pressured into conforming to various behaviours desired by the rest of the group, and this is brought about by either informational or normative influence that is exerted by different techniques. The driver can comply with the requests, as people often do in such situations in everyday life, or obedience can occur if there is little option to resist the requests

without suffering severe consequences. This means that there can be both safe and unsafe behaviour, depending on the requests that are made. Even a single passenger (minority) can affect the driver, if that passenger is consistent and presents facts. The way the mentioned influences are exerted (the performance of the group) is also affected by the cohesion of the group, and thus the driver of a car with passengers is the target of a number of potential group processes.

2. Aims

General aims

The overall aim of the investigations underlying this thesis was to further elucidate the effects of vehicle passengers (i.e., the group) on young drivers. The initial objective was to examine the crash risk for young drivers with passengers and to establish whether such accidents involve any special circumstances compared to those that occur without passengers. The work conducted to that end was done as follows:

- The first endeavour (paper I) dealt with the impact of passengers in the vehicle on the crash risk for young drivers.
- The second goal (paper II) was to analyse the circumstances of crashes involving young drivers in relation to differences in the number of passengers in the vehicle.

The results of that research gave rise to two new questions: what kind of group processes develop between four young men riding together in an automobile, and how do those interactions affect the behaviour of the young driver? Those issues were addressed by video and audio recording young male drivers travelling with three friends in a vehicle in real traffic, and the results were evaluated in two ways:

- The study described in paper III concerned the social interactions that occur in vehicles with young drivers and peer passengers, and how the interplay might influence driving behaviour.
- The fourth and last investigation (paper IV) explored the relationship between group processes (cohesiveness) in the vehicle and the behaviour of the driver.

Specific aims

Each of the four studies also had more specific objectives, which are listed here.

1. *Young drivers—reduced crash risk with passengers in the vehicle.* This initial study had five specific objectives: (a) to scrutinize how the number of passengers influences the crash risk among drivers in different age groups, particularly young drivers; (b) to compare young and older drivers with respect to the effects of passengers on the risk of being involved in a crash; (c) to examine how the number of passengers influences the crash risk for young male and young female drivers; (d) to compare young male and young female drivers with regard to the effect of passengers; (e) to analyse the first four objectives considering different days of the week.
2. *Young male drivers' accident patterns with and without passengers.* The aim of this investigation was to determine whether the circumstances of road accidents differ when there are no passengers as compared to 1, 2, 3, or 4+ passengers in the vehicle. The circumstances that were considered included crash outcome, time of day, day of the week, daylight or darkness, single or multi-vehicle incident, traffic environment, and posted speed limit.
3. *Influence of passengers on young drivers.* The objective of the third study was twofold: (a) to identify social interactions (i.e., comments) intended to directly affect the driving performance, and (b) to measure the actual impact of those interactions on the driving behaviour by recording vehicle mean speeds during the study.
4. *Group dynamics and cohesiveness among young drivers and their passengers.* The fourth study was conducted (a) to analyse the relationship between group cohesiveness and performance (safe or unsafe driving) for young drivers and their passengers; (b) to assess the interactions that occur between young drivers and passengers inside a vehicle in order to pinpoint and classify the scope of interventions that might result in safe or unsafe driving; and (c) to elucidate the relationship between interaction patterns in the vehicle, cohesiveness, and the driver's behaviour.

3. Methods

Register data (papers I and II)

The data used were obtained from two sources in Sweden: the national accident database designated OLY/VITS and a register called Riks-RVU/RES that was created to record aggregated exposure data. All police-reported crashes occurring in Sweden have been registered in the OLY/VITS database, which has been compiled by the Swedish Road Administration (SRA) for several decades. The crashes have been coded primarily according to cause, although the circumstances and the consequences (fatalities, severe or slight injuries, and no casualties) of the registered crashes have also been included. Exposure data (in million person kilometres) had been collected in annual surveys conducted from 1994–1998 in a national study that was originally denoted Riks-RVU and was later called RES. The purpose of that project was to gather information about the travelling habits of people in Sweden, for instance the means of transport they used (e.g., automobile, bus, or train) and the distance, the time, and the purpose of their trips. Several aspects of each traveller were also described, including age, sex, employment, whether licensed to drive, and domicile. Since the questionnaire used was sent to a selection of people, the data were later generalized to the whole population.

Data selection

The studies focused on the years 1994–2000, because data for that period were available in both of the mentioned databases.

To increase the reliability of the crash data, all non-injury traffic accidents were excluded from the analysis, since there was a problem with non-reporting of such information. Thus all crashes that involved private vehicles and led to death or severe or minor injuries, irrespective of whether the driver was at fault, were included in the analyses presented in this thesis.

The following variables were used in the first study: (a) gender of the driver, (b) age of the driver, (c) number of passengers in the car,

and (d) day of the week when the crash occurred. The drivers were divided into males and females, and also into three age groups: 18–24, 25–64, and > 65 years. They were investigated regarding the effects of driving alone or with one, two, three, or more passengers, with the limit set at eight, since that is the maximum number allowed in a minivan or a large family car. The days of the week were divided into two categories: Monday to Thursday and Friday to Sunday.

In the second study, the following factors were selected: (a) gender of the driver (only male drivers), (b) age of the driver (only young drivers at the age of 18–24), (c) the most severe consequence of the crash, (d) the most severe consequence for the driver, (e) the number of passengers (0, 1, 2, 3, or 4+, with 8 the limit), (f) day of the week when the crashes occurred (Monday to Thursday or Friday to Sunday), (g) time of day for the crash (5 a.m. to 10 a.m., 11 a.m. to 4 p.m., 5 p.m. to 10 p.m., or 11 p.m. to 4 a.m.), (h) light conditions (daylight or darkness), (i) type of accident (single-vehicle or all other kinds of crashes), (j) traffic conditions (urban or rural area), and (k) the speed limit (≤ 50, 70, 90, and 110 km/h).

Statistical methods

In the first study, differences in crash risks were compared by analysing incidence density ratios (IDRs). Here, an IDR is the ratio between the respective crash risks for two groups of drivers. The groups were identified according to the variables age, sex, day of the week when the crash occurred (Monday–Thursday vs. Friday–Sunday), and number of passengers. To be able to control for all selected variables simultaneously, a regression model (Kirkwood & Sterne, 2003) was fitted to the data, and IDRs with corresponding 95% confidence intervals were calculated from the estimated regression coefficients and their variance. The dependent variable in the regression was the number of crashes within a group of drivers, and the exposure was included as an offset. The four variables and all possible interactions were included as explanatory variables. A Poisson regression model was used since it was assumed that the number of crashes followed a Poisson distribution.

In the second study, the observed numbers and proportions of accidents were analysed with respect to (a) sex of the driver, (b) age of

the driver, (c) the most severe consequence of the crash, (d) the most severe consequence for the driver, (e) the number of passengers, (f) day of the week when the crash occurred, (g) time of day for the crash, (h) light conditions, (i) type of accident, (j) traffic conditions, and (k) the speed limit. That evaluation was done using the chi^2 test with the significance level set at $p < 0.01$ (Kirkwood & Sterne, 2003). In the next step, all variables describing the circumstances of a crash (excluding the two variables about the consequences of the accident) were used in a binary logistic regression (with 95% confidence interval [CI]). The dependent variable was presence or absence of passengers in the vehicle.

Observational study (papers III and IV)

Observational research was carried out, and the results are presented in papers III and IV. Twelve young men ages 20–22 years were instructed to drive an instrumented car in real traffic. This was done along a pre-planned route that was 65 km long and included all types of traffic environments (urban and rural areas and motorways). Each driver travelled this route twice, once alone and once with three friends as passengers, thus the study had a total of 48 participants. Half of the drivers started alone and the other half with passengers in the vehicle. The members of each group (the driver and three friends) were already acquainted, because they had done military service together and had therefore lived and worked together over the last 10–12 months.

All the participants were informed, both orally and in writing, about what they were supposed to do. For the pre-planned route exercise, the drivers were instructed to drive as they normally did, and the passengers were told to act as they normally did as passengers. They were told that the driving would be assessed by the use of questionnaires that would be administered after the driving event. However, they were not told before hand that the driving would also be investigated with the help of hidden instruments in the vehicle (see below); that information was provided after the pre-planned travelling. Before starting, the drivers had to answer a questionnaire about how they normally drove a car. After driving the test route twice, the drivers completed three additional questionnaires: one was about how they drove on the test route, one concerned the experience of driving

with passengers in the car, and the third was about cohesiveness (Rosander, 2003). The passengers also completed three similar questionnaires that asked about what they thought about the driving, how they experienced being a passenger, and their impressions about cohesiveness. Only the results of the cohesiveness questionnaire were within the scope of the present research and are discussed in this thesis.

All twelve groups were video and audio recorded by use of cameras and microphones that were hidden in different places in the vehicle. This was done to register the conversations and interactions in the vehicle. The car was also equipped with various instruments measuring aspects of the driving, such as the speed, g-forces, distance to the vehicle ahead, and braking. Only the data on speed were analysed here due to insufficient time and research funding, and because speed is known to have an impact on traffic safety.

The participants did not know about the recording until immediately after conclusion of the driving, when they were informed and asked whether they could accept the data being retained and analysed. All the drivers and their passengers agreed to use of the data. The procedure was consistent with established ethical guidelines.

Ethical aspects

Since 1 January 2004, Sweden has had what is called the Ethical Review of Research Involving Humans Act (Svensk Författningssamling [SFS], 2003:460), which applies to all fields of research. At the time the present observational studies were carried out, there were no statutes or laws requiring evaluation of the ethical correctness of investigations in liberal arts and the social sciences. Nonetheless, we did take into consideration the principles that had been developed by the former Swedish Council for Research in Humanities and Social Sciences (HSFR) to guide the ethics of such research (HSFR, 1996), which comprised four contentions concerning (a) information, (b) agreement, (c) confidentiality, and (d) use of the results. These four aspects deal with protection of the individual, which is always weighted towards the research question. This means that the researcher has to consider the value of new knowledge in relation to the possible risks and negative consequences for the study participants.

The first assertion about *information* indicated that, before initiating a study, the researcher should inform the participants about the aims of the investigation and also tell them that they would choose to take part of their own free will and could decline further participation at anytime. There were exceptions to this: if such information might have affected the goals of the study or there were no active participants (for example register data were used instead), then the information could be given as soon as possible after conclusion of the investigation. The statement concerning *agreement* considered the rights of the subjects themselves to decide whether to participate, and that there would be no negative consequences if they withdrew. The contention about *confidentiality* meant that the research findings had to be treated in such way that no single subject could be identified, and *use of the results* declared that the data produced could not be used for purposes other than research or as new knowledge (HSFR, 1996).

All these contentions were considered in the present research, although the participants in the practical driving experiment were not given full information before the start of the planned-route exercises. More specifically, they were not told that their conversations and actions within the test vehicle would be recorded by use of a video camera and microphones. It was judged that the research value was more important in this case, and also that the lack of information would in no way harm the participants. The reason for not informing them about the audio/video recording was the risk that they would not behave in a normal manner. The purpose of the study was to investigate the natural group processes occurring in a vehicle carrying a young driver and three friends as passengers, and the aim was to create circumstances that were as authentic as possible, even if it was in fact a test situation. Thus it was concluded that if the participants had been informed about the recording in advance, they would not have behaved as they usually did (i.e., in a normal way). We worked in concurrence with the HSFR contention concerning information, which, as mentioned above, indicated that if complete information was not given to participants before the start of a study, it had to be supplied directly after the end of the investigation. Hence, *after* conclusion of the test driving, all participants in that study were given full information about the video/audio recording and the fact that they had to consent to the use of the collected data for research purposes. All of the participants did agree, but they were also told that if they later

changed their mind they were free to contact the research group and all the data concerning them personally would be destroyed. None of the participants chose that alternative, so it was possible to analyse all of the collected data. Furthermore, none of the subjects indicated that they had in any way been treated inconsiderately; on the contrary, they pointed out that they could fully understand the choice of research design.

Another ethical aspect that should be considered is the eventuality of the participants being involved in an accident that could result in injuries or even death while performing the pre-planned driving exercise. However, all the participants were aware of that possibility, and it was also clear that each driver was fully responsible if an accident did occur, just as they would have been if driving under normal (non-research) circumstances.

The cohesiveness questionnaire

Several questionnaires are being developed and used to measure group cohesiveness (Evans & Jarvis, 1986; Stokes, 1983; Widmeyer, Brawley & Carron, 1985), but most of them are aimed at capturing information about specific processes in different groups, for example sports teams (Widmeyer et al., 1985). Even if many of the questions on those instruments are more general in nature, there are numerous items that can be confusing to people who do not belong to the type of group under consideration. Therefore, Rosander (2003) developed the GCQ questionnaire for assessment of group cohesiveness, and that instrument was employed in the work underlying this thesis. The questionnaire comprised ten items that covered aspects of both "interpersonal attraction" (social cohesion) and "commitment to task" (task cohesion). The participants had to mark how much they agreed with each statement on a scale from 1 to 5, where 1 stood for no agreement at all, and 5 stood for total agreement (appendix I).

The reliability of the questionnaire was examined using Cronbach's alpha (α) for internal consistency. This showed high overall reliability ($\alpha = .819$) and fairly high reliability for the factors task cohesion ($\alpha = .759$) and social cohesion ($\alpha = .708$).

Qualitative analysis

Paper III

In the study described in paper III, all of the audio/video recorded material was subjected to qualitative content analysis. Based on what was said and done in the vehicle, the material was divided into episodes. An episode was defined as a topic the participants were talking about or acting on (e.g., searching for the radio controls), and a new episode was considered to start when they changed the topic or their actions, or when there was a period of silence in the vehicle. All the episodes were divided into the following seven categories according to what the vehicle occupants were discussing or doing: (a) problem solving, (b) wrong decisions, (c) the experimental situation, (d) physical activity, (e) deviation from the planned route, (f) comments about the driving made by or directed towards the driver, and (g) other conversation (everything said that did not fit into the other six categories). The sixth category was analysed further since it involved remarks aimed directly at affecting the driving behaviour. Briefly, the comments were transcribed and divided into categories according to whether they were made by the driver or a passenger, and whether they were intended to induce the driver to be more cautious or to get him to adopt riskier driving behaviours.

Paper IV

The first steps of grounded theory were used to analyse the interactions (group processes) in the test vehicle (Glaser & Strauss, 1967). The method of grounded theory is suitable for investigating social events, in particular human relations and their meaning, which were of interest in this study. Grounded theory has been developed over a number of years and can be employed to create categories and conceptions without the demand of creating a new theory in the end (Strauss & Corbin, 1998). However, the present analysis should not to be considered as true grounded theory work; it would be more correct to say that it involved a qualitative analysis of content inspired by grounded theory.

Initially, all the filmed material was analysed and divided into episodes as described in paper III. While performing this task, the episodes were also classified according to whether they were intended to affect the driver's behaviour in some way. The episodes that were deemed to potentially have influenced the driving were transcribed verbatim and described, and were subsequently subjected to further analysis. The descriptions summarized the interactions of the driver and the passengers and their conversations. The transcribed and summarized episodes were read several times to identify common aspects, and then they were sorted into categories. During that process different dimensions gradually emerged, that is, it became increasingly clear which episodes had the same content and could form a separate category. The first dimension concerned source, that is, whether an observed initiative came from the driver or from a passenger; only the passenger initiatives were analysed in this study. The second dimension involved whether the intention of a comment or action was to provoke risky driving or safer driving. After sorting the material according to those two dimensions, all of the subordinate categories were labelled based on what they included, for example how the passengers acted to induce a desired driving behaviour.

The work reported in papers III and IV was based on the criteria for qualitative analysis proposed by Larsson (1994). These can be summarized as three main aspects of being qualitative: with regard to the work as a whole, with respect to the results per se, and concerning the validity of the results. These criteria proved to be applicable and useful for this study.

Quantitative analysis

Paper III

Speed was analysed as a variable to investigate the driving behaviour. The mean speed was calculated for each episode of driving of the pre-planned route with or without passengers and also separately for each of the different traffic environments (urban or rural traffic and motorways). The values obtained were subsequently subjected to a t-

test (Kirkwood & Sterne, 2003) in order to disclose any disparities between the different driving conditions.

Paper IV

Pearson's correlation (Hinkle, Wiersma & Jurs 1994) was applied to analyse the relationships between driving behaviour and the cohesiveness and interactions of the vehicle occupants (see Figure 1). More precisely, Pearson's correlation test was applied to analyse the relationships between cohesiveness and unsafe driving behaviour (r1), followed by unsafe driving behaviour and negative and positive interactions (r2), and thereafter interactions and cohesiveness (r3).

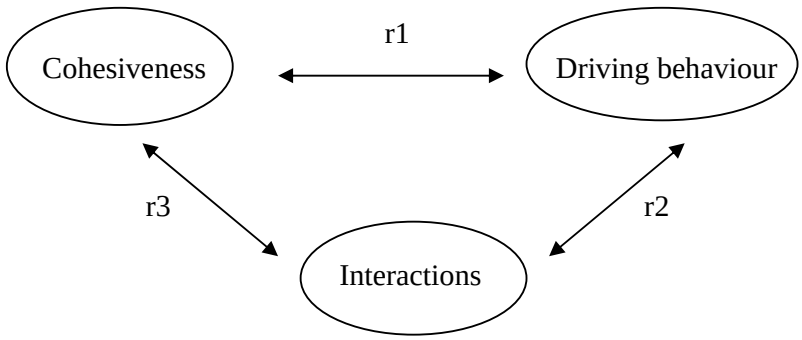

Figure 1. The relationship between the three factors cohesiveness, driving behaviour, and interactions was analysed using Pearson's correlation test.

Cohesiveness was analysed as the mean questionnaire values for each group, and comprised social and task cohesion, as well as total cohesion. The unsafe driving episodes in the films from the test routes were counted after having been identified according to the following definitions of such hazardous behaviour a certain number of times: (a) exceeded the speed limit by more than 10 km/h, (b) diverged from the pre-planned route (intentionally or unintentionally), (c) talked on a

mobile phone, or (d) stopped in inappropriate places. This mode of measurement gave discernible values for the different vehicles. It should be emphasized that it was the number of times unsafe actions occurred that was counted, regardless of the duration of the behaviours. For each driver-passenger group, the mean value from the cohesiveness questionnaire was compared with the number of unsafe driving episodes for that group.

The interaction categories were divided into two groups depending on whether the actions were intended to have a positive or a negative effect on the driving behaviour. The number of actions in each group was counted, and the results were presented according to the model illustrated in Figure 1.

4. The studies

Paper I

Aims

The aim of the work reported in paper I was primarily to investigate how the presence or absence of passengers affects the risk of young drivers being involved in a road crash. The results of earlier research have been ambiguous, that is, some findings have been positive, showing a greater crash risk for lone drivers (Rueda-Domingo et al., 2004; Vollrath et al., 2002), whereas others have been negative, indicating a greater crash risk with passengers in the vehicle (Chen et al., 2000; Doherty et al., 1998; Lam et al., 2003; Preusser et al., 1998; Williams, 2001). Whether the impact of passengers will be positive or negative depends on different situational factors: the age and sex of the driver, and the number, age, and sex of the passengers. Therefore, the specific objectives were as follows: (a) to examine how the number of passengers influences the crash risk for drivers in different age groups, particularly those who are young; (b) to compare young and older drivers with respect to the effects of passengers on the crash risk; (c) to examine how the number of passengers influences the crash risk for young male and female drivers; (d) to compare young male and young female drivers with regard to the effect of passengers; (e) to analyse the first four categories concerning disparities related to different days of the week.

