EVALUATING THE BALLOON ANALOGUE RISK TASK (BART) AS A PREDICTOR OF RISK TAKING IN ADOLESCENT AND ADULT MALE DRIVERS

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Abstract

Young drivers between the ages of 15 and 24 are overrepresented in automobile crash statistics worldwide. Despite the common assumption that young drivers are more at risk of crashing than older drivers due to inexperience, age appears to be the main factor influencing crash risk, even after experience has been taken into account. It is possible that young drivers are involved in a high number of crashes because of their risk-taking tendencies. Accident involvement is not so much influenced by errors and lapses by the driver, but by the willingness to commit driving violations intentionally. However, studies that attempted to measure the risk-taking tendencies of drivers have so far used mainly self-report questionnaires, which are limited in their ability to predict real-world behaviour. This thesis used a new behavioural measure of risk-taking known as the Balloon Analogue Risk Task (BART). In this task, participants engage in computer simulation where a balloon is pumped in order to accumulate money, but when the balloon is pumped too high it explodes, and the money that could have been gained is lost. A group of 50 male drivers were the participants of this study, and these were separated into three age groups: adolescents, aged 16-17, young adults, aged 20-21, and older adults, aged 25 years and over. In addition to the BART, the participants answered a series of questionnaires that focused on risk-related constructs, such as impulsiveness and subjective risk assessment, as well as driving attitudes and intentions. The expectation was that younger drivers would be shown to have greater risk-taking tendencies than older drivers. The results showed that the BART showed no relationship with either driving attitude scores (apart from a small correlation with attitudes towards close following), or any of

the self-reported measures of risk. The other self-report risk measures, however, showed many correlations with various aspects of driving attitudes and intentions. Over age groups, the level of impulsiveness was found to decrease, and the attitudes became less in favour of taking physical risks. Adolescents were also found to be more approving of using a cell phone while driving, and of overtaking in risky circumstances. They had greater intentions to commit violations in the future, and were more likely to get a thrill from driving. The failure of the BART to reveal any significant findings may have been because so far it has only been shown to correlate with self-reported real-world behaviour, and not so much with attitudes and risk-related constructs. The other suggestion of this thesis was that the BART does not simulate risk-taking in the truest sense because there are no specific negative consequences for risk taking, only the removal of a possible benefit. The finding of greater risk taking in adolescent drivers was discussed in relation to Risk Homeostasis Theory and Problem Behaviour Theory, with a focus on how age-related factors might influence driver risk taking. As further discussed, these age-related factors might include the effect of incomplete brain development, the motives for driving, and the lifestyle of the individual.

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Ethics

Ethical approval for this study was obtained from the Psychology Department's ethics committee of the University of Waikato ethics committee. Each participant signed a consent form and was able to withdraw from the study at any time without penalty. Participants were briefed about the details of the study before giving consent, and were provided with the opportunity to ask questions about the study after they had completed the tasks. They were also given the option of receiving a summary of the study's findings through email once the study was complete. Each participant received a $10 MTA voucher for completing the tasks in this study. First year Psychology students also received course credit for their participation.

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Introduction

General

Driving a motor vehicle is a risk that many people over the world are willing to take on a daily basis. In many cases, such as for those people living in rural areas, owning and driving a motor vehicle is a necessity. Unfortunately, the same tool that is regarded to be a necessity is also the tool that presents one of the greatest risks to our health. According to Evans (1991), there are more pre-retirement years lost through motor vehicle accidents than via any other factor. In the United States, motor vehicle crashes are targeted as a major public health problem. They are the most common cause of death for people under 34 years of age (cited in Jessor, Turbin & Costa, 1997). Young people as a group have consistently been found all over the world to be involved in a disproportionate number of crashes, even though they only make up a small proportion of the driving population (Deery, 1999).

It would appear that the most common reaction to the problem of young drivers is to assume that these accidents occur through a simple lack of experience or vehicle control skills. In other words, we tend to blame the actions of drivers on skill deficits. However, this response is not consistent with the evidence that the risk of crashing is more strongly associated with age factors rather than factors related to experience (MacDonald, 1994a). It does not explain why younger drivers are more at risk of crashing than older drivers, even when the levels of experience are the same.

It is possible that too often we focus on errors, or unintentional mistakes, when studying risky driving behaviour. Perhaps we should be focusing more on the

intentional risky behaviour of drivers, the actions they undertake willingly and presumably with an awareness of the potential risks involved. This is the approach taken by Parker, Reason, Manstead and Stradling (1995), who have devised a self-report driving behaviour questionnaire that specifically distinguishes deliberate violations from errors and lapses. Involvement in accidents tends to be reflected in the self-reported instances of violations, while errors and lapses are not so predictive of accident involvement. Therefore, the tendency to have a motor vehicle accident comes as a result of intentional risky behaviour, rather than poor skills, or 'performance'.

Unfortunately, there are very few methods available to researchers in order to measure the exact 'risk-taking tendencies' of drivers, other than self-reported measures. These self-reported measures rely on the assumption that participants will answer the questions honestly, and the self-reported behaviour will actually be consistent with their driving behaviour in the real world. Likewise, results from driving simulator tasks are also limited in terms of ecological validity, and can never truly reflect driving behaviour outside the laboratory (Horswill & McKenna, 1999).

This study included the use of a promising behavioural measure of risk-taking tendencies, known as the Balloon Analogue Risk Task (BART; Lejuez et al., 2002). The BART is a computer-based task that requires participants to pump up a balloon in order to collect money over several trials. If the balloon is pumped past a certain point, it pops, and participants lose the money they have accumulated on that particular trial. Therefore, the risk-taking tendency of the participant is measured by the average number of pumps they will engage in before choosing to collect the money on each trial.

The aim was to evaluate the BART as a predictor of risk taking in young male drivers. It was hoped that the task would prove to be a much more reliable representation of driver risk taking than simple self-report measures of risk taking and attitudes, which are limited by the level of honesty that each person puts in to their responses. Lejuez et al. (2003) suggested that the BART might be able to tap into a conceptually different aspect of risk taking not covered by other self-report measures of risk-related constructs such as impulsivity and sensation seeking. The BART simulates scenarios in which there are no negative consequences for risky behaviour, only the removal of a potential benefit that could have been gained. Since McKenna and Horswill (2006) have suggested that drivers tend to modify their risk taking based on the perceived benefits, and are less affected by the perceived negative (and much less likely) consequences, then perhaps the BART is the ideal programme to simulate the kind of risk taking that drivers indulge in.

The BART was used along with self-report measures of risk and attitudes to determine if young drivers are more willing to take risks than older drivers, therefore resulting in young people being overrepresented in the road crash statistics. If adolescence is a period typically characterised by increased risk taking, then the risks young drivers take on the road may just be another symptom of the risky adolescent lifestyle. The other question asked was whether all young drivers are responsible for taking risks, or just a minority that accounts for the majority of unsafe driving.

Young drivers

Young people, particularly those among the 15-24 year old age group, are overrepresented in road traffic death and injury statistics. This is a problem that can be found worldwide. This overrepresentation is particularly a concern because young people only make up a small minority of road users. For example, in Canada, people within the 16-24 year old age group constitute only 17% of the population, but account for about a third of all fatalities and traffic-related injuries (data cited in Trimpop & Kirkcaldy, 1997).

MacDonald's (1994a) review of crash statistics from several different countries shows that young drivers between the ages of 18-24 are consistently more at risk of crashing than those over 25. The conclusion was that young drivers have a relatively higher crash risk, both per licensed driver and per distance travelled. Wylie (1996) also reviewed Australian driver fatality statistics from 1991 and suggested that when you take into account that much older drivers are generally more physically frail than their younger equivalents (and therefore more susceptible to fatality due to a car crash), driver crash involvement among those aged 17-20 could be as much as 12.5 times higher than that of drivers aged 45-49. USA statistics from the late 1970s show that per licensed driver, more deaths are associated with 18 year olds than for any other ages – the next highest associations were for 16, 17 and 19 year olds respectively (Karpf & Williams, 1983). Williams (1985) determined that the number of fatal crashes by mileage is highest for 16 year old males.

The characteristics of crashes in which young people are involved are also viewed to be unique in comparison with the crashes that older people are involved in. For example, young people (particularly 15 year olds without a licence) are

more likely to be involved in single-vehicle crashes (Williams, Preusser, Ferguson & Ulmer, 1997). These include incidents where no other parties are specifically involved, such as hitting a stationary obstacle or losing control on a bend. The tendency to strike vehicles from behind in rear-end collisions also seems to be related to the age of the driver. Yan, Radwan and Abdel-Aty (2005) found that the Relative Accident Involvement Ratio (RAIR) for rear-end collisions as the driver of the striking vehicle was particularly high amongst the youngest group and only began to decrease after the age of 26.

Young drivers in New Zealand

In New Zealand also, young drivers are overrepresented in the number of traffic accidents. Unfortunately, New Zealand appears to be one of the more severe examples of this phenomenon. Langley, Wagenaar and Begg (1996) reported that New Zealand has a much greater fatality rate among 15-24 year olds compared with the United States of America (USA), Canada and the United Kingdom (UK).