Methods

To achieve those goals, data from the national accident database and exposure data from another database was used. The former database included all motor vehicle crashes that had led to death or severe or minor injuries and were reported to the police in Sweden during the period 1994–2000. Exposure data was annually collected to study the driving habits of licensed drivers in Sweden, considered as annual

person kilometres (millions) travelled in 1994–2000 (the same period as in the national accident database). Data from the two databases were divided into different variables, of which the following were used in the analyses: male and female drivers in different age groups (18–24, 25–64, and 65+ years) studied in relation to the number of passengers in the car (0, 1, 2, or 3+), and driving done on different days of the week (Monday–Thursday and Friday–Sunday). Differences in crash risks were compared by studying incidence density ratios (IDRs). Here, an IDR is the ratio between the respective crash risks for two different groups of drivers. To be able to control for all the selected variables simultaneously, a Poisson regression model (Kirkwood & Sterne, 2003) was fitted to the data, and IDRs with corresponding 95% confidence intervals were calculated from the estimated regression coefficients and their variance. The dependent variable in the Poisson regression was the number of crashes for a group of drivers, and the exposure was included as an offset. The four variables and all possible interactions were included as explanatory variables.

Results and discussion

The results showed that passengers had an overall protective effect, that is, the crash risk was higher for those who drove alone, regardless of their age or sex. This protective effect increased with every extra passenger (up to eight), indicating that the more passengers in the vehicle, the safer the driving. For example, the crash risk when driving alone compared to having three or more passengers in the car was approximately 12 times higher for the drivers who were 25–64 years but was only about five times higher for the youngest drivers. The influence of passengers was weakest (albeit still positive) among the youngest drivers (ages 18–24 years), especially the males in that group. Compared to young females, young males had a higher crash risk in all cases (i.e., regardless of the number of passengers). The crash risk for young males, as compared to young females, was 1.15 times higher when driving alone and 2.05 times higher when driving with three or more passengers. More simply, it appears that young male drivers are always at greater risk of being involved in a traffic accident, although that risk is decreased by the presence of passengers. The pattern of the protective impact was the same on all days of the

week, but was most marked from Friday to Sunday for most of the drivers, regardless of age. This protective effect also increased with increasing numbers of passengers, and the young male drivers had a higher crash risk compared to the young females, irrespective of the days of the week. On Monday to Thursday, the greatest difference between males and females was associated with three or more passengers, and the smallest difference was seen with two passengers. By comparison, the difference in risk Friday to Sunday was greatest in the presence of two passengers and smallest with three or more passengers.

The conclusion drawn from this study was that passengers had a protective effect on all the drivers, irrespective of their age or sex, or what days of week they were driving, which means that the crash risk was greater when driving alone than when there were passengers in the vehicle. Nevertheless, the impact was comparatively greater on those who were middle-aged than on the youngest drivers, especially those who were young males. The results also suggested that passengers had a more beneficial effect on Friday to Sunday compared to Monday to Thursday, at least for the middle-aged and youngest drivers. Plausible explanations for the positive effect of passengers on the crash risk include the following: drivers feeling more responsible with other people in the vehicle (Rolls & Ingham, 1992); differences between the various driver age groups with regard to the ability to handle two tasks simultaneously; a desire to perform well in front of others (Zajonc, 1965).

Paper II

Aim

Young drivers are overrepresented in road crashes, and the drivers themselves say that they are affected by having passengers in the vehicle (Rolls & Ingham, 1992). Furthermore, the passengers constitute about one-third of the annual fatalities and injuries in those crashes. Therefore, the aim of the study described in paper II was to determine whether the circumstances of road crashes differ for young males driving in the presence and absence of passengers. There are

some situations that are characteristic of traffic accidents involving young drivers: they often occur in the evening or at night, especially on Fridays and Saturdays (Gregersen & Nyberg, 2002), and they are frequently single-vehicle (Ballesteros & Dischinger, 2000; Gregersen & Nyberg, 2002) and loss-of-control (Clarke et al., 2002; Harrison, Triggs & Pronk 1999; Laapotti & Keskinen, 1998) events, and are related to speed (Harrison et al., 1999; McKnight & McKnight, 2000). To increase our understanding of the role of passengers in this context, it is important to ascertain whether the circumstances of traffic accidents involving young male drivers differ depending on the number of passengers that are present.

Methods

The data used in the study were obtained from the Swedish national accident database that previously registered all motor vehicle crashes reported by the police. All crashes occurring in 1994–2000 that involved young male drivers (18–24 years of age) and led to death or severe or minor injuries were included. The following crash circumstances were considered: the number of passengers, the most severe consequence, the most severe consequence for the driver, time of day, day of the week, light conditions (daylight or darkness), type of accident (single or multi-vehicle), traffic environment (urban or rural area), and posted speed limit. Initially, the observed numbers and proportions of accidents in the chosen variables were compared using the chi² test with the significance level set at $p < 0.01$ (Kirkwood & Sterne, 2003). In the next step, all variables describing the circumstances of a crash (excluding the two variables concerning consequences) were used in a binary logistic regression (with a 95% confidence interval [CI]). The presence or the absence of passengers in the vehicle constituted the dependent variable.

Results and discussion

The results showed that most deaths and injuries involved a lone driver or a driver with only one passenger, although the proportion of fatally or seriously injured vehicle occupants increased with an increasing

number of passengers. When there was one passenger 25% of the occupants were fatal or seriously injured whilst the corresponding rate was 50% when there were four or more passengers. Obviously, it might be that crashes involving more passengers lead to a larger number of fatalities or serious injuries, simply because there are more people exposed to the harmful effects of the incidents. To address that possibility, and because there is always only one driver in a vehicle regardless of the number of passengers, the drivers were also considered separately when examining the consequences of the accidents. It was shown that the outcomes for the drivers themselves in terms of bodily harm or death also became more severe with every extra passenger in the vehicle. With one passenger in the vehicle, about 20% of the drivers were fatally or seriously injured, whereas such consequences were associated with a little more than 30% of the drivers accompanied by four or more passengers. One explanation for this might be that when there were passengers in the vehicle, the crashes occurred to a greater extent in rural areas and on roads with higher speed limits. Notably, higher speed has been reported to lead to more violent accidents involving larger numbers of fatalities and serious injuries (OECD, 2006). The results also showed that crashes with more passengers in the vehicle had happened more often on roads with higher speed limits (70 and 90 km/h) and outside of city limits, whereas the accidents involving lone drivers had occurred mainly on roads with a speed limit of 50 km/h (or less), which is the most prevalent limit in Swedish towns and cities.

The findings also showed that the total number of crashes involving young male drivers was nearly the same on Monday–Thursday as on Friday–Sunday. However, the proportion of accidents was larger on Monday–Thursday for the drivers who were alone, although this changed when there were passengers in the vehicle. Considering the percentages, the majority of the crashes with passengers occurred on weekends, and almost 70% of those involving four or more passengers happened on Friday to Sunday. In addition, a clear pattern emerged when investigating the time of day the crashes occurred: the later in the day, the more passengers in the vehicle. Most of the crashes (percentages) with no passengers took place during daytime. By comparison, most of those involving one passenger took place in both daytime (11 a.m. to 4 p.m.) and the evening (5 p.m. to 10 p.m.), and those with two and three passengers were most frequent in

the evening. The number of accidents including passengers was higher at night, and this was most apparent when there were four or more passengers. This is also consistent with the results regarding light conditions, which indicated that most of the crashes occurred in daylight with no passengers or only one passenger in the vehicle, and those involving two or more passengers happened primarily during hours of darkness.

Single-vehicle crashes proved to be the most common type of traffic accidents for young male drivers. More precisely, considering all types, about 20% were single-vehicle crashes, and about 80% were in the group designated all other road accidents, when the driver was alone or in the presence of one and two passengers. However, single-vehicle crashes were clearly predominant when there were more than two passengers in the vehicle, reaching levels of about 55% and almost 65% in the presence of three and four or more passengers, respectively.

Thus, it was found that the crash circumstances for young male drivers varied depending on the number of passengers in the vehicle. Compared to driving alone, the presence of passengers was more extensively associated with single-vehicle crashes that occurred in the evening or at night, on weekends, in rural areas, and on roads with higher speed limits. This indicates that the accident patterns for young drivers are even more significant when there is passenger. It was not possible to include the influence of alcohol on the crashes examined in this investigation, since reliable data on that subject were available only for the accidents that led to fatalities. Nonetheless, other studies (SRA, 2004:161) have shown that young drivers are overrepresented in alcohol-related traffic accidents. Such crashes often occur on weekend nights, since that is the time when young people tend to drive under the influence of alcohol. Furthermore, several investigations have revealed that the combination of alcohol in the blood and excessive speed constitutes an important reason why single-vehicle crashes involve young drivers (Brorson, Rydgren & Ifver, 1993; Twisk, 1994). There are a number of methods that can help manage those problems: implementation of graduated licensing systems, use of various types of information campaigns, and education aimed at teaching novice drivers and their passengers to handle such circumstances.

Paper III

Aim

The aim of the study presented in paper III was twofold: to investigate the social interactions that occur in a vehicle with a young driver and passengers, and to determine how such interactions influence the young licence holder's driving behaviour.

Methods

The research objective was achieved by conducting a quasi-experimental investigation in real traffic, using an automobile (Volvo 850) specially equipped with various instruments to measure parameters such as speed, g-forces, and distance to the vehicle in front. Video cameras and microphones had also been installed to record the conversations and actions of the vehicle occupants. All research equipment was hidden so that the subjects were not aware that they were being recorded/registered during the test, but they were informed of that fact immediately after the driving and were asked whether they would like to have their data deleted. All of the drivers and passengers agreed to allow their data to be retained and analysed.

Young men were chosen as subjects, because, compared to other age groups, they are known to have a higher overall crash risk and also to drive with passengers in the vehicle more often (Laapotti et al., 1998), and they say they are affected by passengers to a greater extent than other drivers are (Rolls & Ingham, 1992). All the young men in the study were 20–22 years of age, and they knew each other well since they had done military service together for the last 10–12 months. They participated in the experiment in 12 groups, each comprising one driver and three passengers. The twelve drivers drove a pre-planned route in the instrumented car. Each driver did this twice, once with passengers in the car and once without passengers. Thus the route was driven 24 times with what represents a total of 60 participants. Half of the drivers started out by driving the route alone, and half started with passengers in the car. The route was 65 km long and included three different types of traffic environments: urban and rural areas, and motorways.

Before beginning the experiment, the test subjects were given written and oral instructions on what they were supposed to do. For the drivers, this involved asking them to drive in a normal manner and to be prepared to answer a questionnaire about how they experienced driving alone and with passengers in the car after they had completed the driving. The passengers were told to ride along in the car as they normally would as passengers and that they would also be requested to answer a questionnaire about how they experienced the situation in the vehicle after returning from the drive. Furthermore, all participants were asked to respond to a questionnaire about how they felt in the group (i.e., a cohesiveness test; Rosander, 2003). None of the questionnaire results were used in the present study.

Results and discussion

Speed was recorded as a measure of the driving behaviour of the young males. It was found that, in all three types of traffic environment (urban and rural areas, and motorways), the mean speed was higher when they drove alone than when they had passengers in the vehicle. This indicates that the subjects drove faster when alone than they did in the presence of passengers, although the differences were not statistically significant.

The actions that occurred inside the vehicle were divided into seven categories for analysis: (a) problem solving, (b) wrong decisions, (c) the experimental situation, (d) physical activity, (e) deviation from the planned route, (f) comments about the driving made by or directed towards the driver, and (g) other conversation (everything said that did not fit into any of the other categories). The comments about driving performance were chosen for further analysis, because they were aimed at affecting the driver's behaviour. For the 12 groups, a total of 71 such comments were recorded that were intended to either induce the drivers into some sort of risky behaviour or get them to calm down. The comments could be divided into three sub-categories according to whether they were made to goad (prodding the driver into dangerous actions such as speeding or overtaking another car on the wrong side), to mock (trying to induce risky driving behaviour as in the previous category but by ridiculing the driver), or to calm down (e.g., perceiving the driver as being reckless and asking him to be more cautious). These

three types of comments were made in three different kinds of driving situations: when overtaking another vehicle, when driving faster or slower and when testing the car in various ways. The comments came from some of the passengers but also from the drivers themselves. They were most often intended to goad the drivers into different actions, particularly to drive faster, but in only one third of those cases did the driver agree to do as the passengers wanted. Moreover, none of the comments made to mock the drivers and thereby get them to speed up had any effect. When the drivers made comments on their own driving behaviour, they were mostly trying to encourage themselves to do things like driving faster or testing the car in different ways. All but one of such comments achieved the desired effect.

In conclusion, the young males in this study drove more slowly with friends in the vehicle than they did when they were alone. Furthermore, they resisted pressure from the group to drive in a dangerous way and instead drove more cautiously in the presence than in the absence of passengers. These observations might be interpreted as being due to the drivers' self-confidence, consciousness of their own responsibility, and feelings of being competent in handling a car.

Paper IV

Aims

It has been shown that the impact of passengers on young drivers is ambiguous—in some cases positive (i.e., the crash risk is lower with passengers in the vehicle) and others negative (i.e., the crash risk is higher with passengers). The effect depends on various factors such as the age and sex of the driver, the age and sex of the passengers, and the number of passengers present. Other factors that probably influence the driving situation are how well the driver and the passengers know each other, how they feel about each other, and how they perceive the task of driving and the role of being passengers. The study reported in paper IV was performed to address those issues, and it had three main objectives: to analyse the relationship between group cohesiveness and performance (safe or unsafe driving) among young drivers and their passengers; to investigate the interactions between young drivers and

their passengers in order to identify and classify the range of interventions that might change driving behaviour to achieve safe or unsafe performance; to examine the association between interaction patterns in the vehicle, cohesiveness, and the driver's behaviour.

Methods

To achieve those goals, a quasi-experimental study was conducted in which 12 young men aged 20–22 years drove an instrumented car in real traffic. This was done along a 65-km-long pre-planned route that included all types of traffic environments (i.e., urban and rural areas, and motorways). They drove this route twice, once alone and once with three friends in the vehicle. The members of each group (a driver and three friends) were acquainted with each other because they had done military service together for the last 10–12 months. The drivers were instructed to drive as they normally did, and they were told that after the two test driving episodes they would be asked to complete three questionnaires: one about how they drove on the test route, one concerning the experience of driving with passengers in the car, and a third about how they felt in the group (cohesiveness) (Rosander, 2003). The passengers were told to act as they normally did as passengers and also that, after riding along on the test route, they would be asked to answer the cohesiveness questionnaire to indicate how they felt in the group and how they experienced the trip in the test vehicle. It was only the cohesiveness test that was analysed here. All twelve groups were recorded by use of video cameras and microphones that were hidden in the vehicle. The participants did not know about the recording until immediately after driving the route, at which time they were informed and asked whether they could accept the data being retained and analysed. All the drivers and their passengers agreed to use of the data. The procedure concurred with established ethical principles.

The GCQ questionnaire (Rosander, 2003) was used to assess group cohesiveness. This instrument consists of ten questions covering aspects of both "interpersonal attraction" (social cohesion) and "commitment to task" (task cohesion). To analyse the driving, unsafe behaviour was defined as the number of times the young drivers exceeded the speed limit by more than 10 km/h, deviated from the pre-planned route (either intentionally or unintentionally), talked on a

mobile phone, or stopped in inappropriate places. This mode of measurement gave discernible differences between the vehicles.

The interactions (group processes) that occurred within the vehicle were analysed by applying the grounded theory approach (Glaser & Strauss, 1967). Initially, all the filmed material was analysed, and the observed actions were divided into those that were and those that were not intended to affect the driving behaviour in some way. The actions that may have had an impact on the driving were subjected to further analysis. Each action intended to induce a response was described on the basis of what was said and done in the situation at hand. The actions were subsequently assigned to a number of categories indicating different dimensions: the first concerned source, that is, whether the initiative came from the driver or from the passenger; the second were related to whether the intention was to induce risky or safer driving. Thereafter, all the categories were labelled according to the actions they included. Only the descriptions in the passenger categories were subjected to further investigation. Pearson's correlation test (Kirkwood & Sterne, 2003) was applied to analyse the relationship between driver-passenger cohesiveness and driving behaviour. For each driver-passenger group, the mean value from the cohesiveness questionnaire was compared with the number of unsafe driving episodes. Pearson's correlation test was also used to analyse the correlation between interactions and driving behaviour and between interactions and cohesiveness.

Results and discussion

The results revealed substantial cohesiveness in the investigated driver-passenger groups. On a scale of 1 to 5, the average score was greater than 4 for all three of the measured cohesion variables (total, social, and task cohesion), which means that the group members had felt a connection with each other and an attraction to the task at hand (i.e., driving from one point to another) (Zaccoro, 1991; Zaccoro & Lowe, 1988). Considering performance (unsafe driving behaviour) and cohesion, there was a significant negative relationship between the number of dangerous situations that occurred and task cohesion, and there were similar negative correlations (albeit not statistically significant) with social cohesion and total cohesion. This shows that

the groups with a high level of cohesion, especially high task cohesion, exhibited a lower number of unsafe driving actions, or, in other words, their driving was done in a safer way than was the case for the groups with lower cohesion. High cohesion is strongly related to group norms (Dyaram & Kamalanabhan, 2005) and to adherence to those standards. It seems that the norms in the groups analysed in this study were positive in nature, for example, they implied that drivers should be considerate of other people in traffic and especially of their passengers, or that they should not expose their passengers to unnecessary risks.

The actions of passengers aimed at inducing the driver to change behaviour could be divided into five different categories. In three of those, the passengers tried to get the driver do something that could be dangerous (i.e., adopt unsafe driving behaviour); in the other two, the passengers showed that they wanted the driver to slow down and be more cautious (i.e., adopt safe driving behaviour). The three categories involving attempts to induce unsafe behaviour included prodding the driver to speed up, mocking the driver (often done if prodding did not achieve the desired effect), and challenging the driver. The first category of actions aimed at eliciting safer driving behaviour entailed passengers telling the driver stories that would make him understand what to do without implicitly describing what was desired in some cases. This method was also used by passengers who wanted to provoke some kind of unsafe behaviour. The remaining category comprised requests from passengers to take it easier.

The results of the analysis of driver-passenger interactions in relation to unsafe driving behaviour indicate almost no correlation between positive interactions and unsafe behaviour, but they do show a tendency towards an association (not statistically significant) between negative interactions and unsafe actions. Pearson's correlation test was also used to analyse the relationship between cohesiveness and interactions in the vehicle. This revealed significant negative correlations, indicating that the more negative an interaction (i.e., trying to induce some unsafe action by asking, mocking, or challenging the driver), the less cohesion in the group. This is especially noticeable when considering social cohesion, that is, group members displaying markedly negative interactions did not feel a strong connection with each other. It seems obvious that a lower degree of cohesiveness among passengers can be related to unsafe driving behaviour. The present findings also demonstrate that the more

positive the nature of an interaction (i.e., requesting safer driving), the greater the cohesion (especially social cohesion) between the group members. However, the correlation detected between cohesion and positive interactions is actually only a strong tendency, since it is not statistically significant. Nevertheless, it does seem that social cohesion shows the strongest association with driver-passenger interactions.

In summary, the cohesiveness of the driver-passenger group has a pronounced relation to how driving behaviour develops. In short, a possible interpretation could be that a strong cohesion leads to safer driving and also to fewer negative interactions in the vehicle.

5. Discussion

Crash risk

The results of the current investigations show that the presence of passengers in a vehicle has a positive impact on drivers, regardless of the vehicle occupants' age or sex, or the day of the week the driving is done. The effect is positive in the sense that the crash risk is lower with passengers than when driving alone. Earlier studies have shown that passengers have a positive influence on (i.e., decrease the crash risk for) drivers in all age groups (Rueda-Domingo et al., 2004; Vollrath et al., 2002), except those in the youngest group, for whom the effects can be described as ambiguous. More precisely, some investigations have indicated a positive effect reflected in a decreased crash risk (Rueda-Domingo et al., 2004; Vollrath et al., 2002), whereas others have demonstrated a negative effect seen as an increased crash risk (Chen et al., 2000; Doherty et al., 1998; Lam et al., 2003; Preusser et al., 1998). From the present findings, as well as the results of other European studies (Rueda-Domingo et al., 2004; Vollrath et al., 2002), it can be concluded that passengers have a positive effect on young drivers, which means that they drive more calmly and cautiously in the presence of passengers. This is also supported by the current observation that young males drove at a lower speed when there were passengers in the vehicle than they did when they were alone. That difference in speed was not statistically significant, but the presence of passengers was associated with a clear tendency towards slower driving in all kinds of traffic environments, particularly on motorways where the speed limit is high. However, the positive influence of passengers on the crash risk was less pronounced for young drivers than for those who were middle-aged, and hence the previously reported pattern of young drivers having a higher overall crash risk compared to other age groups (Nyberg, 2007; OECD, 2006) seems to apply even when there are passengers in the vehicle.

Driving licence. There are many potential explanations for a positive influence of passengers on the crash risk of young drivers. As mentioned above, some European studies have demonstrated such an effect (Rueda-Domingo et al., 2004; Vollrath et al., 2002), whereas a

number of investigations conducted in the United States, Australia, and New Zealand have shown a negative effect (Chen et al., 2000; Doherty et al., 1998; Williams, 2001). This discrepancy might be due to differences in the age range used to define a young driver, which are related to the minimum age of obtaining a driving licence in different countries. In Europe a person must be 18 years old to be able to obtain a licence, whereas in other parts of the world the minimum age is 16. On the other hand, if the passenger effect is due to the age at which a driver can obtain a licence (i.e., being inexperienced), there should not be any differences between countries. However, there are differences, and some studies showing a negative effect of passengers on 16–19-year-old drivers have also indicated a detrimental impact on drivers up to the age of 24 years (Lam et al., 2003; Preusser et al., 1998). These findings raise the question of whether cultural differences might be involved. Previous research has revealed cross-cultural disparities in drivers' risk perception (Sivak, Soler & Spagnhol, 1989a), risk taking (Sivak, Soler & Spagnhol, 1989b), and self-assessment (Sivak, Soler & Spagnhol, 1989c), but what about the impact of passengers in this context?

Responsibility and roles. Another explanation for the generally positive effect of carrying passengers might be related to a sense of responsibility. Having passengers in the vehicle means that the driver is responsible for the lives of the passengers and therefore must drive more cautiously. Many drivers, especially young ones, also say they are more careful in the presence of passengers than when driving alone, especially if one of the passengers is a parent or a child (Rolls & Ingham, 1992). This could also be related to the different roles that the driver and the passengers might have. According to Ulleberg and Must (2003), there are several roles for both drivers and passengers, one of which can be described as the responsible driver who pays attention and is careful in traffic, and wants passengers to feel secure during the journey. This is probably a common role, especially when there are passengers in the vehicle. The slightly less positive effect of passengers on young drivers as compared the other age groups might occur because those who are younger often belong to an additional category, in particular they are probably insecure drivers, since they are quite inexperienced. The passengers' roles or actions also have effect. It will be easier for drivers who exhibit responsible rather than risky driving behaviour (Mitsopoulos & Regan, 2001) to also show

responsibility in other ways. Ulleberg (2003) also mentioned stable and safe passengers that are self-confident and dare to say what they think, but there are other kinds of passengers as well. Furthermore, the personalities of the driver and the passengers and how the interactions between them develop will have an impact on what roles will be adopted.

Conversation. Mitsopoulos and Regan (2001) mentioned numerous things that passengers can do, in particular emphasizing that they very often talk to the driver, either to be social or to keep the driver awake. Regardless of the reason for the talking, it represents a social influence on the driver. Notwithstanding, it is still not clear how conversation affects drivers: it might be positive and promote safety, but it might also constitute a distraction that diverts attention from the driving task and thereby results in unsafe behaviour. Reis and Krüger (1995) have suggested that conversation takes resources away from the driver, resources that are needed for other tasks that must be performed simultaneously in driving, and the driver compensates for this by slowing down whenever it is possible. This reduction in speed lowers the crash risk, and thus it represents a beneficial effect of passengers, one that is simply a reaction to increased task demands. Mitsopoulos and Regan (2001) also found that friends do most of the talking to young drivers, more so than a spouse and young passengers (16–24 years of age) talked more compared to drivers in other age groups. This means that having friends as passengers might constitute a special risk for young drivers, who are inexperienced and should not divide their attention between driving and communicating with passengers. This is a plausible explanation for why the positive effect of passengers is more limited for young drivers compared to those in other age groups.

Informational influence. Another reason may be related to informational influence in the sense that young inexperienced drivers need to know how to act appropriately in different situations. According to Tesser et al. (1983) and Baron et al. (1996), the more unsure people are in different situations, the more they rely on others. If passengers are also young, they will probably be equally insecure and not know exactly what to do under various circumstances, and thus their effect on the young drivers will not be as positive as could be expected for older passengers. Furthermore, it is possible that younger passengers will have a less beneficial impact through normative

influence, because they can try to encourage a young driver to engage in unsafe behaviour, and if the driver in turn wants to be a part of the group and not rejected or disliked (Nail, McDonald & Levy, 2000), she/he will do as the passengers request.

Performing. The protective influence of passengers might also be explained by the social psychological phenomenon of wanting to perform well in front of an "audience" (i.e., when someone else is watching) (Zajonc, 1965). In the present context, passengers represent the audience, and safe driving constitutes good performance. An increasing number of passengers might have an additive effect in the sense that the larger the audience, the better the performance—here, the more passengers, the safer the driving. Performing well is not necessarily synonymous with safe driving. Indeed, in some situations it may instead represent showing off, which might explain why passengers have a more beneficial impact on older drivers than on those who are younger. To young drivers, the factor good performance will be either safe driving or showing off, depending on the situation. Mitsopoulos and Regan (2001) found that young male passengers also said that they were more likely than other age groups to encourage (or at least not discourage) drivers to exhibit risky behaviour, especially if the drivers were young male peers, but that did not mean that they were less likely than their coequals to adopt roles associated with safe driving. This effect might also be due to normative influence (Baumeister & Leary, 1995), which implies that the young drivers comply with their passengers (audience) to avoid being rejected and disliked. The group is important to the driver, because it is close to the driver in space and time, and an increasing number of members will increase the conformity.

Driving style and crash circumstances

Some studies have shown that young drivers are at greater risk of being involved in road accidents when travelling with passengers, especially when both the drivers and the passengers are young males (Chen et al., 2000; McKenna et al., 1998; Regan & Mitsopoulos, 2001). The effect of the young male driver-passenger combination has been reported to be associated with risky driving style that includes higher speed and shorter headways (Simsons-Morton et al., 2005). In

addition, Arnett et al. (1997) found that young drivers reported that they kept a higher speed when same-age peers were passengers than they did when a parent was in the vehicle, but they did not drive faster with friends than when they were alone. This observation indicates that parents, but not peers, inhibit reckless driving among young licensees. This may be an example of young drivers carrying out more dangerous actions to comply with peers, whereas the situation with a parent in the vehicle entails obedience to parental authority in order not to risk suspension of driving privileges (Napier & Gershenfeld, 1999).

Safe driving. Together, the mentioned findings show that the identity of passengers has a substantial impact on both driving behaviour and crash risk. Inasmuch as it seems that young male drivers together with male peer passengers represent the worst combination with regard to safety, the observational study included in this research focused on that mixture. The results indicated the opposite effect, in driving style, compared to the findings discussed above. The young male drivers in the observational investigation drove at a lower speed when they had male peers as passengers than they did when they were alone in the vehicle. These results were not statistically significant, but they did indicate a clear tendency towards lower speed in all traffic environments with passengers present as compared to driving alone. This might be explained by that fact that the driving was done in a test situation, and the young drivers did not behave as they normally would have. Or perhaps the young drivers felt it was more important to demonstrate safe driving behaviour for the experimenter than to fulfil their own or others' wishes to act more dangerously in the presence of passengers. If that was the case, normative influence and compliance with the experimenter were more evident than social influence exerted by the group members. Another explanation might be that the groups of drivers and passengers that were investigated were individuals with substantial self-confidence and awareness of their own responsibility, and the drivers were motivated through normative influence to perform in a correct manner. According to Ulleberg (2003), it may be that safe drivers are those who pay attention, are cautious in traffic, and want their passengers to feel secure and for the passengers to reciprocate that feeling.

Speed. Crashes involving young male drivers with peer passengers usually occur in rural areas and on roads with higher speed limits, which is in contrast to traffic accidents with lone drivers. This suggests

that young drivers are more inclined to speed in the presence of passengers than when alone, because many drivers, especially males, exceed the speed limit (SRA, 2005:100). It has also been shown that young drivers are overrepresented in speed-related accidents (Harrison et al., 1999), particularly when there are passengers in the vehicle (Williams, 2001). In support of this analysis of speeding, the present results demonstrate that crash casualties became more extensive with increasing numbers of passengers. It was found that the proportion of dead and seriously injured vehicle occupants rose with each added passenger, which is logical considering that there were more people to be exposed to the harmful effects of the accidents. However, considering only the drivers, it became apparent that they were also killed and injured to a larger extent when there were passengers in the vehicle, possibly due to greater severity of the crashes that occurred. An OECD report (2006) has indicated that higher speed leads to more serious accidents involving a greater number of fatalities and life-threatening injuries.

Crash circumstances. Taking into account the mentioned results in combination with other typical circumstances of crashes involving young drivers and passengers (i.e., single-vehicle incidents occurring on weekends in the evening or at night), the question arises as to what kind of situations lead to road accidents including cars carrying passengers. Obviously it is impossible to say that there is only one special scenario that results in such a crash. However, the findings discussed here give an indication of at least one likely setting, which can be illustrated as follows: young people are leaving a party in a rural area and there are no buses or other means of public transportation into town, and therefore they convince each other to take a car. The picture may also include some influence of alcohol, and they drive too fast and lose control over both the vehicle and the situation in general, resulting in a single-vehicle accident. It was not possible to consider any effects of alcohol on the crashes examined in the present research, since reliable data on that subject were available only for accidents involving fatalities. Nonetheless, other investigators (SRA, 2004:161) have shown that young drivers are overrepresented in alcohol-related traffic accidents. Such crashes often occur on weekend nights, since that is the time when young people tend to drive under the influence of alcohol. Furthermore, several studies have revealed that the combination of alcohol in the blood and excessive speed

constitutes an important reason why single-vehicle crashes involve young drivers (Brorson et al., 1993; Twisk, 1994). Accordingly, it also seems logical that there is some kind of group pressure on the driver, and the current results show that drivers are indeed probably exposed to different types of provocation from passengers.

Interactions between vehicle occupants

We can be uncertain about how to act in various situations in life and therefore seek confirmation, and the same applies to any driver, especially a new licensee with limited knowledge and experience of driving. By comparing our behaviour with and listening to other people, we can get an idea of how well we do different things (Festinger, 1954), like driving a car. We can search for information about how to act and in that way conform to the group, or we can arrive at the same endpoint by being pressured into conforming (informative influence). The drivers included in the present observational study were occasionally exposed to prodding from their passengers (social influence), which was both directly and indirectly aimed at inducing safer or more dangerous driving behaviour. The passengers used different techniques to get the drivers to comply with their wishes. The foot-in-the-door technique (Seligman, Bush & Kirsch, 1976) was implemented both as a means of *getting the driver to speed up* and to *request more cautious driving*. That is, the passengers asked for faster or slower driving. Getting the driver to slow down did not require very many requests. However, the passengers had to ask many times to get the drivers to speed up, probably because the drivers were dubious about going faster, and hence the passengers applied the foot-in-the-door technique entailing more and larger requests. In many cases, the driver did speed up a little after a request, and then it was difficult to deny the next demand, and in that way the passengers sometimes succeeded in getting the speed they desired (compliance).

Sometimes the passengers did not succeed in provoking more hazardous behaviour by the foot-in-the-door method, and then they started to mock the driver by saying things like he was doing things incorrectly or that other drivers were better. This coercion should have led to compliance on the part of the driver, since group members want

to be accepted and liked—not rejected and ridiculed—by their affiliates (Baumeister & Leary, 1995). They could at least have complied for a short while, even if they disapproved of the behaviour desired by their passengers (Nail, McDonald & Levy, 2000), because the specific conditions of the social impact theory (Latané, 1981) were clear in this situation. To be sure, the group size was optimal, and the group was close in space and time when the influence was exerted. However, it seems that the last condition concerning the importance of the group for the individual (here the driver) was not fulfilled, because in most cases the drivers resisted the pressure exerted by their passengers.

The last technique the passengers used in attempts to elicit unsafe driving was to challenge the driver, for example through flattery, which is also a straightforward way of trying to get someone to do what you want. Cialdini (1993) listed some fundamental variables of all techniques, among them reciprocity, a concept indicating that we are more prone to comply with someone who has done or said something good about us or done something nice for us, because we want to do the same in return. Another such variable is authority, which means that we are more willing to recognize and submit to some important person (Cialdini, 1994). The present results do not support such an effect, but if one of the passengers had represented an authority, that person would have exerted a highly detrimental influence by demanding unsafe driving behaviour. Napier and Gershenfeld (1999) have concluded that an individual who does not obey the wishes of an authority can suffer severe consequences, and in a traffic situation that could definitely lead to an accident and death. Milgram (1965) addressed the question of what can be done to defy an authority and found that the answer was that there must be someone who dares to speak out and refuse to fulfil the demands of that important person. In turn, that will certainly entice other people to follow, and thus a group will be formed that may represent a majority that opposes unsafe actions. This reasoning agrees with the Norwegian campaign called “Speak out,” the purpose of which was to encourage passengers to tell a driver if they felt unsafe and did not want to ride in a vehicle with that person (Amundsen, Elvik & Fridström, 1999).

By comparison, the drivers who participated in the present research were very good at resisting attempts to pressure them into behaving in an unsafe way, and there are many conceivable reasons for

that observation. Those individuals may be self-confident drivers who are aware of their own responsibility and are competent in handling an automobile. Furthermore, a driver may have a status in the group of vehicle occupants that makes him/her feel freer to act according to what they think is acceptable (Napier & Gershenfeld, 1999). The balance between the majority and the minority in the group will probably also affect the outcome of any prodding. If there is only one passenger who wants less safe behaviour, that person might be regarded as a deviant, and the rest of the group will try to convince him/her of the unsuitability of the desired action. Countering that person or refusing to accept his/her demand will constitute a certain kind of self-regulation (Reicher et al., 2004). It seems that the groups in the present observational study had fairly strong norms about safe driving, and thus they self-regulated a deviant by not tolerating unsafe behaviour, as evidenced by the drivers resistance to prodding from such individuals.

However, if such self-regulation is not successful and a deviant finds an ally in the group, it can be more difficult for the driver to resist the demands for hazardous driving behaviour. This is particularly noticeable if the minority shows consistency by constantly repeating its message (Moscovici, 1976), which seems to have been what the passengers did in the current observational study. Nevertheless, even if the minority members must be consistent, they also have to be reasonable, as described by Mugny (1982). The present passengers can be looked upon as being reasonable when they switched from insistent urging to get a driver to behave as they wanted, to mocking him or telling stories to achieve the desired outcome. It should be recognized that if passengers start to want the same thing, they will no longer be a minority. In such a case, the driver will represent a minority, and, to resist demands for unsafe behaviour, he/she will have to use consistent argumentation and also apply informational social influence to make the group consider things like the fact that speeding is dangerous. Then the majority will have to ponder that information and hopefully realize that the driver is right, that the requested action is too dangerous and should not be attempted.

The effect of cohesiveness

Cohesiveness (cohesion) affects the performance of a group (Langfred, 1998), and it has been found that a high level of such unity is correlated with increased performance (Norris & Niebuhr, 1980). In the present observational study, it was noted that the groups with high cohesion exhibited a lower number of unsafe driving actions. The relationship between task cohesion and performance was especially pronounced, which agrees with the deductions of Mullen and Copper (1994). A group that is committed to the mutual task performs well, and the group members (vehicle occupants) here generally agreed that the task confronting them (i.e., driving the test car from one point to another) should be done in a safe way, and hence they drove safely (i.e., did not often display dangerous behaviour). Agreement about how to carry out the task was more important for the driving than what the participants thought about each other (social cohesion).

The present findings clearly demonstrate that the crash risk for young drivers was lower when they were in the company of passengers than when they drove alone. The results also showed that safe driving behaviour was not induced solely by the presence of passengers, but that some cohesion in the group was also required. The group members in some cases put pressure on the drivers to adopt safer or more dangerous driving behaviour. However, the greater the cohesion of the group, especially social cohesion, the safer the driving behaviour was. That probably indicates that when group members like each other and feel a mutual attraction, they will not be very inclined to try to influence each other in a negative manner.

Register data

It has been a great advantage having access to the comprehensive data in these national registers, which could be divided into several subgroups. Unfortunately, there were also problems with these sources of information. Even though the data were compiled on a national level, there are always problems associated with using such information. For example there were dropouts and poor agreement between different registers with regard to the filing of the data, especially concerning traffic injuries (Lindqvist, 1991; Thulin, 1987,

2001). It has not been possible to estimate the number of dropouts in the present research, but there was no indication that the rate differed between the subgroups we scrutinized. Accordingly, even if the risk levels were actually higher than suggested by our findings, the results of the comparisons of the subgroups are estimated to be correct.

It was also advantageous to be able to use data on exposure at a national level, but there were dropouts even in that regard. When calculating exposure in different groups, we compensated for the missing information by assuming that the dropout rate was the same in all groups of subjects (Gregersen, 1995).

Observational study

Four people in a vehicle can fulfil the six criteria for being a group—number of persons, face-to-face interaction, personal relationship, a goal to achieve, a common fate, and known by others—although applicability of the last criterion in the present study can be questioned. Did the current participants actually see themselves as a group of friends driving together or simply as a temporary group put together for research purposes? Of course they did constitute experimental groups since they were involved in pre-planned driving for research purposes, but they also comprised established groups with a common history in military training during which they had lived together for over a year and had gotten to know each other well. Nonetheless, it can be questioned whether the young men had acquired their identity and norms from the small group in the vehicle, or if these features were more extensively created within the larger group that existed during military service. Ben-Shalom, Lehrer and Ben-Ari (2003) conducted a study in Israel and found that when soldiers from different parts in the army in that country were assigned to work together in groups, they handled their tasks very well. Those investigators concluded that their subjects trusted each other from the beginning, because they were all members of an army that had a good reputation and therefore functioned well. The situation may well have been the same for the young men participating in our study, that is, the group members may have functioned well together because they all trusted each other after serving in the Swedish army. This might also explain their high scores on the cohesion test, especially with regard to social cohesion.

The behaviour of the participants in our investigation may have been affected by the information and instructions they received before the test route was driven. Some of the groups were suspicious of an assessment conducted solely by use of questionnaires, and thus they searched the test vehicle for instruments that might have been installed to record the driving or the actions in the vehicle, which may have led to non-normal behaviour during the experimental driving. However, most of the groups did not consider the possibility of hidden instrumentation.

I have showed my preunderstanding by presenting my experience and knowledge of traffic safety and group psychology. However, I have tried to work in such a way so that my preunderstanding has not twisted the categorization of the data. To create the final categories, it was first necessary to develop preliminary categories that were repeatedly taken apart and put back together in different ways until they adequately reflected the empirical material according to Larsson's (1994) criteria. To ensure good quality, it was also important that the categories were well structured and rich in content, which means that they had to show the essential elements and the differences of the collected information. All the categories established in this way are presented with quotations to give readers the opportunity to make their own judgements about the precision of the classification. The categories are also bound by the empirical data, since they stemmed from the material, and the categories have been named accordingly.

In summary

The four studies included in this thesis have shown that passengers in the vehicle had a positive impact (i.e., resulted in a lower crash risk) regardless of the age of the driver. This also applied to young drivers (18–24 years of age), although the effect was not as strong as on other age groups, especially when considering young male drivers. However, young male drivers were still involved in road accidents, despite the presence of passengers, and those unfortunate events were associated with specific circumstances. In short, they were more often single-vehicle crashes that occurred at night, on weekends, and in rural areas on roads with higher speed limits, and they had more severe consequences. It was also observed that passengers sometimes put

pressure on young drivers to get them to act in either safer or more dangerous ways. Interactions that were more negative in nature seemed to induce more dangerous behaviour; this relationship was not statistically significant, but the tendency was evident. This showed that the drivers very often resisted urging and coaxing from their passengers. Cohesion also had an impact on the group: a high level of cohesion, especially task cohesion, was associated with a low number of unsafe driving actions. Consequently, it seems that the presence of passengers is not enough to ensure safety, there must also be substantial cohesion in the group to achieve safe driving behaviour.