Information provided by the New Zealand Ministry of Transport suggests that between April 2005 and April 2006, 183 drivers were killed, and 26% of these were between the ages of 15 and 24 (Ministry of Transport, 2006a). In addition to this, 8131 drivers were injured between October 2004 and October 2005, and 32% of these were between the ages of 15 and 24 (Ministry of Transport, 2006a). In other words, this group of young drivers represents over a quarter of all road deaths and almost a third of all road injuries among drivers in New Zealand.

In terms of who is deemed to be at fault in road accidents, drivers in the 15-24 year old group are also clearly overrepresented. Inspection of data provided by the

Ministry of Transport (2006b) suggests that in 2005, 83% of fatal crashes and 79% of serious injury crashes were deemed to be the fault of drivers in the 15-24 year old group. It appears that speed, followed by alcohol, is by far the major contributing factor for young driver crashes. This is generally consistent with the finding that worldwide, the highest proportion of young driver crashes involved 'reckless' driving (MacDonald, 1994a).

In 1987, New Zealand introduced the Graduated Driver Licensing System (GDLS), in order to reduce the high occurrence of young driver crashes. Prior to the introduction of the GDLS, people could apply for a full licence at 15 years of age. Under the graduated system, people are only able to obtain a learner's licence at 15 years of age. At 15 and a half years old, they can obtain a restricted licence, with certain conditions on carrying passengers, driving at night, and drinking alcohol. Then, if the driver participates in a defensive driving course, they may apply for their full driver's licence after one year. Therefore, currently in New Zealand, someone as young as 16 and a half years old can legally drive an automobile with no restrictions or supervision. This is still a very young age compared with other countries. In most European countries the minimum age is at least 17 or 18 years. In New South Wales, Australia, one cannot obtain a full driver's licence until the age of 20. In the USA, laws vary across states, but most states have a minimum age of 16 years.

The purpose of integrating a restricted licence into the process is generally to protect novice drivers from the conditions in which they are most at risk. Primarily these would be the effects of driving with passengers, at night, and/or after drinking. There is certainly much evidence that young drivers are at greater risk of crashing during the nighttime hours, particularly on weekends (MacDonald,

1994a; Ministry of Transport, 2006b; Williams, 1985). In New Zealand, around 50% of fatal crashes on Friday and Saturday nights involve a young driver (Ministry of Transport, 2006b). Data cited by Elander, West and French (1993) showed that the risk of being killed or injured in a crash during the nighttime/early morning hours was two and a half times greater than at any other times of the day. Other data also suggests that 16 year old drivers are found to be carrying the highest average number of passengers during crashes (Karpf & Williams, 1983). Leigh (1999) also reviewed data that suggested that although young drivers may be less likely to drive intoxicated, they are much more vulnerable than older drivers when they do drink and drive.

There is undoubtedly a problem with the compliance and enforcement of the conditions on restricted licences in New Zealand. Harré, Field & Kirkwood (1996) discussed this problem, and found that young males are more likely to break the conditions of the 10pm curfew than young females. Langley, Wagenaar and Begg (1996) determined that the effect of the GDLS on fatal accidents overall has probably been very small. The reduction in crash injuries among 15-19 year olds could be anywhere between 7 and 23 percent, and the authors speculated that this effect could be attributed to an overall reduction in exposure rather than a reduction in exposure to the specific high risk situations targeted by the GDLS. In any case, the relative severity of New Zealand's young driver crash rate compared to other countries certainly shows that additional policies need to be introduced.

Factors affecting the crash risk of drivers

Age versus experience as predictors of driving skill and accident risk

Arguably, most people attribute the high rate of road accidents among young people to a simple lack of experience. Certainly, there is some evidence for this, such as the finding that the crash rate for novice drivers is highest during the first month, and then decreases dramatically during the first seven months (Mayhew, Simpson & Pak, 2003). There is also an argument for this when the effect of anxiety in novice drivers is taken into account, as Näätänen and Summala (1974) suggest. For example, inexperienced drivers may have high anxiety when certain conditions or parties (e.g. passengers, following vehicles) force them into driving at a speed they are not normally comfortable with.

However, there is more evidence to suggest that age may in fact be a more important factor in determining the risk of crashing than experience. Harrington and McBride (1970) found that the frequency of each type of traffic violation decreased with age. Mayhew et al. (2003) determined that during the first few months of driving, 16 year olds are involved in more crashes than recently licensed older drivers are. Yet, the interaction between age and experience in terms of crash risk is not always clear. While Mayhew et al. (2003) found that experience has a relatively greater effect on 16-19 year olds in terms of decreasing crash rates, MacDonald (1994a) concluded that experience tended to have a greater effect on *older* drivers. In addition to this, MacDonald (1994a) also found that for young males, age seems to be the main factor, while for older people and possibly females, experience has a greater effect on crash rates. In support of this, Lajunen and Parker (2001) found that driver anger and aggression in males was

negatively correlated with age, while driver aggression in females was negatively correlated with annual mileage.

Obviously the quantity of experience alone is meaningless unless the actual *quality* of the experience is taken into account. The level of risk that drivers are exposed to during their experience varies; however, as Brown (1982) noted, even when the external conditions are identical, some individuals are simply guilty of creating more opportunities than others for accidents to happen (i.e., through poor hazard detection and recognition). Jonah (1986) suggested that even when we control for the quantity and quality of exposure to risk, young drivers (16-19 years old) still have the greatest risk of accident involvement. The lifetime exposure or experience as a passenger could also have some significant effect on the attitudes of people when they come to learn to drive. Job (1990) noted that repeated exposure as a child passenger might lead to systematic desensitisation of driving as a fear-inducing situation, especially if very few threatening encounters occur during this time.

Despite the common belief that young drivers are involved in a high number of crashes as a result of inexperience and undeveloped driving skills, the majority of evidence suggests that age itself is the main contributing factor to the high rate of accidents.

Gender differences and marital status

The first point regarding gender differences in driving behaviour is that overall there are more male drivers than there are female drivers (Harré, Field & Kirkwood, 1996) and males spend a greater proportion of time driving; however,

it is possible that this gender difference is much smaller among younger groups of drivers (Williams, 1985). These facts would presumably be reasonable explanations for the high rate of male drivers involved in accidents, but findings suggest that their accident involvement goes beyond simple numbers of drivers. When Mayhew et al. (2003) studied young novice drivers over the first few months of driving, they found that males showed a relatively smaller decrease in crash rates over time, compared with female novice drivers.

Males (at least those younger than 55 years of age) have a higher ratio of involvement in rear-end accidents, as the striking vehicle, compared with females (Yan et al., 2005). Indeed, many studies show that males are generally more at risk of crashing than females (see MacDonald, 1994a). In addition, there also seems to be clear differences in the types of violations that each gender is more likely to commit, and in the possible causes for their accidents. Males tend to have a greater number of speeding, equipment, passing, and major (e.g. drink driving) violations compared to females, while females tend to have a greater number of sign and right-of-way violations (Harrington & McBride, 1970). MacDonald (1994a) provided a tentative conclusion that young male drivers are more likely to be involved in crashes due to excessive speed, while young female drivers are more likely to be involved in crashes due to inadequate driving skills.

Harré et al. (1996) questioned young New Zealand drivers and found that males drive faster than females on the open road (speed limit 100km/h), although there was no significant difference on urban roads (speed limit 50km/h). It was also found that males are more likely to have driven after smoking marijuana, and are more likely to have the intention to drive themselves home after drinking at a

social event. Females in fact are more likely to be the passengers in a drunk driver's vehicle.

The effect of marital status on driving behaviour has not been studied extensively. However, Harrington and McBride (1970) drew the conclusion that there is a general tendency for single drivers to have a higher rate of committing traffic violations than married drivers. Female drivers also tend to show a decrease in risky driving after they get married (Jessor, Turbin & Costa, 1997). Findings such as these suggest the way people behave on the road is somewhat reflected by the type of lifestyle they lead.

While young drivers as a group must be treated as having a high risk of crashing, it cannot be denied that it is males who are much more at risk. The variables involved in crashes may not be the same for both male and female drivers, with male drivers more often involved in accident because of intentional risk taking.

Socioeconomic status and lifestyle

Murray (1998) found that the young drivers who are involved in accidents tend to be from a lower socioeconomic status (SES) background, and their school marks are lower than the average of the population. This finding was particularly evident among males. MacDonald (1994b) also concluded that drivers from a low SES background seem to have a higher crash risk than others, along with some other interesting facts relating to car ownership and the age at which a licence was acquired. Among males, car ownership seems to be associated with more driving, more crashes, and poor academic performance. It was also found that males gain

their licence at younger age than females, and that people who have high school grades and highly educated parents tend to acquire their licence at a later age.