Future research

This thesis has shown the possibility of studying interactions in a vehicle and the effect of these interactions to the driving safety. This opens up new possibilities to study this phenomenon in other environments. Since group pressure was found to have a fairly detrimental effect in traffic situations, particularly for young drivers and their passengers, it is important to know more about how this phenomenon operates and how to avoid it, at least when it is intended to induce negative actions. It is essential to teach novice drivers about these group interactions, so that they are aware that they exist and know how to handle them. The present results suggest that there are specific circumstances that lead to crashes involving this age group. Perhaps those conditions can be studied along with the effects of low cohesion and more negative group pressure in order to elucidate the role of the driver-passenger combination in that context. What relationships between vehicle occupants might lead to accidents? Are there any other factors involved that need to be identified?

Furthermore, inasmuch as it seems that social pressure and performance are affected by the cohesion of a group, it would be interesting to see how this works in connection with other types of transportation. For example, what kind of relationships exists between the pilot and co-pilot in the cockpit of an aeroplane? Do they know each other well or do they often change teams? This is a very interesting question as several airlines have as a policy that the pilots shall not be too familiar. Other driving situations that could be studied are interaction in military tank crews or in police car patrols.

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Appendix I

The items in the group cohesiveness questionnaire (GCQ)

1. Most members in the group fit how I think a good group member should be.
2. If I could change to another group I would do it without hesitation.
3. All members don't take responsibility for our collective goal – some try to stay out from our work.
4. I feel that the other members let me participate fully in the group's activities.
5. Everyone in the group take a shared responsibility for our tasks so that they can be performed as good as possible.
6. I don't really care what happens to the group as long as it doesn't affect my own situation.
7. I like being in the group.
8. If I would be asked to join another group like this one I would rather not see any other people from this group join.
9. I do not feel a part of the group's activities.
10. In the group we agree on what is important for us to perform our work as good as possible.

PAPER I

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Young drivers—Reduced crash risk with passengers in the vehicle

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Abstract

Studies have shown that the effect of passengers on accident propensity among young drivers is ambiguous—in some cases positive and some negative. In Sweden, various kinds of information are compiled in registers, including a national accident database and exposure data collected in a national investigation of the driving habits of license holders. Access to such data offers a good opportunity to study crash risks related to driving with and without passengers. This was done for drivers in three different age groups (18–24, 25–64 and >65 years) accompanied by one, two or three or more passengers. Differences in crash risk were estimated using incidence density ratios (IDRs) and 95% confidence intervals. The results show that passengers had an overall protective effect, that is, the crash risk was higher for those who drove alone, regardless of their age or gender. This protective effect increased with every extra passenger (up to eight), indicating that the more passengers in the vehicle, the safer the driving. The influence of passengers was weakest (albeit still positive) among the youngest drivers (ages 18–24 years), especially the males in that group. The protective impact showed the same pattern on all days of the week, but was most marked from Friday to Sunday for most of the drivers, regardless of age.

Keywords: Passengers; Crash risk; Young drivers; Gender

1. Introduction

A large number of people are killed or seriously injured in road crashes each year, and hence traffic accidents constitute a major public health problem. In 1997, the Parliament of Sweden opted for "Vision Zero," the goal of which is to eliminate deaths and serious injuries in traffic. The concept of "Vision Zero" defines a shared responsibility between system designers and road users. As long as the road users obey the traffic rules, the design of the traffic system should protect them from being killed or seriously injured. An example of a strategy devised by system designers is the use of highways with 2–1 lane configuration, where both the opposing traffic and the shoulder of the road are separated by safety fences. As long as the drivers do not exceed the posted speed limit, they will not be involved in head-on crashes or collide with obstacles off the road, and thus they will not be killed or injured. However, we know that many drivers do exceed the speed limit and thereby run the risk of serious crashes. To address this issue, we need to know more about the processes that underlie such violations and dangerous driving.

It is well established that the characteristics of a driver, such as age and gender, have an impact on the probability of being involved in crashes, and the risk of involvement is higher among young drivers, especially the males in that age group (Engström et al., 2003; Nyberg and Gregersen, 2007). The presence of passengers is another factor that seems to affect the likelihood of motor vehicle accidents in different ways. Some studies have shown a positive (i.e., protective) effect of passengers, indicating that the risk of a crash is greater when driving alone, whereas other investigations have demonstrated a negative effect of driving with passengers. Whether the effect is positive or negative depends on different situational factors: the age and gender of the driver, and the number and the age and gender of passengers.

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Young drivers (16–24 years of age) do have a higher overall crash risk than other age groups (Doherty et al., 1998; Engström et al., 2003). Furthermore, according to some studies, this elevated crash risk is disproportionately high under specific circumstances, such as driving on weekends, at night or with passengers in the car and a combination of these three factors appears to have the greatest negative impact (Doherty et al., 1998). Several studies have reported that young vehicle operators are less prone to accidents when accompanied by passengers than when driving alone, but the definition of a young driver varies. The negative effect has been discerned for drivers 16–19 years old in some cases (Doherty et al., 1998; Chen et al., 2000; Williams, 2001) but up to 24–25 years of age in other studies (Preusser et al., 1998; Lam et al., 2003). Among drivers 25 years and older, it seems that passengers have either no effect (Doherty et al., 1998; Lam et al., 2003) or a positive influence (Doherty et al., 1998; Williams, 2001, 2003) on crash risks. However, findings suggest that the positive influence decreases (but is still positive) in drivers over 65–70 years of age (Preusser et al., 1998). In contrast, Rueda-Domingo et al. (2004) and Vollrath et al. (2002) observed such a beneficial impact on all drivers, regardless of age, although the effect was more pronounced among those who were over 45 years than on those who were under 24 years. Summarizing, it seems that the presence of passengers is protective for (or at least not detrimental to) drivers over the age of 24 but has an ambiguous (i.e., either positive or negative) influence on young drivers.

The negative effect on young drivers is also associated with the number and identity of the passengers. The crash risk increases with an increasing number of passengers in the car (Doherty et al., 1998; Preusser et al., 1998; Williams, 2001, 2003), especially if they are same-age peers (Aldridge et al., 1999; Lam et al., 2003) and male (Chen et al., 2000). In addition, for both male and female drivers, the risk is higher if the passengers are young males than if they are young females (Chen et al., 2000). In contrast, the crash risk among young drivers has been reported to be lower if an adult or a child is a passenger, and the risk decreases with the number of adult (parent) or child passengers (Aldridge et al., 1999).

Some studies have shown that the crash risk is higher for both young male and young female drivers when there are passengers in the car (Doherty et al., 1998; Aldridge et al., 1999; Williams, 2001, 2003), whereas other investigations have indicated that that risk is higher for young male drivers (Chen et al., 2000; Regan and Mitsopoulos, 2001).

Table 1 illustrates an overview of the cited studies. The influence of the presence of passengers on crash risks in different countries is shown for young drivers as well as drivers in other age groups. In one case (Aldridge et al., 1999), contradictory effects on crash risk were observed within the same age group depending on the identity of a passenger. More specifically, a child or an adult passenger had a protective effect, whereas a peer in the vehicle had a negative impact.

Why do the results regarding the effects of passengers on young drivers vary between different studies? There are many plausible explanations, one of which might be that the research has been conducted in different parts of the world. Most of the studies suggesting a negative impact of passengers have been performed in the United States, Australia and New Zealand, and the investigations showing a protective effect have been carried out in European countries. There is one obvious difference between these two parts of the world, namely, the age at which a driving license can be obtained, which is 18 years in Europe but 16 years in the United States (most states), Australia and New Zealand. Above all, this can lead to disparate ways of defining young drivers.

Another possible explanation for the difference in the effect of passengers on young drivers might be that many of the mentioned investigations did not use any exposure data, or at least not the same kind of exposure data. In some instances, a solution to that problem has been to conduct case–control studies, with all

Table 1
Overview of the cited studies of the effect of passengers in the vehicle on crash risk

Age group of the driver	Crash effect	Country	Authors
≥18	+	Germany	Vollrath et al. (2002)
≥18	+	Spain	Rueda-Domingo et al. (2004)
16–19	−	Canada	Doherty et al. (1998)
20–59	+		
<25	−	New Zealand	Lam et al. (2003)
≥25	0		
16–24	−	USA	Preusser et al. (1998)
25–29	0		
≥30	+		
16–19	−	USA	Williams (2001, 2003)
30–59	+		
16–20	+ (Adult/child) − (Peers)	USA	Aldridge et al. (1999)
16–17	−	USA	Chen et al. (2000)

'+' indicates a protective effect, '0' no effect and '−' is a negative effect.

the advantages and disadvantages they entail. The definitions of case and controls have also varied between investigations, which might have affected the results. An example of this is when case was defined as all drivers causing crashes, and controls were considered to be all drivers involved in those crashes. Such an approach would exclude all single-vehicle crashes, which would have a significant impact on results related to the risk of crashes among young people driving with passengers, because a large proportion of the accidents involving such drivers are single crashes.

In Sweden, we have the advantage of having access to various kinds of national registers like a comprehensive accident database, and a collection of exposure data on the driving habits of people licensed to operate motor vehicles. These sources of information can facilitate analysis of different types of crash risks, and by that the risk of accidents when driving with and without passengers, especially among young drivers (aged 18–24 years).

2. Aim of the study

The overall purpose was to investigate young drivers regarding the effects of the presence or absence of passengers in the vehicle on the risk of being involved in a road crash. Five more specific objectives were as follows:

1. To examine how the number of passengers influences the crash risk among drivers in different age groups, particularly young drivers.
2. To compare young and older drivers with respect to the effects of passengers on the risk of being involved in a crash.
3. To examine how the number of passengers influences the crash risk for young male and young female drivers.
4. To compare the effect of carrying passengers for young male drivers compared with young female drivers.
5. To analyze the first four categories with regard to differences on different days of the week.

3. Methods

To fulfill the purposes data have been used from the national accident database and from a database including exposure data. The variables that were the same in the two databases were chosen for analysis.

3.1. National accident database

All motor vehicle crashes reported to the police in Sweden were registered in a national accident database designated OLY/VITS. In the present study, data on all crashes that led to death or severe or minor injuries in 1994–2000 were used.

Each crash was classified according to a number of variables, of which the following were used here: age, gender of the driver, number of passengers in the car and day of the week when the crashes occurred. The drivers were divided into the three age groups 18–24, 25–64 and >65 years. They were considered regarding the effects of driving alone or with one, two, three or more passengers, with the limit set at eight passengers, since that is the maximum number carried in a minivan or a large family car. The days of the week were divided into Monday to Thursday and Friday to Sunday.

3.2. Exposure data

Exposure data had been collected annually in a national study of the driving habits of licensed drivers. Information on annual person kilometers (millions) traveled during the period 1994–2000 (the same years as in the national accident database) was available for male and female drivers in different age groups (18–24, 25–64 and >65 years) regarding the number of passengers in the car (0, 1, 2 or >3 passengers), and driving done on different days of the week (Monday–Thursday and Friday–Sunday). This information was used to estimate exposure when calculating crash risks for both males and females of different ages driving in the presence of varying numbers of passengers and on different days.

3.3. Statistical method

Differences in crash risks were compared by studying incidence density ratios (IDRs). Here, an IDR is the ratio between crash risks for two different groups of drivers. The groups were identified by the variables age, sex, days of the week (Monday–Thursday versus Friday–Sunday) and number of passengers. To be able to control for all selected variables simultaneously, a Poisson regression model (Kirkwood and Sterne, 2003) was fitted to the data and IDRs with corresponding 95% confidence intervals were calculated from the estimated regression coefficients and their variance. The dependent variable in the Poisson regression was the number of crashes within a group of drivers, and the exposure was included as an offset. The four variables and all possible interactions were included as explanatory variables.

4. Results

4.1. Crash risk and number of passengers

Table 2 shows the total number of crashes from 1994 to 2000 involving drivers in different age groups (18–24, 25–64 and >65 years) operating a motor vehicle with and without passengers. The table also gives data on exposure in million kilometers traveled with and without passengers, as well as the crash risk for each age group during the same period. It can be seen that the crash risk in all three age groups was lower in the presence of passengers. Furthermore, the risk decreased with each additional passenger, regardless of the age of the driver, except in one case: among the older drivers, the risk was lower with one passenger than with two. Thus, the overall pattern seems to be that an increased number of passengers decreases the probability that a driver will be involved in an accident (a protective effect).

Table 2
Number of crashes, exposure in 10 million person kilometers and crash risk for drivers aged 18–24, 25–64 and >65 years with >0–3 passengers in the vehicle (1994–2000)

Number of passengers	Number of crashes			Exposure			Crash risk[a]		
	18–24	25–64	>65	18–24	25–64	>65	18–24	25–64	>65
0	17343	72273	11186	1466	17936	1345	11.84	4.39	8.18
1	3854	11761	3084	717	8132	1672	4.88	1.49	1.86
2	989	2387	271	246	3110	149	3.70	0.77	1.92
>3	601	1115	96	218	3058	137	2.51	0.37	1.30
Total	22787	87536	14637	2647	32236	3303	4.81	1.17	2.48

[a] Crash risk was calculated from the fitted Poisson regression model.

Table 3
Incidence density ratio (IDR) estimates and 95% confidence intervals (CI) for crash risk when driving alone compared to driving with passengers shown by driver age group (1994–2000)

Age group	IDR (95% CI)		
	1 passenger	2 passengers	>3 passengers
18–24	2.42 (2.33–2.53)	3.20 (2.95–3.47)	4.72 (4.23–5.27)
25–64	2.95 (2.89–3.01)	5.73 (5.48–5.99)	11.87 (11.12–12.67)
>65	4.40 (4.15–4.67)	4.27 (3.68–4.96)	6.27 (4.82–8.17)

4.2. Crash risk and age

In Table 3, differences in crash risk for those driving alone as compared to driving with one, two or three or more passengers are presented for each age group as IDR estimates and 95% confidence intervals. A protective effect of passengers can be seen in all three driver age groups. Compared to driving with one passenger, driving alone was associated with 2.42, 2.95 and 4.40 times higher crash risks for the drivers who were aged 18–24, 25–64 and >65 years, respectively. Furthermore, the beneficial effect increased with every extra passenger among drivers 18–24 and 25–64 years of age. The same was observed for the oldest drivers, with one exception: the protective effect was greater with one passenger than with two.

The results in Table 3 also show that the protective effect of passengers on crash risk was lowest for the youngest drivers, 18–24 years of age. Clearly all drivers benefited from having passengers in the vehicle, but the presence of many passengers had a much greater positive impact on the older drivers than on the younger ones. For example, the crash risk when driving alone compared to having three or more passengers in the car was approximately 12 times higher for the drivers who were 25–64 years but was only about five times higher for the youngest drivers.

Table 4 presents IDRs illustrating comparison of the youngest drivers with those who were 25–64 years of age concerning the effects of driving alone or with one, two or three or more passengers. It can be seen that the crash risk was significantly higher for the youngest drivers in all cases. Compared to the 25–64-year-old drivers, the youngest drivers were at 2.70 times higher risk when driving alone and as much as almost seven times higher risk in the presence of three or more passengers. These findings indicate that the risk of motor vehicle accidents increased with an increasing number of passengers among the youngest drivers as compared to the middle-aged drivers. To sum up, compared to older drivers, the youngest drivers had a higher crash risk regardless of the number of passengers in the vehicle, although increasing numbers of passengers decreased the crash risk.

4.3. Crash risk and gender

Table 5 shows the total number of crashes, the exposure in million kilometers and the crash risk in 1994–2000 for young males and females driving with different numbers of passengers. It can be seen that the crash risk was lower for both genders in the presence of more passengers, although this positive effect was greater for the female drivers. The data also indicate that the probability of young drivers being involved in an accident was higher for the male drivers than for the females.

4.4. Crash risk, gender and number of passengers

Table 6 shows IDR estimates and 95% confidence intervals calculated to illustrate differences in crash risks for both young male and young female drivers. The results indicate that having passengers in the vehicle had a protective effect on both genders.

Table 4
Estimates and 95% confidence intervals of the incidence density ratio (IDR) between 18–24-year-olds and 25–64 year-olds driving with >0–3 passengers (1994–2000)

Number of passengers	IDR (95% CI)
0	2.70 (2.65–2.75)
1	3.28 (3.14–3.42)
2	4.83 (4.41–5.28)
>3	6.78 (5.98–7.70)

Table 5
Number of crashes, exposure in 10 million person kilometers and crash risk for young males and females driving with >0–3 passengers (1994–2000)

Number of passengers	Crashes		Exposure		Crash risk[a]	
	Males	Females	Males	Females	Males	Females
0	12561	4782	1006	459	12.72	11.03
1	2933	921	482	235	6.09	3.92
2	790	199	155	92	5.13	2.67
>3	495	106	157	61	3.59	1.75
Total	16779	6008	1800	847	6.15	3.77

[a] Crash risk was calculated from the fitted Poisson regression model.

Table 6
Incidence density ratio (IDR) estimates and 95% confidence intervals (CI) for crash risk when driving alone compared to driving with >1–3 passengers shown for young male and female drivers (1994–2000)

Drivers	IDR (95% CI)		
	1 passenger	2 passengers	>3 passengers
Males	2.09 (2.00–2.18)	2.48 (2.30–2.67)	3.54 (3.22–3.89)
Females	2.82 (2.62–3.02)	4.13 (3.58–4.77)	6.29 (5.16–7.67)

Table 7
Estimates and 95% confidence intervals of the incidence density ratio (IDR) between young males and females driving with >0–3 passengers (1994–2000)

Number of passengers	IDR (95% CI)
0	1.15 (1.12–1.19)
1	1.55 (1.44–1.67)
2	1.92 (1.64–2.25)
>3	2.05 (1.65–2.55)

For young male drivers, the risk of being involved in a traffic accident when driving alone was just over two times higher than with one passenger in the vehicle, and about three and a half times higher than when there were three or more passengers. By comparison, the protective effect of passengers was more pronounced among young female drivers. In that group, the crash risk when driving alone was 2.82 times higher than with one passenger and 6.29 times higher than with three or more passengers in the vehicle.

Table 7 presents the IDR estimates and 95% confidence intervals computed to compare young male and female drivers regarding crash risk in the presence of different numbers of passengers. As can be seen, the risk for young males was higher in all cases. Compared to young females, the crash risk for young males was 1.15 times higher when driving alone and 2.05 times higher when driving with three or more passengers. More simply, it appears that young male drivers are always at greater risk of being involved in a traffic accident, although that risk is decreased by the presence of passengers, as shown in Tables 5 and 6. In any case, it seems that the effect of passengers is more beneficial for female drivers than for male drivers.

4.5. Crash risk, age, number of passengers and day of the week

Table 8 shows IDR estimates and 95% confidence intervals calculated to illustrate differences in crash risks for the three different age groups at different days of the week; Monday to Thursday and Friday to Sunday. The results show a protective effect of passengers in all three age groups during Monday to Thursday, an effect which increased with every extra passenger. This was especially noted among drivers over 24 years of age. The effect was less protective for the youngest group.