It is very likely that the problem with young drivers is not an issue of skills or experience, but rather the lifestyle and motives of young people in general. Hatakka, Keskinen, Gregerson, Glad and Hernetkoski (2002) acknowledge this issue in relation to driver training – too much focus is on vehicle manoeuvring and skills, with little attention given to how goals and risk assessment can improve their safety on the road. The motives that people have for driving can have a great effect on the way that people drive. Näätänen and Summala (1974) explain that motivation can have an effect on perception, expectancy, subjective risk, and desired action. One possible example would be the effect of being in a hurry when it comes to deciding whether to overtake dangerously.

The lifestyle and motives of young drivers may make them more susceptible to road accidents. The danger of driving at night could be attributed to the effect of darkness and reduced visibility. However, as Clarke, Ward and Truman (2005) point out, the danger is probably more related to the motives that young people have for driving at night. These include driving for recreation and pleasure (usually with their peers) which presumably are associated with speeding and other risky driving behaviours. This is in contrast with older drivers who are typically involved in driving connected with getting to work and transporting family members (Hatakka et al., 2002).

Gregeren and Berg (1994) were able to categorise young drivers into six different clusters based on their lifestyle. These included a ‘high-risk’ group that was predominately male, often drinks, and often has extra motives for driving (such as showing off). On the other end of the scale, a ‘low-risk’ group was

predominately female and was particularly characterised by the fact that they seldom drove. There is also a link between risky driving and non-organised activities with friends (Bina, Graziano & Bonino, 2006). It is presumed that adolescents who frequently meet friends with no other purpose than to 'hang out' are more likely to drive for fun, and exhibit risky driving behaviour in order to show off and gain attention from their peers (Bina et al., 2006).

Therefore, when young people are driving cars, the context cannot be assumed to be the same for each individual. Each driver has different motives, and places different priorities on their driving. The effect of skills and experience may be overridden by other influences, such as carrying friends as passengers in their vehicle.

Driving skill and driving safety

The relationship between driving skills and safety skills

As previously mentioned, it has been suggested that driver training tends to put too much focus on vehicle manoeuvring skills and little on the 'higher' levels of driving factors (Hatakka et al., 2002). Sometimes this is not always intentional on the part of the driving instructors. Katila, Keskinen and Hatakka (1996) interviewed students who had recently completed skid-training courses in four different European countries. They found that both students and instructors rated anticipatory skills as more important than manoeuvring skills, but the emphasis on anticipatory skills was much smaller among the students. Therefore, it is not always certain that young drivers will come out of these courses with the ability to anticipate hazardous situations *before* they encounter them.

Currently in New Zealand, the practical test for a full driver's licence puts a great emphasis on displaying hazard detection skills, and not so much on general manoeuvring skills. However, it is possible that drivers show a large bias when they rate their hazard perception skills (Horswill, Waylen & Tofield, 2004). An understanding of the importance of hazard perception skills does not bring any benefit if people have inflated opinions of their own hazard skills. Horswill et al. (2004) stated that one reason for this is that people receive relatively less feedback on their hazard detection skills while driving, compared with driving skills (for example, having difficulty parking).

Skill training itself does not always necessarily make people more capable drivers. Gregersen (1996) demonstrated that skill training tends to have the effect of causing drivers to overestimate their ability. One group in the study was given specific 'skill' training to perform a skid manoeuvre while the other group was merely given 'insight' into their limitations as drivers. Later on, it was found that there was no significant difference in the manoeuvring abilities of the groups, but the 'skill' group tended to overestimate their skills while the 'insight' group did not.

Clarke, Ward and Truman (2005) explained that accident involvement is frequently the result of risk-taking behaviour rather than driving skill deficits. In fact, it could be argued that certain young drivers have better than average driving skills, but their tendency to voluntarily take risks makes them so much more vulnerable. Sümer, Özkan and Lajunen (2006) discovered that there was an asymmetric relationship between driving skills and safety skills. This relationship shows that people who rate their driving skills high but their safety skills low actually have the greatest number of accidents and violations. It appears that high

safety skills are needed to 'buffer' the negative effects of overconfidence in one's driving skills.

How drivers rate their skills

Most people tend to rate their driving skills as superior to the driving skills of the average driver. Delhomme (1991) found that about 60% of drivers consider themselves to be better drivers than others in general. This was particularly evident among 18-22 year olds, which is interesting since this group has the lowest driving experience. Deery (1999) discussed this problem and emphasised the importance of people having accurate perceptions of their own skill, in order to calibrate these perceptions with their actual capabilities on the road. Many other studies have found that drivers rate themselves safer and more skilful than other drivers (DeJoy, 1989; Horswill, Waylen & Tofield, 2004). Interestingly, it seems that regardless of self-ratings of skills, people on average maintain that they commit fewer offences than others do (Delhomme, 1991).

Male drivers are found to be more confident in their skills, compared with females (Job, 1990; McKenna, Stanier & Lewis, 1991). When drivers from different age groups are asked to rate their driving skill in relation to drivers from their own group and drivers from the older/younger group, some intriguing results are found. Young drivers seem to rate their own ability as being similar to older drivers, but rate their ability as being greater than others in their age group (Matthews & Moran, 1986; MacDonald, 1994b). In contrast to this, older drivers acknowledge they have a greater ability than young drivers have, but rate their ability at a similar level to their peers.

Walton and Bathurst (1998) used a unique procedure to determine how people's perception of other drivers' speed relates to their perceptions of their own skill and safety. Drivers who claimed to be safer than the average driver exaggerated the speed of the average driver more so than drivers who did not claim to be safer than the average driver. In addition to this, Walton and McKeown (2001) found that drivers who incorrectly perceive other people to drive faster than themselves were also the most likely to report that speeding advertising slogans are aimed at other people. This would be consistent with Job's (1990) discussion of the effects of both the media and everyday mistakes of others on the confidence of individual drivers. The media immunises the individual from the message because it shows them that *other* drivers are crashing; and each time the individual witnesses the poor driving of others during a trip, the confidence in their own ability is reinforced.

The type of bias that drivers have when comparing their ability with others is argued among different authors. Their judgements may be consistent with the 'positive-self' bias, as in McKenna et al. (1991), based on their evidence that drivers do not actually rate the average driver poorly (they rate them slightly higher than 5 on a scale of 1-10). In other words, drivers are overoptimistic about the quality of their own driving ability. However, Walton and Bathurst (1998) argued that their results tend to favour a 'negative-other' bias, where people are confident because they perceive other drivers as being worse. This bias was confirmed, at least in terms of speed, since an overwhelming majority of drivers claimed to drive slower than the average driver does, and the perception of the average driver's speed was often exaggerated.

How drivers perceive risk and their accident likelihood

In much the same manner that young people overestimated their skill in relation to their peers, they also tend to rate their accident likelihood as being the same as older drivers but much less than people of their own age (Finn & Bragg, 1986; Matthews & Moran, 1986). Interestingly, drivers in general have the opinion that young drivers have the highest accident risk, but the individual young drivers themselves seem to feel they are an exception to this trend (Finn & Bragg, 1986). For example, college students consider their chance of being involved in most types of accidents to be lower than others in their peer group (DeJoy, 1989). Parker, Manstead, Stradling and Reason (1992) suggested that young drivers, particularly males, are more likely than older drivers to view the positive aspects of committing violations. They show less awareness of the negative outcomes and have a poorer ability to resist committing the violations.

The perceived level of *control* that a driver has over a situation seems to have an effect on their perception of risk also. For example, Hammond and Horswill (2002) found that drivers who scored highly on a desire for control scale chose higher speeds and accepted a greater number of gaps during a video task compared with drivers with a low desire for control. People also perceive their accident likelihood to be lower when they are in control of the vehicle compared with when they are a passenger in the same vehicle (McKenna, 1993). This extends to situations where the level of control over the situation is high (e.g., driving too fast) versus low (e.g., slipping on oil). As a passenger, the accident likelihood was generally perceived to be average, but as a driver, they perceived a lower accident likelihood when the level of control was high.

The ‘illusion of control’ is evident among younger drivers in particular. Finn and Bragg (1986) discovered an interesting difference in how young and older drivers rate the danger of various scenarios. Tailgating, or following too closely, was rated significantly more dangerous by older drivers, while younger drivers rated a pedestrian walking suddenly in front of them as significantly more dangerous. The authors argued that young drivers perceive tailgating as safe because it has an underlying dimension of skill and control – since young drivers have inflated opinions of their own skill, they also believe they have a lot of control in this situation. On the other hand, when a pedestrian walks out suddenly there is seemingly no effect of skill and control on the apparent danger of the situation. Older drivers with more experience (and exposure) may rate this situation as less dangerous because these types of events often happen without resulting in an accident.

Studies have pointed to the possibility that young people are aware of the accident likelihood of young drivers in general, but when asked *specific* questions about their own risk, they rate the accident likelihood as much smaller (Finn & Bragg, 1986; Matthews & Moran, 1986). Matthews and Moran (1986) explained that young drivers are made aware of their group’s tendency to have accidents through the media, but when it comes to rating their own accident likelihood, they have very little experiential information to rely upon, and usually overestimate their skill at overcoming certain situations. Put another way, when they can view themselves as being personally in control of the situation, they perceive the risk of crashing as being low; when they view themselves as a ‘statistic’, they perceive the risk as being higher.

People in general tend to have similar perceptions of the both the risk and the prevalence of various accidents (Vanlaar and Yannis, 2006). At the same time, however, they do not necessarily have accurate perceptions of these. Parker et al. (1992) found that people tend to view speeding less negatively than many other violations, and many people are willing to speed to achieve the positive outcomes of doing so. Vanlaar and Yannis (2006) found that people tend to perceive the behaviour of talking on a cell phone whilst driving as being highly prevalent but only carries a low risk, despite evidence of the effect of driving while using a cell phone being equivalent to driving under the influence of alcohol.

Drivers differ in the level of risk they are willing to accept when they are driving. In a recent study, Musselwhite (2006) was able to categorise drivers into four different clusters, based on the type of risks they take (using self-reported behaviour on 30mph roads as an indicator). The clusters consisted of *calculated* risk takers, who take risks when they feel it is safe to do so (for example, when there is little traffic); *unintentional* risk takers, who rarely take intentional risks while driving; *continuous* risk takers, who frequently take deliberate risks; and *reactive* risk takers, who tend to take risks if in a hurry or are perhaps stressed by the actions of other drivers. It is interesting to note that continuous risk takers make up the smallest proportion of drivers, which indicates that risky driving is concentrated among a minority of drivers. Also important to note is that 90% of the continuous risk takers were male. Unfortunately, the age effects could not be studied due to the confounding effect of driving experience in terms of years holding a licence, although the continuous risk takers group were significantly younger than the other three groups.

Evans and Wasielewski (1983) used a photographic technique to determine the characteristics of drivers who follow cars with small headways, as an example of risky driving. It was concluded that these drivers were more likely to be young males, driving alone, looking sideways at the time of the photograph, not wearing a seatbelt, driving relatively newer vehicles, and had more reported accidents and violations. It was suggested that following closely when driving newer vehicles was another symptom of the illusion of control – newer vehicles are potentially more likely to brake successfully if the car in front slows down suddenly.

The motives of drivers seem to be affected strongly by their willingness to take risks. In the study by McKenna and Horswill (2006), drivers who reported a greater willingness to take risks were more likely to take advantage of a speed limit being removed, allow their driving behaviour to be modified by mood and by passengers, drive faster to reduce the journey time, and find driving thrilling. In contrast, less risky drivers were more likely to drive in a manner that was economical, and were more concerned about being involved in an accident. Interestingly, accident concern was the least likely predictor of risky driving. The authors concluded that the negative outcomes of risky driving on a person's health are very rarely encountered in one's lifetime. The benefits of risky driving, however, occur frequently enough to reinforce this behaviour.

Theories of risk taking

There are a number of theories of risk that could be used as models for risky driving behaviour, two of which will be discussed here. The first of these theories suggests that individuals have a target level of risk that they will accept for any

given activity. When the external conditions for the activity change, individuals will modify their behaviour in some way to ensure that this target level of risk is maintained at the same level. The other theory is a more general psychosocial theory that focuses on the evidence that certain adolescents tend to show a wide range of risk taking behaviours, which are equally as likely to include risky driving.

Risk Homeostasis Theory

The theory of risk homeostasis (Wilde, 1982), also known as risk compensation theory, is based on the belief that individuals (and perhaps groups) are capable of maintaining a target level of acceptable risk, which is often at a level greater than zero. Under this theory, people in general do not aim to minimise the risk involved in a certain activity; instead, they behave in a manner that ensures that their level of acceptable risk is maintained at the target level. This means if the risk involved in one activity is reduced through some external means, a person will compensate for this reduced risk by behaving in a more risky fashion. Likewise, when the external conditions increase the risk involved, a person will adjust their behaviour by behaving in a safer manner.

The level of risk that people will accept depends on four factors: 1) the expected benefits of risky behaviour, 2) the expected costs of risky behaviour, 3) the expected benefits of safe behaviour, and 4) the expected costs of safe behaviour. Therefore, the process is very much a case of cost-benefit ratios for choosing either risky or safe behaviour. An individual will maintain a high level

of risk if they perceive the benefits of risky behaviour to outweigh the benefits of safe behaviour, after the perceived costs have been taken into account.

The Risk Homeostasis Theory proposes a very negative prospect for those involved in designing safety measures for activities such as driving. The reason for this is that if people tend to adjust their behaviour to maintain a consistent level of risk, then any improvement in safety features will have diluted benefits because people will compensate for the increased safety by taking greater risks. The majority of the evidence put forward by supporters of the theory generally involves instances where the introduction of some safety intervention has had no noticeable effect on the number or rate of injuries or fatalities associated with the activity.

Wilde (1997) cites several instances where interventions to improve the safety of drivers have failed to have any significant effect. One is the finding that air-bag-equipped cars tend to be driven in a more aggressive manner than cars without air-bags (Peterson, Hoffer & Millner, 1995). Another is that cars outfitted with anti-lock brakes (ABS) are driven faster and closer to the car in front compared with cars without ABS (Fosser, Sageber, & Sætermo, 1996). In both cases, drivers appear to have compensated for the improved safety by driving more recklessly than they would have without the safety features. In the former example, the presence of air-bags probably gives drivers the perception that the expected costs of driving aggressively are now lower than previously – if they hit something then their own risk of injury is relatively small. Because the risk of injury is smaller, an adjustment in behaviour (driving aggressively) is necessary to raise the perceived risk to the target level.

The theory has its fair share of critics, McKenna (1987) among them. One particularly intriguing point that McKenna (1987) makes is that people cannot possibly be maintaining their risk at a constant level, when there is relatively less evidence that people adopt safer behaviours if the external conditions become riskier. He cites evidence that suggests when people are driving in rain, there appears to be little change in braking, and the number of accidents increases. In another example, when some parts of the United States repealed their laws that required motorcyclists to wear helmets, the number of fatalities in those states increased. This indicates that very few motorcyclists had compensated for the increased costs of risky behaviour by driving more safely.

Regardless of these arguments, Risk Homeostasis Theory may still have some relevance to the present issue of determining if, how and why some drivers take more risks than others. This is because the theory suggests that crash risk is actually independent of external factors such as the physical features of the vehicle, the road, the conditions, and the handling skills of the driver. In terms of interventions to reduce crash risk, we need to focus on changing the tendency of drivers to accept high levels of risk, rather than make improvements *around* the driver to reduce the costs of taking risks (such as airbags, etc.)

Describing the accepted level risk in terms of cost-benefit ratios is also helpful to us particularly when approaching the issue of younger drivers taking more risks than older drivers. Of course, it is still doubtful (or at least yet to be proven) whether an individual can actually internally *calculate* a target level of risk for any given activity. However, we can certainly attempt to determine the differences between young and older drivers in terms of what they see as benefits and costs of risky versus safe behaviour. For example, not wearing a seatbelt is a risky

behaviour that young people are likely to perceive differently in terms of benefits and costs. To a teenager, the benefit of not wearing a seatbelt may be peer approval and increased popularity. The difference between a teenager and an adult is that peer approval is a much more powerful reinforcer for a teenager, so much that they may be willing to accept the increased costs involved.

However, if it is a case of studying the individual differences in drivers that make some take more risks than others, than perhaps it would be more appropriate to focus on a theory that is specifically directed at the individual level of personality and behaviour. More importantly, if young drivers are shown all over of the world to take more risks and are involved in a disproportionately large number of crashes, than a suitable theory would be one that focuses on the problem of risk taking amongst adolescents.

Problem Behaviour Theory

According to Problem Behaviour Theory (PBT; Jessor & Jessor, 1977), adolescent risk behaviours are found to be interrelated. Adolescents who engage in one problem behaviour are likely to engage in other problem behaviours as well. If this is the case, then risky driving is simply part of a larger syndrome that is characterised by problem behaviours. Indeed, Jessor (1987) found a relationship between self-reported thrill seeking and risky driving, and also found that the measure of risky driving was related to other individual problem behaviours such as problem drinking and drug use.

The theory acknowledges that adolescents are sometimes willing to engage in risky behaviour to fulfil a variety of purposes. Among these purposes are likely to

be to have fun, to gain approval from peers, or to satisfy their own feelings of inadequacy or failure. PBT suggests that we should not focus on separate types of problem behaviour, but incorporate them into something that represents an overall lifestyle of risk-taking. This notion is consistent with the points mentioned earlier regarding the importance of considering lifestyle when assessing the crash risk of individuals.

Jessor, Turbin and Costa (1997) provided evidence that drivers over time become less risky as they undergo a 'maturing out' process with respect to various adolescent problem behaviours. In fact, the strongest predictor of risky driving was behavioural conventionality, which was measured on scales representing the frequency of engaging in delinquent-type behaviours such as stealing and lying. The scores for risky driving reflected a tendency to violate norms and rules, more so than the impairment of driving through substance use.