Table 8 also shows that the presence of passengers reduced the risk of crashes from Friday to Sunday for the young drivers and those aged 25–64 years. Moreover, the protective effect increased with increasing numbers of passengers. The oldest driver group was also benefited by passengers in the vehicle, but the protective effect was greater with one passenger than with two or more. Table 8 further indicates that the positive impact of passengers was more pronounced on Friday to Sunday than on

Table 8
Incidence density ratio (IDR) estimates and 95% confidence intervals (CI) for crash risk when driving alone compared to driving with passengers on Monday–Thursday and Friday–Sunday shown by driver age group (1994–2000)

Age group	Days of the week	IDR (95% CI)		
		1 passenger	2 passengers	>3 passengers
18–24	Monday–Thursday	2.25 (2.13–2.39)	2.05 (1.82–2.32)	4.72 (4.23–5.27)
	Friday–Sunday	2.61 (2.47–2.76)	4.99 (4.49–5.54)	6.58 (5.75–7.53)
25–64	Monday–Thursday	2.62 (2.54–2.69)	4.89 (4.60–5.20)	9.50 (8.62–10.48)
	Friday–Sunday	3.32 (3.22–3.43)	6.72 (6.31–7.15)	14.82 (13.60–16.14)
> 65	Monday–Thursday	3.47 (3.23–3.74)	6.08 (4.93–7.49)	7.59 (5.17–11.14)
	Friday–Sunday	5.58 (5.10–6.11)	3.00 (2.43–3.71)	5.19 (3.62–7.45)

Table 9
Estimates and 95% confidence intervals of the incidence density ratio (IDR) between 18–24-year-olds and 25–64 year-olds driving with >0–3 passengers

Number of passengers	IDR (95% CI)	
	Monday–Thursday	Friday–Sunday
0	2.61 (2.55–2.68)	2.78 (2.71–2.86)
1	3.03 (2.85–3.22)	3.54 (3.34–3.76)
2	6.22 (5.43–7.12)	3.75 (3.33–4.22)
>3	7.34 (6.03–8.94)	6.27 (5.36–7.33)

Separate results for Monday–Thursday and Friday–Sunday (1994–2000).

Table 11
Estimates and 95% confidence intervals of the incidence density ratio (IDR) between young males and females driving with >0–3 passengers

Number of passengers	IDR (95% CI)	
	Monday–Thursday	Friday–Sunday
0	1.24 (1.19–1.30)	1.07 (1.02–1.13)
1	1.25 (1.12–1.39)	1.94 (1.75–2.14)
2	1.14 (0.90–1.45)	3.23 (2.64–3.97)
>3	2.76 (1.96–3.89)	1.52 (1.17–1.99)

Separate results for Monday–Thursday and Friday–Sunday (1994–2000).

Monday to Thursday for drivers 64 years of age and under. For the oldest group of drivers, the same was true in the presence of one passenger, whereas the effect was greater on Monday to Thursday when there were more passengers.

Table 9 presents IDR estimates comparing 18–24-year-old and 25–64-year-old drivers regarding crash risk with different numbers of passengers on different days of the week. For the youngest drivers, the risk was higher in all cases, regardless of the days of the week. Further consideration of that age group indicated that the crash risk with one or no passengers was greater on Friday to Sunday than on Monday to Thursday, whereas the presence of more than one passenger had the opposite effect, that is, was more beneficial on Monday to Thursday.

4.6. Crash risk, gender, number of passengers and days of the week

In Table 10, the IDR estimates and 95% confidence intervals for young male and female drivers are presented to illustrate the differences in crash risk. It appears that young male drivers are protected by the presence of passengers on all days of the week, although from Monday to Thursday the positive effect was almost the same in the presence of different numbers of passengers, whereas on Friday to Sunday it was greater for every extra passenger. An equivalent effect was seen for young female drivers on Friday to Sunday, but the beneficial impact was even more marked. Considering Monday to Thursday in this group, the best protection was provided by three or more passengers, and a lesser effect was seen with two passengers in the vehicle.

Table 11 presents IDR estimates computed to compare young male and female drivers regarding crash risk in the presence of different numbers of passengers on different days of the week. The young male drivers had a higher crash risk, regardless of the days of the week. On Monday to Thursday, the greatest difference between males and females was associated with three or more passengers, and the smallest difference was seen with two passengers. By comparison, the difference in risk Friday to Sunday was greatest in the presence of two passengers and smallest with three or more passengers.

5. Discussion

A great advantage of this study was having access to a national crash injury register, which enabled us to use a large stock of data and thereby ensure high statistical power, even after dividing the data into several subgroups. There is always a problem of dropouts in national registers, and it was not possible to estimate the size of that factor in our study. Nonetheless, there is no indication that the dropout rate differed between the subgroups we scrutinized. Accordingly, even if the risk levels were actually higher than suggested by our findings, the results of the comparisons of the subgroups are estimated to be correct. It was also advantageous being able to use data on exposure at a national level, but even in that case there were dropouts. When calculating exposure in different groups by gender, age, day of the week and region, we compensated for the missing information by assuming that the dropout rate was the same in all groups of subjects.

Several factors affect the crash risk with and without passengers in the vehicle, and we chose to consider age, gender and day of the week, since data on these variables were available in both of the available registers. Obviously other important factors like time of day, passenger type and alcohol use will also have an impact, but we could not use those variables, because there was no information about them in the two registers.

Our results indicate that passengers had a protective effect on all the drivers, irrespective of their age or gender or on what

Table 10
Incidence density ratio (IDR) estimates and 95% confidence intervals (CI) for crash risk when driving alone compared to driving with >1–3 passengers on Monday–Thursday and Friday–Sunday shown for young male and female drivers (1994–2000)

Drivers	Days of the week	IDR (95% CI)		
		1 passenger	2 passengers	>3 passengers
Males	Monday–Thursday	2.25 (2.12–2.39)	2.14 (1.91–2.41)	2.27 (1.96–2.64)
	Friday–Sunday	1.94 (1.84–2.05)	2.87 (2.62–3.14)	5.51 (4.93–6.17)
Females	Monday–Thursday	2.26 (2.04–2.50)	1.97 (1.58–2.44)	5.04 (3.69–6.88)
	Friday–Sunday	3.51 (3.18–3.88)	8.68 (7.19–10.49)	7.86 (6.15–10.04)

days of week they were driving, which means that the crash risk was greater when driving alone than when there were passengers in the vehicle. This positive influence of passengers agrees with other studies, especially with respect to the older drivers (Doherty et al., 1998; Lam et al., 2003). A protective effect of passengers was observed on all drivers, although the impact was comparatively greater on those who were 25–64 years of age than on the youngest drivers, 18–24 years old. Young drivers do have an overall higher crash risk compared to other age groups, and this was true even in the presence of passengers. Therefore, it can be said that the protective effect of passengers was less pronounced among the young drivers than among those who were middle-aged. The results also showed that passengers had a more beneficial effect on Friday to Sunday compared to Monday to Thursday, at least for the youngest drivers and those aged 25–64. The impact of passengers was somewhat more positive on older individuals driving on Monday to Thursday.

As mentioned in the introduction, research results regarding the influence of passengers on young drivers are ambiguous. However, the results from this study are in accordance with other investigations conducted in Europe, because they show that passengers had a positive effect on young drivers, more precisely, those 18–24 years of age (Rueda-Domingo et al., 2004; Vollrath et al., 2002). A negative effect of passengers has been most often detected among 16–19-year-old drivers in studies carried out in the United States, Australia and New Zealand (Doherty et al., 1998; Chen et al., 2000; Williams, 2001). Inasmuch as a person must be 18 years old to obtain a driving license in Europe, there are no licensed drivers younger than that age. If the influence of passengers on drivers is somehow related to the characteristic of the age at which a license can be obtained (i.e., being an inexperienced driver), the negative effect should have been discerned in Europe as well. However, that is not the case. Moreover, some studies showing a negative effect of passengers on 16–19-year-old drivers have also indicated a detrimental impact on drivers up to the age of 24 years (Preusser et al., 1998; Lam et al., 2003). These findings raise the question of whether cultural differences might be involved. Previous research has revealed cross-cultural disparities in drivers' risk perception (Sivak et al., 1989a), risk taking (Sivak et al., 1989b) and self-assessment (Sivak et al., 1989c), but what about the impact of passengers in this context?

The overall positive effect of carrying passengers might be related to a sense of responsibility. Having passengers in the vehicle means that the driver has to take care of other people, that he or she is responsible for the lives of the passengers and therefore must drive more cautiously. Many drivers, especially young ones, also say they are more careful in the presence of passengers than when driving alone, especially if one of the passengers is a parent or a child (Rolls and Ingham, 1992). Unfortunately, we had no knowledge of the identity of the passengers in this study. Nonetheless, we did observe a more protective influence of passengers on Friday to Sunday, and thus it is plausible that the composition of passengers differs depending on what day of the week it is. One explanation for our finding might be that drivers more often take car trips with their families on Friday to Sunday, and they have a greater feeling of responsibility when family members are the passengers. Another aspect that might lead to a lower crash risk on Friday to Sunday in the presence of passengers could be that most people are off work on weekends and are therefore probably more relaxed. On weekdays, people are more stressed to get to and from work, to go shopping or to take part in various recreational activities.

The results might also be interpreted as indicating that passengers are a source of distraction. A driver can be distracted by conversation with a passenger, and it is possible that doing the two tasks of driving and talking at the same time is too complicated. According to our results, it seems that drivers take it easier so that they can handle both the traffic environment and their passengers. Coping with such a situation ought to be particularly difficult for young drivers, because they are relatively inexperienced, which might explain the more limited positive effect of passengers on young drivers than on older ones. Another plausible factor is that the passengers themselves do not accept inappropriate vehicle handling, for example, driving too fast. The reactions of passengers to such behavior will no doubt have a greater effect on young drivers as they grow older and probably gradually become more confident with regard to operating a motor vehicle. This assumption might to some extent be the reason why we noted that the presence of passengers had smaller positive effects on the crash risk among younger drivers (Vollrath et al., 2002).

The protective influence of passengers also involves a social psychological phenomenon, namely, wanting to perform well in front of an "audience" (i.e., when someone else is watching) (Zajonc, 1965). In this case, good performance would entail safe driving. An increasing number of passengers might have an additive effect in the sense that the larger audience, the better performance—here, the more passengers, the safer the driving. Performing well is not necessarily synonymous with safe driving. Indeed, in some situations it may instead represent showing off, which might explain why the impact of passengers is more beneficial among older drivers than those who are younger. For young drivers, the factor good performance will be either safe driving or showing off, depending on the situation.

Drivers will probably also want to perform well when traveling with their families, for example, to go on vacation. The findings indicate that the more passengers in the vehicle the safer the driving, but it is not known in what situations or under what circumstances people drive with passengers, especially with many passengers. It is possible that when families go on longer journeys, they plan in advance so that everyone feels good about going on a trip, and thus they are not in a hurry. Such a situation is probably more common on Friday to Sunday. The opposite circumstances might be when people drive to work without any passengers, which could easily lead to stress and along with that speeding, and in turn result in an elevated risk of being involved in an accident. Such a scenario would explain the difference in crash risk between driving alone and having many passengers in the vehicle. At present, there is no information to confirm this hypothesis, and hence it would be interesting to address this issue in the future.

Some studies have shown that young drivers are at greater risk of being involved in road accidents when traveling with passengers, especially when both the drivers and the passengers are young males (McKenna et al., 1998; Chen et al., 2000; Regan and Mitsopoulos, 2001). The effect of the young male driver–passenger combination has been reported to be associated with risky driving style that includes higher speed and shorter headways (Simsons-Morton et al., 2005). According to Arnett et al. (1997) young drivers reported a higher speed when there were same-age peers in the vehicle compared to having a parent as a passenger, but they did not drive faster with friends than being alone. This observation indicates that parents, but not peers, inhibit reckless driving among young licensees. Together, the mentioned findings show that the identity of passengers has a substantial impact on both driving behavior and crash risk. In the present study, we were not able to examine different driver–passenger combinations, because we did not have access to exposure data concerning the identity of passengers. Nonetheless, since it appears that all combinations of passengers had a positive effect on crash risk in this investigation, it is possible the drivers in the youngest age group more often had a parent or a child as a passenger rather than same-age peers. If that was the case, it would explain why we were unable to detect the negative effect of passengers on drivers that has been reported by other investigators.

It is certainly plausible that the positive effect of passengers on crash risk could be due to aspects such as cultural differences, responsibility, the ability of drivers to handle two tasks simultaneously and the desire to perform well in front of others. Nevertheless, even if passengers do have a protective effect, accidents still occur in vehicles transporting passengers, and we need to learn more about this fact. It would be interesting to further explore cultural differences among young drivers and under what circumstances the accidents with passengers occur. Very little information is available concerning what happens inside a vehicle carrying passengers, and thus research is required to provide a better understanding of what is said and done in this setting. What group processes are there, and do they differ depending on the nature of the driver–passenger combinations? These are urgent questions that must be answered to help us better understand and explain the passenger effect.

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PAPER II

Young male drivers' accident patterns with and without passengers[*]

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Abstract

Compared to other age groups, young drivers are overrepresented in road crashes. However, it is not only those drivers who are affected, their passengers constitute about one-third of the annual fatalities and injuries in such accidents. Therefore, to be able to develop measures aimed at increasing traffic safety, it is important to understand the circumstances surrounding crashes that involve young people driving both with and without passengers in the vehicle. The aim of the present study was to determine whether the circumstances of road crashes differ for young males driving in the presence and the absence of passengers. The following crash circumstances were considered: consequences, time of day, day of the week, daylight or darkness, single- or multi-vehicle incident, traffic environment, and posted speed limit. The results showed that the crash circumstances for young male drivers varied depending on the number of passengers in the vehicle. Compared to driving alone, the presence of passengers was more extensively associated with single-vehicle crashes that occurred in the evening or at night, on weekends, in rural areas, and on roads with higher speed limits.

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Introduction

Drivers are not the only ones affected by traffic accidents—passengers are also killed and injured. In 2005, 26 530 people died or sustained injuries in road crashes in Sweden, and 18 540 of those individuals had been in a vehicle as either a driver or a passenger at the time of the accidents. Of the 18 540 affected within vehicles, 6010 (about one-third) were passengers, and a total of 4057 were young (18–24 years of age), and 1404 (35%) of those young people were passengers (SIKA and SCB, 2005). Inasmuch as passengers constitute a large portion of the injuries and fatalities, it is essential that that group be taken into consideration, and that attention also be focused on the driving situations that arise when there are passengers in the vehicle. This is important since drivers themselves say that passengers play a role, as suggested by a study conducted in the United States, in which 90% of young males reported that they were influenced in some way by their passengers. However, results regarding differences in driving with and without passengers vary (Rolls and Ingham, 1992). Some investigators have shown a negative effect of passengers on young drivers (Chen et al., 2000; Williams, 2001) and some have found the opposite (Vollrath et al., 2002; Rueda-Domingo et al., 2004; Engström et al., 2008). Regardless of whether the passenger effect is positive or negative, traffic accidents do happen, both in the presence and the absence of passengers in the vehicle. Compared to other age groups, young drivers are overrepresented in road crashes, and there are circumstances that are distinctive for the accidents in which they are involved (Engström et al., 2003). To be able to develop measures to increase the safety of young drivers, it is necessary to understand the conditions surrounding their accidents, both with and without passengers.

Compared to older drivers, those who are young are overrepresented in crashes that occur at all hours, but especially in the evening and at night, and particularly at those times on Fridays and Saturdays. Furthermore, this applies chiefly to young male drivers (Gregersen and Nyberg, 2002), as illustrated by the findings of Williams (1985) indicating that those individuals were at increased risk per kilometer driven during hours of darkness, and, notably, even though only 20% of their driving took place at night, 50% of their fatal accidents occurred during those hours. It has also been observed that

traffic accidents involving teenage drivers with teenage passengers were more likely to happen between 9 p.m. and 6 a.m. than was the case for older drivers accompanied by passengers (Williams and Wells, 1995).

The kinds of accidents that are typical for drivers of different ages vary. Older drivers are most often involved in collisions between vehicles, an example of which is a crash occurring at an intersection because an older driver does not notice the counterpart in time and fails to give right-of-way (Hakamies-Blomqvist, 1993).Young drivers are overrepresented in all types of road accidents, but especially single-vehicle (Gregersen and Nyberg, 2002; Ballesteros et al., 2000) and loss-of control (Clarke et al., 2002; Harrison et al., 1999; Laapotti and Keskinen, 1998) crashes. Young male drivers are responsible for a majority of all single-vehicle accidents, which are often the result of loss of control over the vehicle; by comparison, among young females loss-of-control accidents usually entail collision with another car (Laapotti and Keskinen, 1998). Furthermore, it has been reported that young drivers are even more likely to be involved in single-vehicle accidents when there are passengers present (Williams, 2001), and the victims of those accidents are more often young males (Öström and Eriksson, 1993).

Accidents occur to varying extents on roads with different speed limits. However, the rate of traffic crashes is determined not only by the stipulated speed limit, but also by the speed at which the vehicle operator chooses to drive. Speed choice has been shown to depend on the age and sex of the driver, as well as the presence of any passengers and the age and sex of those individuals (Waylen and McKenna, 2003). Young drivers have been found to be overrepresented in speed-related crashes (Harrison et al., 1999), especially when there are passengers in the car (Williams, 2001). A study conducted in California and Maryland in the United States showed that high speed contributes to about 20% of the road accidents involving young drivers (McKnight and McKnight, 2000). Teenage drivers take greater risks in traffic when they have male teenagers as passengers, and this risky driving involves shorter headways and higher speeds than usual (Simons-Morton et al., 2005). Speeding has been reported to be more common among male than female drivers, and it seems to be most common among young drivers on curvy roads with a speed limit of 70–90 km/h (Harrison at al., 1999).

In summary, it seems that young drivers are overrepresented in road crashes under specific circumstances, and many young male drivers themselves say that they are affected by having passengers in the vehicle. To increase our understanding of the role of passengers in this context, it is important to ascertain whether the circumstances of traffic accidents involving young male drivers differ depending on the number of passengers that are present.

Aim of the study

The aim of this study was to investigate young male drivers with regard to the relationships between the conditions prevailing during a crash and the number of passengers in the vehicle. More specifically, the question that was addressed was whether the circumstances differ in road accidents involving no passengers as compared to those with 1, 2, 3, or 4+ passengers in the vehicle, and the crash circumstances that were considered included the following: consequences, time of day, day of the week, daylight or darkness, single or multi-vehicle incident, traffic environment, and posted speed limit.

Methods

The national accident database

The data used were obtained from OLY/VITS, the Swedish national accident database, which previously registered all motor vehicle crashes reported by the police. Of interest in the present study were data on all crashes occurring in 1994–2000 that involved young male drivers (18–24 years of age) and led to death or severe or minor injuries**.** The following variables were considered for each crash:

- *The number of passengers in the vehicle*, classified into 0, 1, 2, 3, and 4+. The designation 4+ comprised a limit of 8 passengers, since that is the maximum number of persons carried in a minivan or a large family car.
- *The most severe consequence of the crash*, categorized as fatal/serious or slight injuries.

- *The most severe consequence for the driver*, divided into fatally/seriously or slightly injured.
- *The day of the week on which the crash occurred*, considered as Monday–Thursday or Friday–Sunday. This division was chosen because it had previously been reported that young drivers are overrepresented in crashes occurring on weekends (Gregersen and Nyberg, 2002).
- *The time of day for the crash*, assigned to one of four groups: 5 a.m. to 10 a.m., 11 a.m. to 4 p.m., 5 p.m. to 10 p.m., or 11 p.m. to 4 a.m. This partitioning has also been used in other studies (Nyberg and Gregersen, 2007), because it separates the hours of daylight and darkness, and crashes involving young drivers are overrepresented during the latter.
- *The light conditions*, classified as daylight or darkness. Dawn and dusk were included in darkness, since they do not entail full daylight.
- *The type of accident*, categorized as single-vehicle or all other kinds of crashes.
- *The traffic conditions*, classified as occurring in an urban or a rural area.
- *The speed limit* on the road where the crash occurred.

Statistical methods

To begin with, the observed numbers and proportions of accidents in the chosen variables were compared using the chi^2 test with the significance level set at $p < 0.01$ (Kirkwood, 2003). In the next step, all variables describing the circumstances of a crash (excluding the two variables about the consequences of the accident) were used in a binary logistic regression (with 95% confidence interval [CI]). The dependent variable was presence or absence of passengers in the vehicle (Kirkwood, 2003).

Results

The consequences of the crashes

Table 1 shows the numbers and proportions of vehicle occupants (i.e., both drivers and passengers) who were fatally or severely injured or were slightly injured in the crashes involving young male drivers in 1994–2000. As can be seen, most deaths and injuries occurred when there were no passengers in the vehicle, although the proportion of fatally or seriously injured vehicle occupants increased with an increasing number of passengers. A lone driver or a driver with one passenger explained the majority (about 80%) of the accidents entailing only minor injuries. However, this proportion decreased as the number of passengers increased, and the situation was reversed at the level of four or more passengers, for which more than half of the crashes caused fatal or serious injuries.

Table 1
The numbers and proportions of accidents in 1994–2000 involving young male drivers and different numbers of passengers shown according to the consequences (severity) for all vehicle occupants

Number of passengers	Fatal/Serious injuries	Slight injuries
0	2407 (19.2%)	10154 (80.8%)
1	712 (24.3%)	2221 (75.7%)
2	256 (32.4%)	534 (67.6%)
3	120 (36.7%)	207 (63.3%)
4+	88 (52.4%)	80 (47.6%)
Total	3583 (21.4%)	13196 (78.6%)

$\chi^2 = 250.415$, df = 4 $p < 0.01$

Table 2 shows the outcome of the traffic crashes for the young male drivers themselves. Similar to the results for all vehicle occupants (see Table 1), most of the crashes entailed only minor injuries for the drivers, although the number of slightly injured drivers decreased with an increasing number of passengers. The proportion of fatally or seriously injured drivers increased with every extra passenger in the

vehicle and constituted about one third of all the drivers when there were four or more passengers.

Table 2
The numbers and proportions of crashes in 1994–2000 involving young male drivers and different numbers of passengers in the vehicle shown according to the severity of the outcome for the drivers

Number of passengers	Fatally/Seriously injured	Slightly injured
0	1140 (16.7%)	5701 (83.3%)
1	360 (20.9%)	1361 (79.1%)
2	133 (24.6%)	407 (75.4%)
3	65 (25.7%)	188 (74.3%)
4+	43 (32.6%)	89 (67.4%)
Total	1741 (18.4%)	7746 (81.6%)

$\chi^2 = 61.690$, df = 4, $p < 0.01$

Day of the week, time of day, and light conditions

Table 3 shows that the total number of accidents involving young male drivers was almost the same on Monday–Thursday as on Friday–Sunday. However, the proportion of accidents was larger on Monday–Thursday for the drivers who were alone, although this changed when there were passengers in the vehicle. Considering the percentages, the majority of the crashes with passengers in the vehicle occurred on weekends, and almost 70% of those involving 4 or more passengers happened on Friday to Sunday.

Table 3
The numbers and proportions of crashes involving young male drivers and different numbers of passengers in the vehicle occurring on Monday–Thursday and Friday–Sunday in 1994–2000

Number of passengers	Monday–Thursday	Friday–Sunday
0	6758 (53.8%)	5803 (46.2%)
1	1313 (44.8%)	1620 (55.2%)
2	293 (37.1%)	497 (62.9%)
3	123 (37.6%)	204 (62.4%)
4+	51 (30.4%)	117 (69.6%)
Total	8538 (50.9%)	8241 (49.1%)

χ^2= 198.218, df = 4, $p < 0.01$

Table 4 shows the hours at which the crashes involving young male drivers with different numbers of passengers occurred. There is a clear pattern indicating that the later in the day, the more passengers in the car. Most of the crashes (percentages) with no passengers took place during daytime, especially from 11 a.m. to 4 p.m. By comparison, the crashes with 1 passenger were most common during daytime (11 a.m. to 4 p.m.) and in the evening (5 p.m. to 10 p.m.), and those with 2 and 3 passengers were most frequent in the evening. The number of accidents including passengers was higher at night, and this was most apparent when there were 4 or more passengers.

Table 4
The numbers and proportions of accidents involving young male drivers and different numbers of passengers occurring at different hours of the day and night in 1994–2000

Number of passengers	5–10 a.m.	11 a.m. - 4 p.m.	5-10 p.m.	11 p.m. -4 a.m.
0	2197 (17.8%)	4770 (38.7%)	3831 (31.1%)	1531 (12.4%)
1	348 (12.1%)	987 (34.2%)	994 (34.5%)	556 (19.3%)
2	81 (10.5%)	218 (28.1%)	284 (36.6%)	192 (24.8%)
3	24 (7.5%)	80 (24.9%)	114 (35.5%)	103 (32.1%)
4+	14 (8.4%)	34 (20.5%)	52 (31.3%)	66 (39.8%)
Total	2664 (16.2%)	6089 (36.9%)	5275 (32.0%)	2448 (14.9%)

χ^2= 431.849, df = 12, $p < 0.01$

The variables considered in Tables 5 and 4 are similar, albeit not completely comparable, because the nights in Sweden are very short in the summer but very long in winter. The data on light conditions (daylight and darkness) presented in Table 5 indicate that most of the crashes occurred in daylight with no passengers or only one passenger in the vehicle, and that the crashes involving 2, 3, or 4+ passengers occurred primarily during hours of darkness.

Table 5
The numbers and proportions of accidents involving young male drivers and different numbers of passengers occurring under different light conditions in 1994–2000

Number of passengers	Daylight	Darkness
0	7567 (60.8%)	4877 (39.2%)
1	1531 (52.6%)	1379 (47.4%)
2	361 (46.0%)	424 (54.0%)
3	130 (40.0%)	195 (60.0%)
4+	55 (32.9%)	112 (67.1%)
Total	9644 (58.0%)	6987 (42.0%)

$\chi^2 = 207.759$, df = 4, $p < 0.01$

Type of accident, urban or rural area, and speed limit

Single-vehicle crashes proved to be the most common type of traffic accidents among young male drivers. As shown in Table 6, for young males driving alone, about 20% of all accidents were single-vehicle crashes, and about 80% were in the group designated all other crashes, and that group also dominated in the presence of 1 and 2 passengers. However, single-vehicle crashes were clearly predominant when there were more than 2 passengers in the vehicle, reaching levels of about 55% and almost 65% in the presence of 3 and 4+ passengers, respectively.

Table 6
The numbers and proportions of different types of traffic accidents involving young male drivers and different numbers of passengers in 1994–2000.

Number of passengers	Single-vehicle crashes	All other crashes
0	2343 (18.7%)	10218 (81.3%)
1	985 (33.6%)	1948 (66.4%)
2	346 (43.8%)	444 (56.2%)
3	179 (54.7%)	148 (45.3%)
4+	108 (64.3%)	60 (35.7%)
Total	3961 (23.6%)	12818 (76.4%)

$\chi^2 = 841.292$, df = 4, $p < 0.01$

Table 7 shows whether the crashes happened in urban or rural areas. It seems that crashes with no passengers in the vehicle occurred more often in urban areas, whereas those involving passengers were more frequent outside of cities. With 3 and 4+ passengers, around 70% of the crashes occurred in rural areas.

Table 7
The numbers and proportions of crashes in 1994–2000 involving young male drivers and different numbers of passengers occurring in urban and rural areas

Number of passengers	Urban area	Rural area
0	7154 (57.1%)	5381 (42.9%)
1	1316 (44.9%)	1613 (55.1%)
2	282 (35.7%)	507 (64.3%)
3	104 (31.8%)	223 (68.2%)
4+	44 (26.2%)	124 (73.8%)
Total	8900 (53.1%)	7848 (46.9%)

$\chi^2 = 361.808$, df = 4, $p < 0.01$

Table 8 presents data on road crashes in relation to the speed limit. As can be seen, the crashes with no passengers occurred mainly on roads with a speed limit of 50 km/h (or less), which is the limit most often in force in Swedish cities. This agrees with the information in Table 7 indicating that crashes without passengers in the vehicle were more frequent in urban areas. Furthermore, Table 8 shows that the crashes with passengers happened on roads with a higher speed limit compared to the crashes without passengers, which also concurs with the observation that road accidents involving vehicles carrying passengers were more common in rural areas (see Table 7). With increasing numbers of passengers in the vehicle, the proportion of accidents increased on roads with speed limits of 70 and 90 km/h.

Table 8

The numbers and proportions of accidents in 1994–2000 involving young male drivers and different numbers of passengers shown in relation to speed limit

Number of passengers	**Speed limit (in km/h)**			
	≤ 50	**70**	**90**	**110**
0	6228 (50.7%)	3049 (24.9%)	2335 (19.0%)	654 (5.3%)
1	1139 (39.6%)	828 (28.8%)	706 (24.5%)	204 (7.1%)
2	248 (32.0%)	223 (28.8%)	236 (30.5%)	67 (8.7%)
3	86 (26.9%)	93 (29.1%)	111 (34.7%)	30 (9.4%)
4+	34 (20.6%)	57 (34.5%)	60 (36.4%)	14 (8.5%)
Total	7735 (47.2%)	4250 (25.9%)	3448 (21.0%)	969 (5.9%)

$\chi^2 = 333.748$, df = 12, $p < 0.01$

Regression model

Table 9 shows the relation between the crash circumstances considered in this study (three excluded) and the presence of passengers in the vehicle with regard to the impact on crash outcome for young male drivers. The two variables concerning the most severe crash consequences for all vehicle occupants and specifically for the drivers were not included in the test, because they constituted effects of the accidents. Nor was the variable light condition included, because it was not significant in the regression analysis.

Table 9

The relation between crash circumstances and the presence of passengers in the vehicle with regard to the impact on crash outcome for young male drivers.

Variables	**Estimated OR (Exp (B))**	**95% CI for Exp (B)**
Type of accident		
Single-vehicle	1.00	
All other	0.45	(0.41–0.49)
Time of day		
5 a.m. to 10 a.m.	1.00	
11 a.m. to 4 p.m.	1.62	(1.43–1.83)
5 p.m. to 10 p.m.	2.05	(1.81–2.32)
11 p.m. to 4 a.m.	2.36	(2.06–2.70)
Days of the week		
Monday–Thursday	1.00	
Friday–Sunday	1.36	(1.28–1.48)
Environment		
Urban	1.00	
Rural	1.23	(1.09–1.39)
Speed		
≤ 50 km/h	1.00	
70 km/h	1.30	(1.15–1.45)
90 km/h	1.46	(1.27–1.69)
110 km/h	1.41	(1.17–1.71)

Estimated odds ratio (Exp(B)) and 95% CI for Exp (B).

[a] Dependent variable encoding, no passenger=0; passengers=1. Method used=forward stepwise (likelihood ratio).

The results given in Table 9 indicate that there was a greater chance that the accidents that occurred with passengers in the vehicle would involve a single-vehicle crash that took place during the evening or at night, on a weekend, in a rural area, and on a road with a higher speed

limit. Overall, this logistic regression model classified 74.8% of the sample correctly. However, it offered much greater accuracy when classifying the accidents without passengers (97.3% correct) compared to those with passengers (8.5% correct).

Discussion

Having access to a national register of road crash injuries was a great advantage in this study. Nonetheless, there is always a problem of unreported traffic accidents in such registers, especially with respect to crashes involving only minor injuries. However, considering the present data, there is no indication that the dropout rate would have differed between the various subgroups of young males driving with and without passengers. Since register information was missing in relation to some of the variables that were investigated, the total number of crashes is not the same in all the tables (maximum number 16,779).

As mentioned in the introduction, research results concerning the impact of passengers on young drivers have varied. However, some investigations conducted in Europe (Vollrath et al., 2002; Rueda-Domingo et al., 2004; Engström et al., 2008) have shown a protective effect, and one of those studies (Engström et al., 2008) found that the positive influence increased with every extra passenger in the vehicle. Notwithstanding, road accidents still happen, both in the presence and the absence of passengers, and it is important to understand the circumstances that are associated with those crashes. The present findings demonstrate that, in crashes involving young male drivers, the situations differ depending on the number of passengers in the vehicle. Examples of circumstances from earlier studies that are known to be overrepresented for that group of drivers are single-vehicle accidents (Gregersen and Nyberg, 2002; Clarke et al., 2001; Ballesteros et al., 2000), crashes occurring on weekends and at night (Gregersen and Nyberg, 2002), and, these circumstances are shown to be even more significantly in accidents involving increasing numbers of passengers.

The current results suggest that the crash violence becomes more pronounced with increasing numbers of passengers, since the data indicate that the young males included in the study drove at higher speeds when they were accompanied by passengers. The reasoning for

this assumption is as follows. The proportion of dead and seriously injured vehicle occupants (i.e., the most severe consequence) increased as the number of passengers increased (see Table 1). Obviously, it might be that crashes involving more passengers will lead to a larger number of fatalities or serious injuries, simply because there are more people exposed to potential crashes. To address that possibility, and because there is always only one driver in a vehicle regardless of the number of passengers, the drivers were also considered separately when examining the consequences of the accidents. The results of those analyses showed that the outcomes for the drivers themselves in terms of bodily harm or death also became more severe with each extra passenger in the vehicle (see Table 2). An explanation for this might be that the outcomes were more serious when there were passengers in the vehicle, as compared to no passengers, because the accidents in those cases occurred to a greater extent in rural areas and on roads with higher speed limits (see Tables 7 and 8). Higher speed has been reported to lead to greater crash violence involving more fatalities and serious injuries (OECD, 2006).

It is also possible that the young males drove much faster than the speed limits, since roads allowing a maximum of 70, 90, or 110 km/h seem to be "made" for speeding. Furthermore, it is clear that many drivers often exceed the speed limit (SRA, 2005:100). In earlier studies, it was observed that young drivers were overrepresented in speed-related accidents (Harrison et al., 1999), particularly when there were passengers in the car (Williams, 2001). The speed chosen by the driver also depends on who the passengers are (Arnett et al., 1997; Waylen and McKenna, 2003). According to Simons-Morton et al. (2005), the worst situation entails a young driver with young male passengers, and it appears that male drivers are also more prone to speeding. Unfortunately, in the present study, the characteristics of the passengers could not be determined, because the Swedish national accident database does not include such information. Nevertheless, it is plausible that, in a vehicle driven by a young male, when there are more passengers present, they will often be male peers.

In general, little is known about how passengers affect the crash risk on roads with different speed limits since no exposure data are available concerning the destinations of people driving with passengers on those various types of thoroughfares. However, the proportion of accidents on roads with higher speed limits was found to increase with

increasing numbers of passengers in the current study, which suggests thatthe outcome of the accidents will also be worse, for example seen as more serious injuries. The presence of more people in the vehicle will also raise the rate of injuries.

According to the present results, most of the crashes involving passengers were single-vehicle accidents that occurred at high speeds, in rural areas, at night, and on weekends. In earlier studies, young male drivers were observed to be overrepresented in both single-vehicle (Gregersen and Nyberg, 2002; Ballesteros et al., 2000) and loss-of-control (Clarke et al., 2002; Harrison et al., 1999; Laapotti and Keskinen, 1998) accidents, particularly at night (Williams and Wells, 1995; Gregersen and Nyberg, 2002) and on weekends (Gregersen and Nyberg, 2002). The current findings indicate that this pattern is even clearer when there are a number of passengers in the vehicle. More than half of the accidents with passengers occurred on Friday to Sunday and almost 70% when there were 4 or more passengers in the vehicle. This should be compared with the totally driven kilometers for young male drivers with and without passengers. 55% of the totally driven kilometers was driven during Friday to Sunday and 45% from Monday to Thursday (Björketun, 2007). Certainly, a larger amount of the driving by young males in the presence of passengers is done on weekends, but the extent of that driving does not correspond to the rate of crash occurrence. More precisely, it seems that the proportion of the accidents is larger than the proportion of the exposure. The reasoning in this case is about the same as can be arrived at regarding crashes that happen at night, because those incidents comprise an overrepresentation of young drivers, and this seems to be true also when there are passengers in the vehicle. It was found that young males did most of their driving with passengers during the daytime and in the evening (38% and 39%, respectively, of the total kilometers driven), 17% was done in the early morning hours, and only 6% was done at night (Björketun, 2007). Since it was observed in this study that most of the accidents occurred in the evening and at night, it seems that the young male drivers were overrepresented in crashes during hours of darkness.

It was not possible to include the influence of alcohol on the crashes examined in the present investigation, since reliable data on that subject were available only for accidents involving fatalities. Nonetheless, other studies (SRA, 2004:161) have shown that young

drivers are overrepresented in alcohol-related traffic accidents. Such crashes often occur on weekend nights, since that is the time when young people tend to drive under the influence of alcohol. Furthermore, several investigations have revealed that the combination of alcohol in the blood and excessive speed constitutes an important reason why single-vehicle crashes involve young drivers (Twisk, 1994; Brorsson et al., 1993). Öström and Eriksson (1993) analyzed all fatal road crashes involving passenger vehicles in northern Sweden in 1980–1989. Those investigators noted that more victims in single-vehicle accidents than in multiple-vehicle crashes had the following characteristics: male, younger age, higher blood alcohol concentration, and usually not restrained. It was also observed that the single-vehicle crashes occurred more often in May–October, on Friday to Sunday, and from 9 p.m to 6 a.m. The results of that study confirm that alcohol is one of the most important factors associated with traffic fatalities, particularly in single-vehicle crashes. Öström and Eriksson also found that the passengers were sober more often than the drivers, although many more passengers in single-vehicle than in multiple-vehicle crashes were inebriated.

Thus a possible scenario is as follows: a crash involving a vehicle whose occupants are leaving a party, perhaps in a rural area, and both the driver and the passengers are under the influence of alcohol, and the driver is speeding. How can we handle such a scenario? Some countries, for example the United States (some states), New Zealand, and Canada, have graduated licensing systems (GLSs) that impose various restrictions (Engström et al., 2003), such as not allowing driving to be done at specific times of the day or night or with passengers in the vehicle (at least not too many). These restrictions have been found to have positive effects on the crash involvement of young novice drivers (Begg et al., 2001). This could be one way of both dealing with and preventing the proposed scenario.

Another approach could be to make young drivers more aware of these kinds of situations and teach them how to handle such problems through the use of various types of information campaigns. This has been done in Norway in a project called Speak Out, the aim of which was to encourage passengers to let the young driver know if they felt unsafe and did not want to ride in the vehicle (Amundsen et al., 1999). The results of that endeavor showed that crash injuries and fatalities among adolescent passengers were reduced by 30%. Unfortunately, the

rate of deaths and injuries was not lowered for the young drivers and thus it was concluded that the campaign did not diminish unsafe driving because the young passengers simply took other means of transportation. Perhaps some other approach should be applied in future campaigns, or it might be best to use completely different methods.

A third way to teach novice drivers and their passengers to handle the above-mentioned scenario could be through education. The GDE matrix (Hatakka et al., 2002) is a framework for defining goals of driver education, and it divides the skills needed for being a safe driver into four levels. The lower levels cover the actual driving task, and the upper levels define aspects of life in general and motives that people bring into their role as a driver. The influence of passengers is related to the upper levels, which concern the goals and context of driving and the goals in life and skills needed to live. In these levels, the drivers use proficiencies associated with risk situations to plan a trip and to determine how that task will be affected by their own thoughts and actions. It is to a significant extent a question of becoming aware of how passengers, peer pressure, and social norms influence the choices related to driving and risk taking. Driver education on the upper levels of the GDE matrix is difficult and depends largely on who the learner is. Individualized education is necessary, because each license aspirant must learn how to make self assessments and draw conclusions about his/her own behavior. To achieve that objective further knowledge is needed about the qualitative aspects of passenger influence. How does peer pressure on young male drivers and passengers actually work? Very little is known in that context, and thus it is highly important to focus additional research on that subject. What really happens inside a vehicle driven by young males with passengers? What do the peers say, and how does the driver react?

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PAPER III

Passenger Influence on Young Drivers*

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Abstract

Several studies have analysed the relationship between carrying passengers, speed and accident involvement but few studies have analysed the process behind how young drivers are influenced by passengers whilst driving. This paper reports a quasi-experimental study with an instrumented car equipped with different instruments measuring speed, g-forces, distance ahead etc. Inside the car video cameras and microphones had been installed to record conversations and actions. 12 drivers drove a pre-planned route twice, once with passengers and once without. The results showed that the passengers put drivers under pressure to do different dangerous actions, but in most cases the driver resisted this pressure. The mean values for speed were higher when driving alone than driving with passengers. However, the differences were not significant. Findings are interpreted with reference to the characteristics of the subjects selected for this study.