There are two advantages that PBT gives us when we attempt to study the problem of younger drivers being overrepresented in road crashes. The first is it acknowledges that the efforts to educate young drivers may never be significantly effective if we do not pay any attention to the psychosocial and behavioural aspects of their lifestyles (Williams, 1993). What is more, we cannot treat young drivers as a homogenous group, because some adolescents will 'mature' out of delinquent tendencies sooner than others, while some perhaps never will at all. Authors of driving studies often refer to the antagonism of the 'young driver problem' versus the 'young problem driver' (see MacDonald, 1994a). The 'young driver problem' is more influenced by skill factors – young drivers are more at risk because they lack experience. On the other hand, the 'young problem driver' is influenced by motivational factors – young drivers are more at risk because

they *take* more risks than others do. PBT is consistent with the latter notion, since it suggests that risky driving is simply another subset of risky behaviours characterised in the adolescent lifestyle.

The other advantage of PBT is that it allows us to consider a different group of risk takers on the road that we have barely discussed – the passengers. Among those young people who are overrepresented in the crash statistics are those who were occupants in the vehicles of another young driver. Certainly, we must admit that it is not just the drivers who are willing to take risks, but also the young people who allow themselves to be passengers, even when the driver is either drunk, breaching the conditions of their licence, or both. This assumption may have some support, according to Beirness and Simpson (1988), who concluded that lifestyle factors tend to have an association with traffic accident involvement, regardless of whether or not the individual is actually the driver of the vehicle.

Therefore, both Risk Homeostasis Theory and Problem Behaviour Theory have some relevance to the issue of risk taking among young drivers. The former acknowledges that young drivers overall maintain a higher target level of risk compared with older drivers, which possibly may be due to young drivers perceiving greater overall benefits for taking risks. The latter acknowledges that driver risk taking is simply another part of a larger syndrome characterised by problem behaviour, and some adolescents are more likely to exhibit this syndrome than others are.

Understanding why adolescents take risks on the road: A case of brain development?

The debate over whether 15 years olds are too young to be in charge of driving a motor vehicle is somewhat confounded by what people's definition of a 'capable' driver is. If it were simply a case of learning the skills necessary to operate a vehicle, then yes, most 15 year olds would be capable of learning to drive a vehicle in terms of starting and stopping safely, indicating, negotiating corners, and other general driving skills. What we are not certain of is whether 15 year olds can use these skills responsibly without supervision. It is becoming more evident that many young drivers lack certain qualities that are necessary to be a 'responsible' driver. These might include patience, having empathy and consideration for other road users, choosing the safest option rather than the most convenient or rewarding option, and being able to adapt their behaviour to suit the changes in conditions.

The absence of these qualities is very likely to be due to the fact that the brain is still developing during adolescence. There is both physiological and behavioural evidence for this, both of which will be discussed here in turn.

Magnetic Resonance Imaging (MRI) has shown scientists that the prefrontal cortex (PFC) of the frontal lobe of the brain is still developing well into our 20s (Weinberger, Elvevag & Giedd, 2005). This area of the brain is associated with impulse control and the ability to plan and make decisions in order to achieve some future goal. These abilities are sometimes referred to as the *executive functions* of the brain. It is often when an individual has suffered some kind of injury to the frontal lobe that we see most clearly the consequences of having a poor executive functioning ability. Weinberger et al. (2005) describe examples

where adults who have suffered frontal lobe damage become extremely impulsive, are unable to achieve goals that require a specific order of steps, and are very inflexible in adapting to changing environmental demands.

The inability to adapt to changing conditions and inhibit prepotent responses (see Williams, Ponesse, Schacher, Logan, & Tannock, 1999) could possibly be shown in the example of young novice drivers at intersections. MacDonald (1994b) describes how young novice drivers are poor at adjusting their driving to the conditions without clear, obvious signals. At an inconspicuous intersection, experienced drivers will adjust their speed to anticipate the obvious potential hazard, even though they have the right of way. Young novice drivers on the other hand will perceive their right of way as the only important factor and will make no such adjustments to their speed. Coincidently, MacDonald (1994b) suggests that novice drivers are actually very good at learning the give-way rules, but they lack the awareness that not all drivers will actually give way to them all the time.

Weinberger et al. (2005) suggest that when adults are choosing the best course of action, they also compare what actually happens with what *might* have happened, and later use that internal information to guide their actions in the future. For adolescents whose executive functions are still developing, the ability to learn from driving experiences is unlikely to be present. In others words, young drivers might not be gaining anything significant from their driving experience. So for example, if a young driver accidentally (or intentionally) performs a dangerous overtaking manoeuvre on a blind stretch of road, do they later consider the consequences that might have happened, or do they only pay attention to the consequence that *did* happen (i.e., passing the other vehicle unharmed)? If this is the case, then there is no incentive to avoid making the same mistakes again.

Dahl (2004) describes adolescence as a period in which individuals begin to show an increase in risk taking, novelty seeking, sensation seeking, and emotional intensity. The need to experience reward becomes a priority, and unfortunately, some adolescents allow their decision making to be heavily influenced by the prospect of immediate gratifying rewards. In terms of driving, perhaps we should be particularly worried that adolescents tend to allow their emotions to regulate their behaviour. McKenna and Horswill (2006) found that drivers who exhibited the most risk taking were also those who had reported that they often allow their driving to be affected by their mood. Dahl (2004) suggests that although most adolescents are capable of making wise decisions under conditions of low arousal and cool emotions, those same adolescents can have a tendency to make poor decisions when experiencing intense emotional arousal. Perhaps we need to look at the number of accidents that occurred shortly after an adolescent had been involved in an argument with their peers, parents, or partner, to gauge fully the effect of emotional arousal on driving behaviour.

Clearly, adolescents have yet to develop many of the qualities that characterise a responsible adult. The term ‘adult’ in fact, is not intended to represent a state of physical development, but a point at which at individual is said to be capable of fulfilling a social role (Dahl, 2004). Perhaps the most significant finding in relation to driving is that the decrease in risky driving among individuals is signalled by the change in behaviour and perceptions that occur when reaching adulthood (Jessor et al., 1997). Once again, this suggests that there is something else, beyond the level of skill and experience, which influences how safely a person drives their vehicle.

Measuring the risk taking tendencies of drivers

The problem of treating young drivers as a homogenous group

To say that *all* young drivers are guilty of exhibiting risky driving behaviour would not be fair. In fact, it is believed that a minority of young drivers account for the majority of risk taking (such as drinking, not wearing a seatbelt, and tailgating), and consequently account for the majority of crashes (Jonah, 1986). However, it is certainly *within* this group that most driver risk taking occurs. As mentioned earlier, Musselwhite (2006) found that the group of continuous risk takers was significantly younger than the other groups of intentional and unintentional risk takers.

The first feature that should be noted is that young males are particularly prominent in the group of risky drivers (for example, see Evans & Wasielewski, 1983). In Brown and Copeman (1975), younger males were found to give significantly lower ratings of seriousness for several traffic violations compared with older females. Young male drivers were described as a deviant subgroup that was insensitive to the social consequences of their behaviour.

There are various factors within the lifestyle of young drivers that cannot be assumed consistent among individuals. MacDonald (1994b) discussed the effects of car ownership, school grades and licensing age on the propensity to be involved in accidents. Another feature mentioned was the effect of having a part time job, which was generally more common among students with low grades and from low SES families. These young people would clearly come under a group of drivers who have more driving exposure through getting to and from their jobs, and arguably may prioritise recreation driving over doing their schoolwork. Gregersen

and Berg (1994) categorised young drivers into groups based on their lifestyle. The variance in accident risk between these groups was significantly large. For example, the high-risk group had an accident risk eight times greater than drivers over the age of 26. The low-risk group, in comparison, was three times more likely to have an accident, and in fact was well below the standard accident risk for their age group. This shows that the accident risk of young drivers is strongly related to the lifestyle they lead.

Ulleberg (2002) conducted a cluster analysis of young drivers based on personality inventory scores, self-reported risky driving, driving anger, and perception of risk. Six possible clusters were interpreted from these. Particularly noteworthy was Cluster 2, profiled as the 'normless' group. This group was clearly the most deviant, with sensation-seeking, low-anxiety, high normlessness (lack of concern with behavioural norms that other people would expect), low altruism and high driving anger. Perhaps not surprisingly, 81% of drivers in this group were male. A particularly worrying result was that this group was the least satisfied with a safe driving campaign that was presented to them, and was most likely to disregard it. The low-risk group, on the other hand, evaluated the campaign more positively and was satisfied with it. This seems to suggest that risky drivers are the least affected by media campaigns that aim to target risky driving, and that relatively less risky drivers tend to pay more attention to them.

Therefore, it is evident that young drivers as a group show a large amount of variance in the level of risk they take while driving (possibly more variance than would be found among older drivers). As a result, when young drivers are studied, they should not be treated as a homogenous group. However, one problem with these findings, and with the present study, is how to put labels on the types of

drivers who are significantly 'high-risk'. In addition, as Gregersen and Berg (1994) discussed, how can this problem be approached when the general and political view is that *everyone* has the *right* to drive?