Introduction

We know that adolescents on their way to adulthood are testing themselves as well as the people around them. The influence from parents decreases and friends become more important. During this period many young people become drivers, and it is a known fact that young drivers are over-represented in accidents. There are several

* Engström, I. (2003). Passenger Influence on Young Drivers. In L. Dorn (Ed.) *Driver Behaviour and Training*. (pp. 191-199). Aldershot Hants: Ashgate.

explanations for this over-representation of which one is the influence of passengers on the driver. The influence of passengers on young drivers is particularly important to study since they more often have passengers in the car than older drivers. According to a Finnish study (Laapotti, Keskinen, Hatakka and Katila, 1998) older drivers have passengers in 50 per cent of their driving time while young drivers have passengers in 61 per cent of the time. Young male drivers have passengers in the car more often than young female drivers. Young male drivers have passengers in 64 per cent of their driving time while young female drivers have passengers in 59 per cent of the time. The most common passengers for older drivers are family members while young drivers it is usually friends at the same age. About 90 per cent of young American men say that they are influenced by passengers in the car. The level of influence varies but most of them say that they drive differently when alone compared to having passengers in the car (Rolls and Ingham, 1992). FARS (1997) has shown that the negative effect for young drivers of having friends at the same age as passengers is the higher risk of being involved in an accident. Several studies have analysed the relationship between carrying passengers, speed and accident involvement but few studies have analysed the process involved in passenger influence. An important question is what kind of influence friends have on young driver behaviour? What happens when friends get into the car together and what will that mean for the driver behaviour?

Young drivers and passengers

Earlier studies of passenger influence show three different types of results. The first group of results show that drivers drive more slowly with passengers in the car than when they are alone in the car. According to a study of Wasielewski (1984) there is a significant difference if the driver is alone or having passengers present. On a road with a speed limit of 72 km/h drivers with passengers drove on average 71.9 km/h while drivers without passengers drove at 73.9 km/h, which exceeded the speed limit. It was shown in a study of Baxter, Campbell, Huyser, Manstead, Reason and Stradling (1989) that if a passenger was present there were fewer transgression of the law. The risk of being involved in an accident was lower with a

passenger present in the car than without (Miksa, 1991). Interpretations of the results are that drivers drive more slowly with passengers in the car than without, and can feel more responsible when having passengers. They will make the drive as comfortable as possible, or the driver is so focused on the passengers that they forget to make fast progress (Baxter *et al*, 1989).

The second group of results points in the opposite direction, namely that drivers with passengers have a higher risk of being involved in an accident than those without (FARS, 1997; Krüger, 1989). According to Doherty, Andrey and MacGregor (1998) the risk of involvement in an accident is higher with two or more passengers than with just one passenger. A reason why young drivers drive in a more dangerous way with passengers present could be that they feel a pressure from the others in the car to drive in a special way. They are forced to drive faster than they can cope with (Rolls et al., 1992).

The third and last group of results shows that the effect of having passengers present depends on several different things like the age of the driver and passengers, who the passenger is, when during the day or night the trip occurs etc. When the young drivers themselves answer the question about how they drive with passengers they say that if the passenger is a parent they drive more slowly than if the passenger is a friend (Ingham, 1991a; Rolls *et al,* 1992). The reason why they drive more slowly with a parent is that they want to show them that they can manage the situation and that they therefore will not be worried when they drive on their own. Besides, it is probably easier to borrow the car if you show that you can drive in a mature way. On the other hand, they drive more erratically and with excessive speed with friends in the car because they feel that it is expected of them. The atmosphere in the car is such that this behaviour will make you one of the gang. Drivers who can resist pressure from the peers are probably safe young drivers who generally commit less dangerous behaviours (Rolls *et al.,* 1992).

Those results are confirmed by another study (Aldridge, Himmler, Aultman-Hall and Stamatiadis, 1999) which shows that young drivers drive more safely with an adult or a child in the car than with a friend of the same age. In the latter case the young driver causes more accidents compared to having a parent or a child as passenger. This could indicate that there is peer pressure taking place since single vehicle accidents are more common amongst young drivers than

multiple vehicle accidents due to excessive speed. On the other hand if there is an adult or a child in the car there are fewer accidents, even fewer then if the young drivers drive by themselves. This could be due to a sense of responsibility when children are present.

Proportionally the youngest drivers (16 to 19 years of age) cause the most accidents when passengers are present, particularly when the passengers are friends of the same age. This is valid for all days of the week and for all times during the day and night. However, most accidents with passengers for this age group happen during nights and particularly during nights at weekends (Doherty et al., 1998). This shows that it depends on the situation when the accident occurs. The question is what happens in the car with friends at the night? What is said and what is done? Is the driver put under pressure to behave in specific ways? If this is the case, how is this done?

The aim of the study is to investigate the social interactions that occur in the car with a group of young drivers and how these interactions influence driving behaviour.

Method

Several different methods have been used for studying passenger effect. There have been accident analysis, interviews, surveys, observations from the roadside and followings of cars with passengers. These studies have had the aim of analysing driver behaviour, but there is little knowledge of what is happening inside the car. What is the driver and passengers talking about? What are they doing and how do they experience the situation? To satisfy this lack of knowledge an observation study has been performed from inside the car.

This is a quasi-experimental study using an instrumented Volvo 850. The car was equipped with different instruments measuring speed, g-forces, distance ahead etc. Moreover, inside the car video cameras and microphones were installed to record conversations and actions. Since all measuring equipment was hidden, the driver and passengers were not aware that they were being recorded during the test. They were, however, informed immediately after the test and asked whether they would like their data deleted. All drivers accepted that the data could be retained and analysed.

The subjects were all young men since they more often than young women have passengers in the car. They also have a higher risk of an accident than young women do. All the young men in the study were 20-22 years of age and knew each other well since they had done military service together for the last 10-12 months. They participated in the experiment in groups of four, one driver and three passengers. There were a total of 12 groups in the study which means that all in all 60 people participated in the study. Twelve drivers drove a pre-planned route with the instrumented car. Each driver did this twice, once with passengers in the car and once without passengers. Half of the drivers started out to drive on their own and half of them started out with passengers in the car. The route distance were 65 km and included different types of traffic environments such as urban traffic, rural traffic and motorways.

Before the experiment started, the test subjects were given written and oral instructions on what they were supposed to do. The drivers' instructions asked that they drive like they normally do and to answer some questions about the experience of driving alone and with passengers in the car after the drive is completed. The passengers' instructions were that they should sit in the car as a passenger and to answer some questions about the experience of the situation as a passenger after the drive was completed. After the test subjects were given the instructions and a map that showed the pre-planned route. After they had studied the map, the experimenter went trough the procedure so there would be no misunderstandings.

Results

Speed

The mean values for speed are shown in Table 18.1. The results are divided in the conditions driving alone and driving with passengers and also in the three different traffic environments; urban traffic, rural traffic and motorways.

Table 18.1
The mean values for speed divided in driving alone and driving with passengers and in different traffic environments

Traffic Environment	Alone	Group
Urban traffic	54.3	53.1
Rural traffic	84.3	82.4
Motorways	112.1	109.4

The results show that the mean values for speed were higher when driving alone than driving with passengers (group) in all three traffic environments. This shows that the subjects drove faster when alone compared when passengers were present. However, the differences were not significant.

Interaction inside the car

Analysis for events inside the car can be divided into seven categories. These categories are presented below:

- Problem solving - how the participators solved the task to move forward. How they understood the map and negotiated the route.
- Wrong decisions - how often the participators made wrong decisions and drove the wrong way and what gave rise to this wrong decision.
- The experimental situation – concerning all conversations relating to the experiment. For example if and how they were being recorded, what was said in the instructions etc.
- Physical activity – someone in the car moved and whether this disturbed the driver.
- Intended route departure – the participators made the decision to drive in another way than was given in the instructions.
- Comments to or from the driver about driving – comments from someone in the car, even the driver, about how to drive.

- Other – all conversation that did not fit into the other categories.

Comments about driving performance have been chosen for further analysis as they are aimed at the driver and how he should behave. For the 12 groups, 71 such driving comments were recorded. These comments were either about pushing the driver to do different things or it was aimed to get the driver to calm down. The comments could be divided into three groups: to egg on, to mock and to calm down. The first two categories are about pushing the driver, and the last one is about getting him to calm down. More detailed definition of these terms is presented below.

- To egg on – someone in the car pushes the driver to do different thing such as drive too fast and sometimes even do actions that are dangerous such as overtaking another car on the wrong side.
- To mock – the same content as when egging on the driver but in these situations someone tries to get the driver to do dangerous actions through ridicule and making fun of the driver.
- To calm down – has the opposite meaning to the other two. Here someone in the car thinks that the driver is already driving without caution and tries to get him to calm down.

These three types of driving comments existed in three types of driving situations. These situations were when overtaking, when driving faster and when testing the car. More precisely it was comments about overtaking; driving faster or slower and whether to test the car in different ways. These driving comments are made from some of the passengers but it also from the driver himself. In Table 18.2 it can be seen how these comments are divided into the different situations.

Table 18.2
Driving comments from the passengers

Driving comments	Comments from passengers	Driving reaction from driver	No driving reaction from driver
To egg on			
- overtake	6	2	4
- drive fast	24	8	16
- test the car	8	2	6
To mock			
- overtake	2	1	1
- drive fast	12		12
- test the car			
To calm down			
- overtake			
- drive fast	5	1	4
- test the car			

As can be seen in the table the most common behaviour is to egg on the driver in different ways. This is especially common in situations where it comes to driving faster but it is only in 1/3 of the cases that the driver does as the passengers want him to do. In most of the cases the driver resists the pressure. Examples of driving comments where the driver was egged on was: *"Step on the gas, step on the gas. Press the gas for heaven sake"*. When it comes to getting the driver to drive faster by mocking him, the results showed no such effect. Not once did the driver react as the passenger wanted him to react. An example of driving comment where the driver was mocked was: *"Let's press the gas now. You can drive 110 here. For heaven sake what is that smell. It smells burnt. You drive as an old woman, ha, ha"*.

The driver can also make comments on his own driving which can be seen in Table 18.3. The driver's own comments are mostly about egging himself on in situations where he wants to go faster and when he wants to test the car. As can be seen there are driving reactions on these comments in every case but one. Examples of driving comment from the driver himself are: *"Yes, now we are going to leave the*

motorway. Now you will see a real skid in the curve before the round-about". It is only once that the driver does not follow up his own comment by acting the way he says he would.

Table 18.3
Driving comments from the driver self

Driving comments	Comments from the driver himself	Driving reaction from driver	No driving reaction from driver
To egg on			
- overtake	1	1	
- drive fast	6	5	1
- test the car	5	5	
To mock			
- overtake			
- drive fast			
- test the car			
To calm down			
- overtake			
- drive fast	2	2	
- test the car			

Discussion

The results from this study showed that young men drive more slowly with friends in the car than they do when they are alone. Interpretation of these results could be discussed with reference to Andersson (1987) and Schultze Larsen (1994). Adolescents are strongly influenced by their friends. It is important to behave as everybody else in the group to show that one is a part of the group. However, there is no specific age where this effect is stronger than in another age in adolescence. One explanation for these results could be that the subjects for this study have passed the age where the influence of friends is as its strongest. They are 20-22 years of age and may not be that concerned about what their friends think and do. Another explanation could be that these

passengers are not the primary influencing group for the drivers. Even though they are all in military service together for a long period of time and got to know each other they may not be a reference group for how to behave as a driver. Moreover, as military service will soon be completed, the influence of this group will decrease.

As can be seen in the results the drivers are exposed to a quite strong pressure from the others in the car to drive in different dangerous ways. In most of the cases they resist this pressure. There are several reasons why some drivers felt able to resist group pressure. The results should be interpreted as due to self-confidence, consciousness of own responsibility and a competent individual that knows how he wants to drive a car. Support for this explanation would be that the driver resists the group pressure even though he does not get any support from anyone else in the car. The most important people to the driver are possibly people that are outside this group. These people's opinions about how to drive may be more important. Perhaps these people represent what is appropriate in terms of driving behaviour. This type of interpretation is supported by several studies (e.g. Baron, Kerr and Miller, 1992; Hare, Blumberg, Davies and Kent, 1996 and Napier and Gershenfeld, 1999).

It seems that drivers thought it more important to be able to demonstrate safe driving behaviour to the experimenter than to fulfil the passengers' wishes to act in a dangerous way. The possible sanctions from the experimenter may have been stronger than the ones from the passengers. It would have been more embarrassing to answer to the experimenter if anything had happened, than answering to their friends.

Conclusions

To sum up it could be said that drivers resisted group pressure to drive in a more dangerous way and they drove more calmly with passengers in the car than without. The data and the comments will be analysed further in order to gain an even better understanding of the communication process in the car.

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PAPER IV

Group dynamics and cohesiveness among young drivers and their passengers[*]

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Abstract

The objective of this investigation was to analyse the relationship between group cohesiveness and performance among young drivers and their passengers. Furthermore, interactions in the vehicle were studied to classify the scope of interventions that might change driving performance. The relationship between within-vehicle interactions, cohesiveness, and driver behaviour was also investigated, and that was achieved by practical driving exercises performed by twelve young male drivers in a specially instrumented car in real traffic and with passengers. The exercises were recorded using cameras and microphones hidden in the vehicle, and the driving behaviour was measured by different instruments. The drivers also answered a cohesiveness questionnaire. The results show that high cohesiveness led to safer driving and fewer negative interactions in the vehicle. Also, the group interactions exerted both positive and negative pressure aimed at changing the actions of the drivers.

Introduction

In everyday life, we are all members of different groups, such as families, school classes, employee units, and football teams. Some of these groups are more important to us than others, and some of them

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have a greater impact on our behaviour. They can be permanent (e.g., families), or they can be temporary (e.g., taking part in a demonstration). The processes that occur within a group can be perceived by individual members as positive or negative, which in turn will obviously affect the performance of the group.

One type of temporary group exists in traffic when a driver has passengers in the vehicle, a situation that has been found to have different effects on the crash risks for drivers of different ages. It has been observed that passengers have a positive (protective) influence on older and middle-aged drivers, seen as a lower crash risk in the presence of passengers as compared to driving alone (Doherty et al., 1998; Preusser et al., 1998; Williams, 2001, 2003). However, the passenger effect on young drivers is ambiguous: some studies showing a negative impact (Doherty et al., 1998; Chen et al., 2000; Williams, 2001; Lam et al., 2003) and others indicating a positive effect (Vollrath et al., 2002; Rueda-Domingo et al., 2004; Engström et al., 2007). Such results suggest that different kinds of group processes occur among young drivers and their passengers, which in some cases leads to good performance (safe driving) and at other times adverse performance (unsafe driving). According to Williams (2007), there are a number of examples of positive and negative passenger behaviour. The positive actions can include keeping the driver alert, helping with navigation, warning for hazards, trying to prevent risky driving, operating the radio, and even taking over the driving if necessary. Examples of negative behaviour are when passengers distract the driver, encourage risk taking, instigate showing off, or interfere physically with control of the wheel. Whether the actions in the vehicle and the resulting performance (driving) will be positive or negative may depend on various factors, such as the number and identity (age and sex) of the passengers. It is known that the crash risk rises with an increasing number of passengers (Doherty et al., 1998; Preusser et al., 1998; Williams, 2001, 2003), especially if they are same-age peers (Aldridge et al., 1999; Lam et al., 2003) and male (Chen et al., 2000). On the other hand, the crash risk is lowered with an adult (parent) or child as passengers (Aldridge et al., 1999). It can also be assumed that the driving situation will be influenced by how well the driver and the passengers know each other, how they feel about each other, and how they perceive their roles as driver and passengers. This leads to the

rather unexplored question of how the cohesiveness of the driver-passenger group affects the driving performance.

Cohesiveness and performance

A number of studies have shown that group performance is affected to varying extents by the phenomenon of cohesiveness, which can be regarded as the "cement" that keeps a group together (Mullen and Copper, 1994; Dyaram et al., 2005). Thus it is no doubt important to consider cohesiveness when studying the effects of passengers in a vehicle. Festinger (1950) was among the first to describe the concept of cohesiveness, referring to it as follows (p. 274): "the resultant of all the forces acting on members to remain in the group [, and that] these forces may depend on the attractiveness or unattractiveness of either the prestige of the group, members in the group, or the activities in which the group engages." This and other definitions have led to extensive focus on the degree to which group members are attracted to each other and how much they want to be part of the group (Dyaram et al., 2005). Traditionally, this has been measured by asking group members how attracted they are to each other and how much they want to stay in their groups (Hogg, 1992). Accordingly, too much interest has been placed on the individuals in a group rather than on the group as a whole. It has also been shown that interpersonal attraction is not an adequate measure of cohesiveness, and therefore it might be appropriate to expand the definition to include commitment to the task (Zaccoro, 1991; Zaccoro and Lowe, 1988). In other words, the concept of attraction does not refer solely to feelings towards other group members, it also comprises the goal and tasks of the group and thus the group as such. Attraction to the goal, or task cohesion, may be a reason for wanting to be in the group and might suffice to create group cohesiveness (Murdrack et al., 1989).

There is a debate about whether the most important factor for group performance is social cohesion or task cohesion. Langfred (1998) has implied that both are needed, whereas Mullen and Copper (1994) mean that task cohesion is a stronger and better determinant of performance. There are also results indicating that task cohesion is more clearly related to work performance than interpersonal cohesion is (Mullen and Copper, 1994; Zaccoro, 1991; Zaccoro and Lowe,

1988), which suggests that work-group performance is more efficiently predicted by task cohesion than by social cohesion and individual attraction to the group (Carless and DePaola, 2000). Mullen and Copper (1994) have concluded that in groups that perform well, the members do not necessarily like each other and may not be proud of the group, but they are committed to successfully conducting their mission, and they regulate their behaviour to achieve that goal.

The association between cohesion and performance is also affected by factors such as group size, the nature of the task to be performed, group norms (Dyaram et al., 2005), and whether or not the assemblage is indeed a real group (Mullen and Copper, 1994). Studying both artificial and real groups, Mullen and Copper (1994) found that the latter had a stronger effect on the relation between cohesiveness and performance, and they also noted that smaller groups had a greater impact than larger groups. The nature of the task to be performed by a group is significant as well. Tasks that require more interaction, coordination, and communication among the group members have a greater influence on the relationship between cohesion and performance compared to tasks with few of the mentioned characteristics (Zaccoro et al., 1986; Gully et al., 1995). According to Guzzo and Shea (1992), there are three ways in which the task is important in determining the effectiveness of the group: it is a source of motivation for individual members; it affects the connection between member interaction and effectiveness; it influences the relationships between the members with regard to the task (i.e., the task-related interactions). This means that if the members share a commitment to the task, they (the group) will be more effective. Considering norms, it has been shown that groups with high cohesion and high task norms perform better than those that have high cohesion but low task norms and the former more widely enforce observance of the norms. There is much pressure to conform to the norms in groups with high cohesion, and that situation can be looked upon as being more interpersonal since the members try to please each other and avoid confrontations, which is usually done at the cost of task productivity (Janis, 1972). If the group is too cohesive, there is risk for groupthink. The more cohesive a group is the more pressure there is to follow the norms. This is not enough though to get groupthink but cohesiveness is a strong antecedent to groupthink (Mullen and Brian, 1994).

The studies cited above focused on various assemblages such as groups of employees, sports teams, and therapy groups (Dyaram et al., 2005; Carless and DePaola, 2000; Mullen and Copper, 1994; Zaccoro, 1991; Zaccoro and Lowe, 1988). No investigations of this type have focused on the driver-passenger group in private vehicles and therefore both interesting and important information could be gained by studying passengers to scrutinize the group processes that may evolve, and also to examine how cohesiveness affects the performance of the driver.. The traffic safety work should lead to reduce crashes and therefore it is important to better understand the group processes that may lead to unsafe driving behaviour and how cohesiveness may affect these situations.

The aim of the study

The present study had three main objectives. First of all, work was done to analyse the relationship between group cohesiveness and performance (safe or unsafe driving) among young drivers and their passengers. Secondly, the interactions that occur between young drivers and their passengers within vehicles were studied to determine and classify the scope of interventions that might change performance in terms of safe or unsafe driving. The third aim was to explore the relationship between patterns of within-vehicle interactions, cohesiveness and driver behaviour.