Comparing risk-related constructs with driving behaviour

Elander, West and French (1993) explained that there is quite a long history of research that attempts to relate psychological characteristics to automobile crash frequency. The emphasis has changed over the last 50 years or so, initially focusing on personality and psychopathology, then focusing on cognitive skills, then more recently, a shift from the low-level, skills-based approach to higher order skills. There has also been a shift from simply trying to identify high-risk drivers to trying to understand the behavioural factors in crashes more generally.

The problem with young drivers as a high-risk group is that the risky driving behaviour of adolescents may simply be one aspect of a general lifestyle characterised by risk-taking (Jonah, 1986). If young people adopt a positive attitude towards taking risks and their everyday behaviour is affected by this attitude, then clearly this risky behaviour will manifest in the way that they drive also. One example of this is the finding that adolescents who are most likely to display risky driving are also engaged most often in other risk-taking behaviours (Bina, Graziano & Bonino, 2006). As Leigh (1999) pointed out, several dimensions govern risk-taking behaviour. There is always the relative perception of positive versus negative consequences, and the acute versus chronic nature of potential harm, among other things. Young male drivers have already been shown

to put more weight on the positive aspects of taking risks when driving (Parker et al, 1992).

One possible indicator of the tendency to exhibit risky driving behaviour could be reflected in a person's score on a risk-related construct. Among some of these risk-related constructs are impulsiveness, sensation seeking, anger/aggression, and disinhibition. These kinds of constructs are generally based on self-reports by the participants. Therefore, it is always possible that an individual will report answers that are inconsistent with what they really believe. One method of overcoming this is to include a Social Desirability Scale (see Lajunen & Summala, 1995). This scale represents the individual's desire to fit in socially, as they answer the questions, rather than their actual intentions or attitudes.

One risk-related construct that is commonly measured with self-reports is the Sensation Seeking Scale (Zuckerman, 1979). Trimpop, Kerr and Kirkcaldy (1999) determined that sensation seeking tends to decrease with age. Males tend to score higher than women on sensation seeking scales (see Dahlen, Martin, Ragan & Kuhlman, 2005), and young males also show more dangerous thought patterns than females of the same age (Harré et al., 1996). Two of the 'high-risk' clusters identified in Ulleberg (2002) were characterised as the sensation-seeking group. In Trimpop and Kirkcaldy (1997), two subscales of sensation seeking – thrill and adventure seeking and disinhibition were significant predictors of driving violations.

Hilakivi et al. (1989) conducted a sixteen-factor personality test to predict the accident involvement of young drivers. Among some of the factors related to high accident involvement were little respect for social demands, impulsiveness, adventurousness, and ignorance of danger signals. Young drivers with a relatively

good accident record tended to be conscientious, careful, self-controlled, and not too trustful (which presumably indicates that they are more likely to anticipate and react to the mistakes of other drivers). Trimpop and Kirkcaldy (1997) found that drivers who displayed significantly fewer violations and accidents were more goal-orientated, less adventurous, and had a higher desire for control.

However, it should be noted that in many cases these personality variables or risk-related constructs are only predictors of driving violations, and not actual accident histories. For example, in Trimpop and Kirkcaldy (1997), the personality variables were less predictive of accident involvement compared with the number of traffic violations. Dahlen et al. (2005) found that none of the variables actually predicted minor or major accidents, yet impulsiveness (for example) aided in the prediction of lifetime violations, risky driving, and the use of a vehicle to express anger. Fortunately, despite the inability to predict accident involvement from psychological variables, the drivers who report having accidents also report significantly more violations than the non-accident drivers (Trimpop & Kirkcaldy, 1997). This could mean that there is a connection between accident involvement and these psychological variables, but the relatively rare occurrence of accidents reduces the chances of any significant findings.

Attitudes and behaviour

The attitudes that drivers have towards driving behaviour and accident risk is one of the key focus points for the present study. Drivers with particular attitudes are more likely to commit driving violations and/or be involved in accidents than other drivers. Assum (1997) determined that drivers who found speeding more

acceptable and who are less considerate of other road users have significantly higher rate of accidents. However, the contribution of attitude to the accident involvement of drivers showed some inconsistency when analysed in terms of age, gender, and annual mileage. Young drivers had a higher risk of accident involvement, even those who tended to have the 'right' attitude towards driving. In contrast, drivers with a higher annual mileage tended to have more 'wrong' attitudes, yet they also had a lower accident risk. It was concluded that the relation between attitudes and accident risk was only maintained when gender was introduced. Specifically, males with the 'wrong' attitude had a significantly higher risk of accidents than males with a more positive attitude. This is consistent with the suggestion by Harré et al. (1996) that although young males are more likely to drive than females, it is their difference (and possibly variance) in attitude that contributes to their high accident risk.

As always, there is a certain reluctance to use self-report questionnaires to measure the driving behaviour of individuals. One cannot always be certain that the opinions people express on a questionnaire will be entirely consistent with the way they behave in the real world. However, many studies have shown that the self-reported attitudes of driving are often reliable predictors of risky driving behaviour in the future. For example, Iversen (2004) concluded that the attitudes measured during an initial survey were predictive of the risky driving behaviour (i.e., number of accidents and violations) measured during a second survey.

The theory that is often used in these studies to explain the relationship between attitudes and behaviour is the theory of planned behaviour (TPB; Ajzen, 1991). TPB suggests that the intention to engage in certain behaviours (such as risky driving) can be predicted based on 1) the person's attitude towards that behaviour,

2) the person's personal norm towards that behaviour, and 3) the perceived behavioural control. So for example, we could speculate that a person is likely to speed in the future if they have a positive attitude towards speeding, they personally believe that speeding is normal or acceptable, and they perceive a high level of control over their speeding.

Thus, there is good reason to include questionnaires relating to attitudes when measuring the risk taking of drivers. The Driver Attitude Questionnaire (DAQ; Parker, Stradling & Manstead, 1996) includes statements relating to speeding, drink-driving, close-following, and dangerous overtaking, with each statement phrased in a manner that is either favourable or unfavourable towards engaging in these behaviours. What results is a driving attitude score, where high values represent a safe approach to driving, and low values represent a positive attitude towards risky driving behaviour.

As previously mentioned, another approach to ensuring the reliability of self-report questionnaires is to use a social desirability scale, such as the Marlowe-Crowne scale (Crowne & Marlowe, 1964). The scale helps determine whether participants are providing answers that are honest and realistic, or are simply responding in a manner that they believe is the most socially desirable, i.e., giving the answers that will gain the most social approval. A participant is deemed to be showing socially desirable responding if too many of their answers reflect socially approved but unrealistic answers (using a true or false scale).

Questionnaires that are related to driving attitudes and behaviour are helpful in measuring the risk taking tendencies of drivers, especially when the occurrence of accidents and convictions is small or absent in a person's driving history. Some authors agree that the attitudes that drivers report can be reliable predictors of the

behaviour they will choose on the road, as long as we are convinced of the honesty in the responses they give to the questions.

Measuring the intent to commit driving violations

A common assumption about drivers (particularly young drivers) who have accidents is that they make mistakes through poor vehicle control skills and a lack of experience. People are often less willing to attribute accidents to the deliberate risky behaviour of drivers – situations where drivers are generally aware of the risks involved, and accepting of those risks. Research suggests that there should be more focus on deliberate risk taking behaviour when looking at the accident involvement of drivers, rather than the tendencies to make driving errors or 'mistakes'.

Reason et al. (1990) devised the Driver Behaviour Questionnaire (DBQ), which includes a range of items that can be categorised as instances of lapses, mistakes, unintended violations, or deliberate violations. A later study by Parker et al. (1995) determined that accident involvement was reflected in the self-reported violation scores, while errors and lapses were not so predictive of accident involvement. This suggests that it is the willingness to commit driving violations (and accept the risks involved), rather than unintentional mistakes, that leads to involvement in accidents. Drivers are more at risk of having accidents if they are willing to accept the risks associated with deliberately committing driving violations. This leads to the question of whether young drivers are more prone to causing accidents because as a group, they either have poor awareness of risks, or an

overall tendency to accept risk in its various forms. This may go against the belief that young drivers are more vulnerable simply because of their inexperience.

A behavioural measure of risk-taking: The Balloon Analogue Risk Task

The ability to measure the risk taking tendencies of drivers is limited mostly to self-report questionnaires. There are very few methods available that allow researchers to observe the actual risk-taking behaviour of participants in a realistic setting. Horswill and McKenna (1999) have devised a video-based technique for measuring risk-taking behaviour that does show some potential. This technique involves the participants watching a range of filmed driving scenarios and indicating how they would respond to each situation. In the case of speeding, for example, a participant will indicate whether they would drive faster or slower (and by how much) than the driver in the scene. McKenna and Horswill (2006) recently used the video-based technique as a measure of risk-taking, along with the Driving Violations questionnaire (Parker et al., 1995), and found that risk measured in this manner appeared to be influenced by the ratings of thrill seeking and self-rated driving skill. However, the video-based technique may possibly be limited to the specific scenarios that it involves. That is, it does not provide a general measure of the overall risk taking tendencies of a participant.

One possible method of measuring behaviourally what level of risk a person will accept is the Balloon Analogue Risk Task (BART) created by Lejuez et al. (2002). The BART measures risk through a computer-based task, in which participants pump up a balloon to accumulate money. Each balloon has a different threshold at which it will explode, and when this does occur, the money

accumulated in that trial is lost. The level of risk that participants take is calculated by the average adjusted number of pumps (for trials in which they did not pop the balloon).

Lejuez et al. (2003a) found that the BART strongly differentiated smokers from nonsmokers, and the BART scores also correlated well with the number of drug classes tried by participants. In addition, the BART was also a much better predictor of risky behaviour than the Bechara Gambling Task (BGT), and was found to be a useful complement to other risk-related constructs such as sensation seeking and impulsivity in determining real-life risk taking. Lejuez et al. (2002) concluded that scores on the BART were correlated with self-reported occurrence of addictive, health and safety risk behaviours (for example, having intercourse without a condom). They also found that BART scores accounted for variance in these behaviours *beyond* that accounted for in demographics and self-report measures of risk-related constructs. It should be noted that males score higher on the BART task, and also engage in more self-reported risk taking behaviours than females (Lejuez et al., 2002; 2003b). An analysis of the effects of age on BART scores has yet to be completed.

Therefore, the BART may be a useful tool for assessing risk behaviour in drivers and relating it to their self-reported risk taking on the road. Dahlen et al. (2005) suggested that the study of driving behaviour would benefit from the increased use of multiple predictors for risky driving. The BART may also have the potential to tap a conceptually different aspect of risk taking than what is provided by measures of self-esteem, sensation seeking and impulsivity (Lejuez et al., 2003b). In the present study, the BART will be used to determine if the level

of risk that drivers are willing to accept on a behavioural task is also reflected in the level of risk they take while driving.

The BART simulates a scenario in which there are no specific negative consequences for risky behaviour, only the loss of a potential benefit that could have been gained (that is, pumping the balloon so much that it pops does not result in a loss of money, but the money that could have been collected on that trial is taken away). According to McKenna and Horswill (2006), the risk taking of drivers is heavily influenced by the positive benefits involved (such as reduced journey time for speeding). Concern over the negative consequences (such as crashing, getting a ticket), however, is less predictive of the risks that drivers will take. With this knowledge, it is possible that the BART is the ideal programme to simulate the kind of risk taking that drivers are involved in. That is, the kind of risk taking that is influenced by the net 'payoff' of positive benefits.

Other possible measures of risk taking

If we were to treat driver risk taking as another subgroup within all other risk-taking behaviours, then it would be wise to include other measures that allow us to assess the attitudes drivers have towards taking a variety of different risks. Llewellyn (2003) designed the Physical Risk Assessment Inventory (PRAI) for his PhD thesis after deciding that there were no appropriate assessments of subjective risk other than sensation seeking scales. The PRAI requires participants to rate the level of physical risk they feel is associated with various activities. The items included in this inventory can be separated into either 'health' or 'sport' factors.

According to Llewellyn (2003), the health risk behaviours are associated with an ‘antisocial’ factor that is identified by a high level of sensation seeking, and high propensities for both physical and social risks. The sport risk behaviours are associated with a ‘venturesomeness’ factor that is associated with high levels of confidence and a high propensity for physical risks. In this case, it would be interesting to see if one or both of these factors can account for variance in driver risk taking.

Another self-report measure of risk acceptance that can be used is the Attitude Towards Risk questionnaire (RISK; Franken, Gibson & Rowland, 1992). This questionnaire contains items that are either related to psychological risks or physical risks. These two factors are also described in the literature as representing either ‘Disregard of social approval’ or ‘Disregard of danger’. In Franken et al.’s (1992) experiment, a negative correlation was found between sensation seeking and attitudes towards risk. People who were high sensation seekers did not perceive their world to be as threatening as low sensation seekers did. This questionnaire would be helpful to determine what an individual’s overall perception of risk is – for example, whether they often think about doing risky things that others would disapprove of, whether they like the feeling that comes with taking risks, or whether they think that taking risks is fun.

The above tools will be included to give more backing to the theory that risky driving is another symptom of an overall attitude towards risk taking. They also allow us to determine how individuals perceive risky driving behaviour, in terms of whether it involves disregarding the physical danger involved, or disregarding socially acceptable norms.

The present study

The main purpose of the present study was to evaluate the effectiveness of the Balloon Analogue Risk Task (BART) as a predictor of risk taking in male drivers. In addition to the BART, other self-report measures of risk were used to determine which tools would be the most reliable predictors of risky driving, and help establish the theory that risky driving is regulated by an overall tendency to accept risks.

The second purpose of this study was to determine whether young drivers as a group are significantly greater risk takers than older drivers. If this were true, then we would expect overall that young drivers would score higher on the BART and the self-report measures of risk, and report less safe attitudes towards driving compared with older drivers. Within this group of young drivers, there was also interest in determining whether there is a relatively uneven distribution of risk taking compared with older groups, with a small minority of young drivers accounting for the majority of high-risk taking.

This study included a sample of male drivers, which consisted of three age groups – adolescents, young adults, and older adults. Male drivers were chosen because they are the target group in terms of risk taking and accident likelihood. This study was part of a larger project that also sought to look at the differences in executive functions over different age groups of male drivers.

Several findings were predicted in this study. The first was that the BART would be a reliable predictor of risk taking tendencies, both in regards to driving and in general. This prediction was based on the findings that show the BART to be a predictor of many other risky behaviours such as smoking. This means that high scores on the BART would be correlated with high levels of risk according to

other risk-related measures, high numbers of violations, intentions to commit violations frequently in the future, and an overall unsafe driving attitude.

The second expectation was there would be a significant difference between the youngest and oldest age groups in terms of driver risk taking and risk taking in general. The youngest group was expected to exhibit higher levels of risk taking on both the BART and the self-report measures, as well as reporting attitudes towards driving that were relatively less safe than older drivers would report.

Thirdly, although young drivers on average would appear to be riskier than older drivers, there was expected to be an uneven or skewed distribution, with a small minority of drivers producing a wide range of high risk taking scores at the higher end of the scale. This expectation was based on the suggestion that a minority of young drivers account for the majority of risk taking. In other words, a minority of young drivers in this sample would be responsible for the extreme levels of risk taking, illustrating the inability to regard young drivers as a homogenous group.

Fourthly, if unsafe driving behaviour is influenced by a general tendency to accept and take risks, then the self-report measures of risk should correlate with the responses individuals give on the driving behaviour and attitude questionnaires. High risk taking as measured by the self-report tools should be reflected in unsafe driving attitudes and a high intention to commit violations in the future. However, a relatively low occurrence of accidents and convictions would make it difficult to correlate any risk-related measures with the actual driving history of individuals.

Finally, driver risk taking would be predicted by the level of driving skill people report themselves to have, and by their tendency to rate driving as a thrill-

seeking activity, while self-reported accident concern and accident likelihood would have less correlation with risk taking on the road. Therefore, drivers who rate themselves as very skilful, and those who find driving thrilling, would be shown to have unsafe driving attitudes and a high intention to commit violations in the future. In addition to this, the majority of drivers, regardless of age and experience, would rate themselves as more skilful than the average driver.

In summary, this study aimed to show that the BART could act as a reliable behavioural measure of driver risk taking, and complement, perhaps even replace, measures that are based on self-reports. The BART, along with self-report measures of risk and attitudes were incorporated to determine whether young drivers as a group have significantly different perceptions of risk compared with older drivers, which may lead to their overrepresentation in road crash statistics.

Method

Participants

A group of 50 males from the Waikato region of New Zealand were recruited as participants for this study. Participants were required to have held a valid full or restricted car driver licence (class 1 or 1R respectively) for more than six months, and to be between the ages of 16-17, 20-21, or 25 years and over. Therefore, participants had to be at least 16 years of age to have held a restricted licence for six months. They also needed to be able to speak and read NCEA Level 1 English, in order to complete the surveys, and the face-to-face tasks that were included as part of another study. The 16-17 year old participants (n=25) were labelled the *adolescent* group, the 20-21 year olds (n=8) the *young adult* group, and the 25 years and older participants (n=17), the *older adult* group.

The 16-17 year old participants were recruited from Hamilton Boys High School, in Hamilton. The school principal and the Board of Trustees were first consulted about the project and they agreed to allow their students to participate in the study. The coordinator of the life skills course at the school allowed the students to participate in the project as part of the driver education component of the course.