Methods

Practical driving exercises

Practical driving exercises were carried out in a specially instrumented car in real traffic by twelve young male drivers aged 20–22 years. They drove a pre-planned 65-km route that comprised all types of traffic environments in urban and rural areas and on motorways. They drove the route twice, once alone and once with three friends in the vehicle; half of the drivers started alone and the other half with passengers. Thus the study included a total of 48 participants. The members of each group (i.e., a driver and three passengers) had

become well acquainted while doing military service together over the previous 10–12 months.

Before the test subjects started driving, they were given information about what they were supposed to do, and they also answered a questionnaire about how they usually drove a car. The instructions they received indicated that they should drive the way they normally did, and that after driving the test route twice they would be asked to complete three questionnaires: one about how they drove the route, one about how they experienced driving with passengers in the car, and a third about how they felt in the group (cohesiveness) (Rosander, 2003). The passengers were told to act as they normally did when riding in a vehicle driven by someone else, and after the driving they also answered a questionnaire about how they felt in the group (cohesiveness) and another one about how they experienced being a passenger. Since this study focused on the effect of cohesiveness, only data from this questionnaires are presented here.

The actions of all twelve groups were recorded using video cameras and microphones that were hidden in the vehicle. The participants did not know about the recording until immediately after the driving, when they were informed and asked whether they could accept the data being retained and analysed. All of the participating drivers and passengers agreed to allow use of the data. The procedure was in line with established ethical principles.

The questionnaire

Several different questionnaires about group cohesiveness have been developed and used (Stokes, 1983; Widmeyer, Brawley and Carron, 1985; Evans and Jarvis, 1986), but many of them focus on specific processes in certain types of groups, for example sports teams (Widmeyer et al., 1985). Even if several items on those instruments are fairly general in nature, some are confusing for people who are not members of the particular type of group under consideration. Therefore, the questionnaire chosen for use in the present study was the GCQ developed by Rosander for assessment of group cohesiveness, which comprises the following ten items that cover aspects of both interpersonal attraction (social cohesion) and commitment to task (task cohesion):

1. Most people in the group are congruent with my perception of how a good group member should be (task).
2. If it were possible to change to another group, I would do so without hesitating (social).
3. All members don't take responsibility for our collective goal—some try to avoid our work (task).
4. I feel that the other members let me participate fully in the group's activities (social).
5. Everyone in the group shares responsibility so that the tasks can be done as well as possible (task).
6. I don't really care what happens to the group, as long as it doesn't affect my own situation (social).
7. I like being in the group (social).
8. If I were asked to join another group similar to this one, I would prefer that other members of my present group did not also choose to move to the same new group (social).
9. I don't feel like I'm a part of the group's activities (social).
10. Within the group, we agree on what is important for us — to perform our work as well as possible (task).

The participants rated their agreement with each statement on a scale of 1 to 5, where 1 stood for complete disagreement and five for complete agreement. Analysis of internal consistency using Cronbach's alpha (α) indicated a high overall reliability (α = .819) and fairly high reliability for the factors task cohesion (α = .759) and social cohesion (α = .708).

Definition of driving behaviour

Different variables can be used to measure safe or unsafe driver behaviour, most often various aspects of vehicle speed, for example average speed (Woolridge and Fitzpatrick, 2000; Boyce and Geller, 2001) or variation in speed (Steyvers and Waard, 2000; Nolén and Nyberg, 2001). Other variables include the following: how the driver uses different controls in the car, like the accelerator and brake pedals (Duncan et al., 1991; Hakamies-Blomqvist et al., 1999); the distance the driver keeps to the vehicle ahead (Duncan et al., 1991; Brackstone et al., 1998); the driver's scanning behaviour, such as where the driver

chooses to look and for how long (Brookhuis et al., 1991; Dingus et al., 1997); lateral positioning of the vehicle on the road (Martens et al., 2000; Steyvers and Waard, 2000). Other types of measurements have determined whether drivers participating in studies have followed a pre-planned route or done things like turn on the radio, use a mobile phone, or make gestures at other road users (Boyce and Geller, 2001; Boyce and Geller, 2002), which have been considered to indicate unsafe driving behaviour because they create inattention. Mental overloading might also lead to unsafe driving behaviour seen as inappropriate reactions in different situations, for example stopping at places that can easily cause an accident (Dingus et al., 1997).

In the present study, unsafe driving behaviour was defined as any of the following: the number of times the young drivers exceeded the speed limit by more than 10 km/h, divergence from the pre-planned route (both intentionally and unintentionally), talking on a mobile phone, or stopping in appropriate places. This measurement strategy gave discernable differences in data on individual drivers.

Quantitative analysis

Pearson's correlation test (Hinkle et al., 1994) was used to analyse the relationships between cohesiveness and driving behaviour exhibited by the participating young drivers and passengers. For each driver-passenger group, the mean values from the cohesiveness questionnaire were compared with each group's number of unsafe driving episodes. The number of times unsafe driving behaviour occurred was determined by analysing the films from the test routes, in all cases considering the number and not the duration of unsafe actions.

Pearson's correlation test was also used to analyse driver-passenger interactions in relation to driving behaviour and also to cohesiveness. In the assessments, driving behaviour and cohesiveness were considered as described above, and the driver-passenger interactions were divided into categories covering different dimensions (see below). All categories in the Pearson's correlation test were assigned to two groups according to whether they were intended to have a positive or a negative effect on driving behaviour.

Qualitative analysis

In the first step in analysing the interactions (group processes) that occurred in the vehicles the grounded theory was accounted for (Glaser & Strauss, 1967). This method is particularly valuable when assessing social occurrences, especially if the objective is to explore human relations and their meaning, as was the aim in the current study. The grounded theory technique has been developed over a number of years and can be used to create categories and conceptions without the need to create a new theory at the end of a study (Strauss & Corbin, 1998). However, the analysis in this study is not to be considered as a grounded theory analyse. A more correct description ought to be a qualitative analysis of content inspired by grounded theory.

As a first step, all the filmed material was analysed and divided into episodes involving or not involving the specific intention of affecting the behaviour of the driver in some way. The episodes that may have had an effect on driving behaviour were subjected to further analysis. Each of those episodes were written down and was described on the basis of what was said and done in the individual situations, and they were subsequently sorted into categories covering two different dimensions. The first dimension concerned source, that is, whether the initiative came from the driver or from the passenger; the second dimension was about whether the intention was to induce risky driving or safer driving. Thereafter, all the categories were labelled according to what they encompassed. Only the passenger categories were used in further analyses.

Results

Cohesiveness and unsafe driving

The results showed a rather high degree of cohesiveness in the twelve driver-passenger groups. The mean values for all groups were as follows: total, 4.38 (max. = 5.00); relation cohesiveness, 4.52; task cohesiveness, 4.16. The average number of unsafe actions was 7.91 for all groups, which means that each group had almost eight risky situations (range one to 20) during the 65-km-long trip.

As indicated in Table 1, the results of the Pearson's correlation test showed that both the total group cohesion and task cohesion showed a significant negative correlation with the number of unsafe actions, whereas no such correlation was found with regard to social cohesion.

Table 1
Correlation between cohesiveness and unsafe actions

Cohesiveness	Pearson's correlation	Significance
Social	–.40	n.s.
Task	–.68	$P < 0.05$
Total	–.61	$P < 0.05$

Thus, the results indicate that a high level of group cohesion, and especially high task cohesion, was associated with a lower number of unsafe driving actions, or, in other words, that driving was performed in a safer way.

The nature of interactive dynamics within the vehicle

Five categories were discerned when considering episodes involving passengers trying to get the driver to change behaviour. Three of the categories concerned attempts to induce unsafe driving behaviour, and the other two categories were primarily about prompting safe driving behaviour (i.e., slowing down and being more careful). In the following section, one example from the present study is given for each of the five categories.

Getting the driver to speed up

A common situation seen in the video films was when the passengers tried to get the driver to speed up simply by saying just that. To provide motivation for driving faster, they said things like they wanted to see how fast the car could go or that they just wanted to drive fast. In the example below, the driver stayed under the speed limit until one of the passengers wanted him to accelerate for no special reason. However, even when the driver had almost reached the speed limit, the passengers were not satisfied and wanted him to drive faster.

"They are driving on a straight stretch of a road that has a speed limit of 70 km/h. The driver is looking at the map when one of the passengers says that he wants the driver to "step on it." The driver complies and increases the speed from 60 to about 70 km/h. There is some small talk in the car for a while, but then again the same passenger says that he thinks they should drive faster. The driver looks a bit surprised but accelerates up to 80–85 km/h."

In this example and in several similar situations the driver accelerated as requested, but the level of the increase in speed depended on the traffic situation. In some cases, the driver refused to drive faster, saying that it was dangerous to speed or that the police would catch them. Thus it seems that such situations involved some sort of explicit or implicit negotiation, although it also appears that a request for greater speed has an impact on young drivers.

Mocking the driver

When the passengers felt that they were not getting their driver to do what they wanted him to, such as speeding up, they could start to mock him as a means of persuasion. One way of ridiculing the driver was to say that other drivers handled their cars very well, and that compared to him they really knew how to drive. Another way was to tell him that he was doing something wrong as soon as he made even the slightest mistake (even if it could not actually be classified as a clear error). This is exemplified by the following observation:

"The passengers have just tried to get the driver to speed up but without success when they enter a roundabout, and the car goes a little bit over a lane line. One of the passengers immediately asks the driver why he crossed a lane line and tells him that it is not right to drive like that. The other passengers agree with the first passenger. The driver merely smiles as an answer. They leave the roundabout, and the driver accelerates to 95 km/h on a road with a speed limit of 90 km/h. One of the passengers leans forward and looks at the speedometer, laughs and says that they are going too fast and that he does not like it. One of the other passengers agrees, whereupon the driver smiles, a bit embarrassed, and slows down to just under 90 km/h."

The drivers often got somewhat embarrassed in situations like this and did not know how to react. They did not know if the passengers were joking with them, or if they really meant what they said, and thus they did not always comply with the passengers' requests. In this category, the passengers seldom succeeded in changing the driver's traffic behaviour, which might be logical, since the passengers adopted the strategy of mocking when a driver did not do what they told him to do. Nonetheless, it is certainly possible that drivers can be disturbed by such passenger interference and hence drives less safely.

Challenging the driver

At the time this study was carried out, the specially instrumented test automobile was quite new, and the drivers and their passengers thought it was a "cool car" and they were excited about driving it. Therefore a very common situation or request among the participants was to test the vehicle with regard to its top speed or rate of acceleration, which often led to unsafe driving behaviour.

"After a request to stop, one of the passengers thinks that they should test the car. The driver then accelerates up to 120 km/h on a road with a speed limit of 90 km/h, and everyone in the car thinks it is "cool." One passenger urges the driver to speed up to 200 km/h and says that if he does he will be his friend for the whole week and they will tell everyone how great he is. The driver just laughs and slows down to the speed limit. Another passenger gets excited and tells them a story about when he drove at a speed of 200 km/h."

In this example, the passengers tried to persuade the driver to keep going too fast by flattering him and saying that if he did he would essentially be their idol for a week, but they did not succeed. Another passenger tried to get the driver to speed up to 200 km/h by telling a story about when he himself drove at that speed, and he wondered if the present driver could match that, but again without success. In this category, the passengers tried to induce the drivers to do different things through challenges, that is, by saying that they themselves were good at the suggested action or that the drivers would be "the best" if they followed the suggestions. The outcome was mixed, in some cases the drivers did what they were asked to do and at other times they did

not. It is obvious that this type of challenge can lead to a higher level of unsafe driving.

Stories told by passengers

Some of the passengers told stories to induce a desired (safe or unsafe) driving behaviour. Instead of telling the driver directly what they preferred, they would give an account of a particular occurrence in an attempt to make the driver understand what they wanted him to do.

"The car enters the motorway and the driver accelerates to 135 km/h (the speed limit is 110 km/h). The driver looks at the passengers to see whether they like it or not, but there are no reactions. Then one of the passengers tells a story about a friend that almost drove off the road when it was foggy. That seems to embarrass the driver, and he says to the passenger next to him that they ought to take it easy so they don't drive off the road. The driver says that they don't have to get themselves killed, and then he slows down to a speed of just over100 km/h."

In this example, the passengers and the driver talked about the dangers of driving too fast and how grave the consequences can be. Without actually saying it in so many words, this discussion implied that it would be sensible to slow down. The driver also understood the point of the story and slowed down. This is an indirect way of asserting the need for safer driving.

Request to take it easy

Sometimes the passengers were more direct in their requests for the driver to take it easy. The comments in this context often concerned speed, although in some cases they suggested that the situation was getting too dangerous.

"The driver enters the motorway and accelerates, and then changes to the passing lane and is about to overtake another car. As he does so, a large truck moves into the passing lane in front of them, and the driver has to put on the brakes. After passing the truck, one of the passengers says that it might be a good idea to take it easy, and then the driver returns the vehicle to the cruising lane and slows down to 90 km/h on a stretch of the motorway where the speed limit is 110 km/h."

In this example, one of the passengers wanted the driver to slow down, probably because he felt that the situation was getting to be too dangerous. The drivers in this category always complied with passengers' requests for safer driving, for instance by slowing down.

In summary, the present analysis disclosed three types of passenger behaviour that may underpin unsafe driving behaviour: inciting the driver to speed up, mocking the driver, and challenging the driver. The data also revealed two types of passenger remarks aimed at safer driving: stories told by passengers and requests to take it easy.

Interactions and unsafe driving behaviour

The relationships between unsafe driving behaviour and the interactions of vehicle occupants were investigated using the previously mentioned definitions of these two variables. The five interaction categories were dichotomized into one group comprising negative interactions intended to elicit less safe driving behaviour (requests to speed up, mocking the driver, and challenging the driver) and another that included positive interactions meant to prompt safer driving behaviour (stories told by passengers and requests to take it easy).

Table 2 shows the results obtained using the Pearson's correlation test to analyse the relationship between interactions in the vehicle and the number of unsafe driving actions. None of the results reached statistical significance.

Table 2
Correlation between the interactions of vehicle occupants and unsafe driving behaviour

Interactions	Pearson's correlation	Significance
Negative	.53	n.s.
Positive	.12	n.s.

The results indicate almost no correlation between positive interactions and unsafe behaviour, as well as a tendency towards an association between negative interactions and unsafe driving.

Interactions and cohesiveness

Pearson's correlation test was also used to analyse associations between cohesiveness and the interactions of vehicle occupants, dividing the five interaction categories into two groups as described above (see section 4.3). As can be seen in Table 3, the results of the analysis were statistically significant for all three aspects of cohesion when considering negative occupant interactions. The negative correlations indicate that the more negative the interaction (i.e., trying to induce unsafe driving actions), the less cohesion there was in the group. This is especially apparent for the aspect of social cohesion, which implies that there was little attraction between members of groups with extensive negative interactions. It seems obvious that a lower degree of cohesiveness among passengers will be associated with unsafe driving behaviour.

Table 3
Correlation between cohesiveness and negative interaction

Cohesiveness	Pearson's correlation	Significance
Social	–.92	$P < 0.01$
Task	–.75	$P < 0.01$
Total	–.89	$P < 0.01$

No statistically significant results were obtained in the correlation between cohesion and the positive interactions of vehicle occupants (Table 4). Nonetheless, the data do indicate that the more positive the interaction (i.e., requesting safer driving), the greater the cohesion experienced by the group members, and this is especially apparent with regard to social cohesion.

Table 4
Correlation between cohesiveness and positive interaction

Cohesiveness	Pearson's correlation	Significance
Social	.364	n.s.
Task	.247	n.s.
Total	.324	n.s.

Discussion

Previous studies have shown that whether the actions in a vehicle and the performance of young drivers (i.e., operation of the vehicle) will be positive or negative depends on factors such as the number and identity of the passengers. The worst cases of unsafe driving entail the presence of passengers that are same-age peers (Aldridge et al., 1999; Lam et al., 2003) and male (Chen et al., 2000), and an increasing number of passengers (Doherty et al., 1998; Preusser et al., 1998; Williams, 2001, 2003). Other investigations have found that a group's performance is also affected by its cohesiveness (Mullen and Copper, 1994; Dyaram et al., 2005), although to varying extents. Therefore, it is interesting that the present results indicate that high cohesiveness leads to safe driving.

The driver-passenger groups in the current study showed high cohesiveness, as indicated by an average score greater than 4 (on a scale of 1 to 5) for all three of the cohesion variables that were measured—total, social, and task cohesion. This means that the group members displayed attraction to each other and to the task at hand (driving a specified route) (Zaccoro, 1991; Zaccoro and Lowe, 1988), although the degree of cohesiveness varied between individual trips.

Considering connections between performance (unsafe driving behaviour) and cohesion, the results indicated that task cohesion showed a significant negative correlation with the number of dangerous situations, whereas no significant relationship was found for social cohesion in that context. A significant negative correlation was also detected between total cohesion and unsafe driving, which agrees with the opinion of Mullen and Copper (1994) implying that task cohesion is a better determinant of performance, especially work performance. No studies thus far have focused on the performance of groups of people in vehicles, and hence it is not known what type of group they represent. Perhaps they could be compared with a working group, so that driving from one point to another would be the task, and it would be good performance if the group made it safely to the destination. The performance of working groups has also been measured in terms of good behaviour, but in the current study performance was considered in relation to unsafe behaviour (i.e., unsuitable performance).

It seems that the drivers and passengers in the present investigation had the same commitment to the task they were given,

which was to travel from one point to another along a given route. Safer driving performance was observed in the groups with high cohesion than in those with lower cohesion. It has been reported that high cohesion is strongly related to group norms (Dyaram et al., 2005), and groups with a high level of cohesion also subject their members to more extensive enforcement of norms. The groups in the present study seemed to have more preferable norms, such as being considerate of other people in traffic and, in particular, feeling that none of the occupants in the vehicle should expose the passengers to unnecessary risks.

Even if the current results show a positive relationship between high cohesiveness and low risk taking, in some situations the passengers did provoke a higher level of unsafe behaviour. This might have occurred because the passengers did not agree with the driver about how the vehicle should be operated. In some cases the passengers obviously perceived the driving as being too slow, and thus they tried different ways of inducing the driver to speed up. Sometimes they succeeded and sometimes they did not. There were also occasions when the passengers wanted the drivers to take it easier, and the drivers were more sensitive to that type of request than to suggestions to drive less safely. This reasoning is probably reflected by the lack of significant correlation found between group interactions and unsafe driving behaviour. Clearly, the drivers did not always conform to the passengers demands.

The results also indicate that cohesiveness was significantly correlated with the negative interactions between the vehicle occupants (i.e., the act of trying to get the driver to operate the vehicle in an unsafe manner). More precisely, all three types of cohesion were negatively correlated with the negative interactions, which means that groups with lower cohesion showed a higher level of negative interplay. This finding agrees with earlier studies of other types of groups in which it was found that unsafe actions were more strongly associated with low than with high group cohesion. The difference between the investigations is that the most important factor was social cohesion in the current study but was instead task cohesion in the work by other researchers. This implies that if in-vehicle group members are not attracted to each other, they will be more inclined to induce the driver to unsafe actions. If there is attraction between the group members and they have the same idea about how to solve their task,

they will be equally disinclined to entice the driver to unsafe performance. The current findings do not indicate any significant correlation between positive interactions in the vehicle and cohesiveness.

In summary, group cohesiveness has an important impact on the development of driving behaviour. High cohesion leads to safer driving and also to a lower level of negative interactions in the vehicle, a finding that may be useful in driver education programs and in graduated licensing systems comprising passenger restrictions. The results also demonstrate that group interactions and passenger-driver dynamics in a vehicle cannot be neglected. Indeed, the old signs in buses and taxis saying "No talking to the driver while the vehicle is in motion" had their purpose. This study has also clearly shown that further exploration of interaction dynamics in vehicles is needed to better elucidate the causal connection between passenger behaviour and the unsafe actions of drivers.

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