Participants from the other age groups were recruited through an advertisement (Appendix A) posted around the University of Waikato and on other public noticeboards. Smaller flyers containing the same information were also posted on cars in the University car park and in letterboxes around Hamilton. People interested in participating contacted the researchers through email and were then sent an information sheet (Appendix B) and a list of times they could come to the

lab to complete the survey. Two $10 MTA voucher were given to each participant to cover the costs of their expenses, the first being given after completing the first part of the project, consisting of the questionnaires and the BART. First year psychology students were also able to receive course credit for their participation.

Materials

For the majority of the sample (38), all of the tasks for this study were carried out in a medium sized computer lab at the University of Waikato. The computers used for this project were Dell Pentiums with 15-inch monitors. These computers were set up so that the survey could be completed online and the BART programme would open up immediately following the survey. All of the data was recorded on a Microsoft Excel spreadsheet that could later be accessed online. A pair of Transonic earphones was plugged into each computer to allow participants to hear the sound on the BART. The other 12 participants completed the tasks in a quiet room at an agreed upon venue. Their questionnaires were presented in paper form, and a Dell Pentium laptop computer was used for the BART.

Participants were first required to answer questions related to demographics (Appendix C). These included age, ethnicity, current partner status (e.g. single, divorced, etc.), the type of drivers licence held (restricted or full car licence), the date at which they obtained their last licence, how many kilometres they drove in a usual week, the number of accidents they have been involved in during the last twelve months and the number of 'near hits' they have experienced in the last months. *Accidents* were described as collisions that occurred on the public roads, while the participants were the driver of the vehicle, irrespective of who was at

fault. *Near Hits* were described as instances when the participant narrowly avoided being in an accident on public roads, while they were the driver of the vehicle, irrespective of who was at fault. The demographics questionnaire also required participants to indicate how many times they had received a conviction or warning for various traffic offences (e.g. speeding, following too close) in the last twelve months. A *conviction* is when the offence has legal consequences resulting in a fine and/or demerit points. A *warning* is when the participant is stopped by the police regarding their driving but no further action is taken.

The *Driving Violations* questionnaire (Appendix D) included 11 items, eight of which were taken from the Driver Behaviour Questionnaire (DBQ; Parker et al., 1995). The final three items were based on the speed questionnaire developed by French, West, Elander and Wilding (1993), but were changed slightly to make the statements relevant to New Zealand roads. Participants were required to indicate how often they would expect to do each of the behaviours in the future, on a 5-point Likert scale, ranging from *hardly ever/0%* to *nearly 100% of the time*. For example, one of the items was how often they would expect to 'exceed the 100 km/h speed limit on the open road'. Both the violations questionnaire (Parker et al., 1995) and the speeding questionnaire (French et al., 1993) have been found to predict accident involvement.

The *accident concern* questionnaire (Appendix E) included four questions related to perceived driving skill, risk taking, and the likelihood of accidents, used by McKenna and Horswill (2006). For the first two questions, participants rated how strongly they agreed or disagreed with the statements. The first statement was, "I sometimes feel worried that I will be involved in an accident", and the second was, "I often get a thrill from driving". Responses were given on a 9-point

scale ranging from 1 *(strongly disagree*) to 9 (*strongly agree*), with the midpoint labelled as *neither agree/disagree*. The third statement was, "How likely are you to be involved in accidents in the future compared with the average driver?" Responses were given on an 11-point scale ranging from 1 (*much less likely*) to 11 (*much more likely*), with the midpoint labelled as *about the same*. The fourth statement was, "How skilful do you think you are compared with the average driver?" Responses were given on an 11-point scale ranging from 1 (*much less skilful*) to 11 (*much more skilful*), with the midpoint labelled as *about the same*. McKenna and Horswill (2006) included questions 1 and 3 as measures of accident concern, while questions 2 and 4 are included as two alternative measures of possible influences on risk taking (i.e., gaining a thrill from driving and rating their driving skill as better than the average driver).

The *Manchester Driver Attitude Questionnaire version A* (Appendix F; DAQ; Parker et al., 1996) included 20 items that focused on the attitudes participants have towards four different types of risky driving behaviour. There were five items each for overtaking (e.g., "It is quite acceptable to take a slight risk when overtaking"), drink-driving (e.g., "Even one drink makes you drive less safely"), close following (e.g., "People stopped by the police for close following are unlucky because lots of people do it"), and speeding (e.g., "Speed limits are often set too low, with the result that many drivers ignore them"). Half of the statements were presented as being in favour of the four types of risky driving behaviour, while the other half were presented as being negative towards them. Responses were given on a 5 point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), with the midpoint labelled as *neither agree or disagree*. Total scores on

the DAQ could range from 20-100, with higher values representing a relatively safe attitude towards driving overall.

The *Driver Risk Taking* questionnaire (DRT; Appendix G), taken from Conner and Lai (2005), was included as an additional driving attitude questionnaire and could also be used to determine whether participants were providing consistent answers to driver attitude questions. It included 24 items: six concerned with overtaking, six with drink-driving, five with close-following, five with speeding, and two items related to using a mobile phone whilst driving (e.g., "It is dangerous to talk on your mobile phone whilst driving"). All of the items were obtained from the A and B versions of the DAQ, with the exception of the two items related to mobile phone use. Responses were given on a 5 point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), with the midpoint labelled as *neither agree or disagree*. Half of the statements were presented as being in favour of risky driving behaviour, while the other 12 statements were negative towards risky driving. Scores on the DRT could range from 24-120.

The *Physical Risk Assessment Inventory* (PRAI; Llewellyn, 2003) asks participants to indicate the level of physical risk that is associated with various activities, such as mountain climbing and smoking marijuana (Appendix H). There were 24 items in this inventory, which participants rated on a 7 point scale ranging from 0 (*no physical risk*) to 6 (*extreme physical risk*). Half of the items were regarded as representing sport-related risks (items 1, 3, 5, 6, 8, 11, 12, 14, 17, 19, 21, and 24), while the other half were regarded as health-related risks (items 2, 4, 7, 9, 10, 13, 15, 16, 18, 20, and 23).

The *Attitudes Towards Risk Questionnaire* (RISK; Appendix I) includes 10 items taken from the questionnaire used by Franken et al. (1992). Participants

answered each item by indicating how much a statement describes them. Half of these questions (numbers 2, 3, 8, 9 and 10) were psychological risks items, such as, “I do not let the fact that something is considered immoral stop me from doing it”. The other half of the questions (numbers 1, 4, 5, 6 and 7) were physical risks items, such as, “I like the feeling that comes with taking physical risks”. Responses were given on a 5 point scale ranging from 1 (*not like me*) to 5 *(like me*).

The *Marlowe Crowne Scale* (Appendix J; Crowne & Marlowe, 1964) was included as a measure of social desirability, to determine whether the participants were answering the questionnaires honestly or if they were basing their answers on what is most socially desirable. The version used in this study (Reynolds, 1982) included 13 statements concerned with personal attitudes and traits, for example, “It is sometimes hard for me to go on with my work if I am not encouraged”. Participants responded to these statements as either being true, or false. A score was obtained from this questionnaire, ranging between 0-13, which represents how much a participant is responding in a socially desirable manner.

The *Barratt Impulsivity Scale* (Appendix K; Barratt, 1985) was included as a measure of impulsivity among participants. This questionnaire included 28 statements, such as, “I plan tasks carefully”, which participants answered by indicating how much the statements described the way they act and think. Responses were given on a four point scale (1-4), with the points labelled as *rarely/never*, *occasionally*, *often*, and *almost always/always*, respectively. A total score (ranging from 28-112) representing impulsivity was obtained from this scale, which could also be separated into attentional, motor, and non-planning components.

The *Balloon Analogue Risk Task* (BART; Lejuez et al., 2002) is a computer-based laboratory task that is designed to measure the risk-taking tendencies of a participant through their behaviour. At the beginning of the task, four items are presented on the computer screen (see Figure 1): a small balloon, a button that may be pressed to pump up the balloon, a reset button labelled *Collect $$$*, and a display labelled *Total Earned*. The participants can click the button to inflate the balloon 1°, and will 'earn' 5¢ for each pump. The money from each pump is accumulated in a temporary bank that is not shown to the participants. At any point the participants may click on the *Collect $$$* button, which transfers the money from the temporary reserve to the *Total Earned*. A slot machine payoff sound plays to confirm this payment. However, each balloon has an individual explosion point, meaning that if the balloon is pumped over its threshold, it will 'pop' (signalled with sound effects), and the money from the temporary reserve is lost.

Each balloon has a threshold of somewhere between 1 and 128 pumps. In other words, on the first pump the probability of popping is 1/128, on the second pump the probability is 1/127, and so on. This process of increasing risk is intended to model real life situations, so that excessive risk often results in diminishing returns, and increasing health and safety threats (Lejuez et al., 2002). In this task, each successive pump increases the amount of money to be lost because of an explosion, while at the same time decreases the relative gain of any additional pump. Theoretically, the average explosion point will be 64 pumps, and the strategy that could earn participants the largest amount of money would be to pump the balloon an average of 64 times on each trial. The result would involve the balloon popping 50% of the time but a maximum payoff of $48.00 in total.

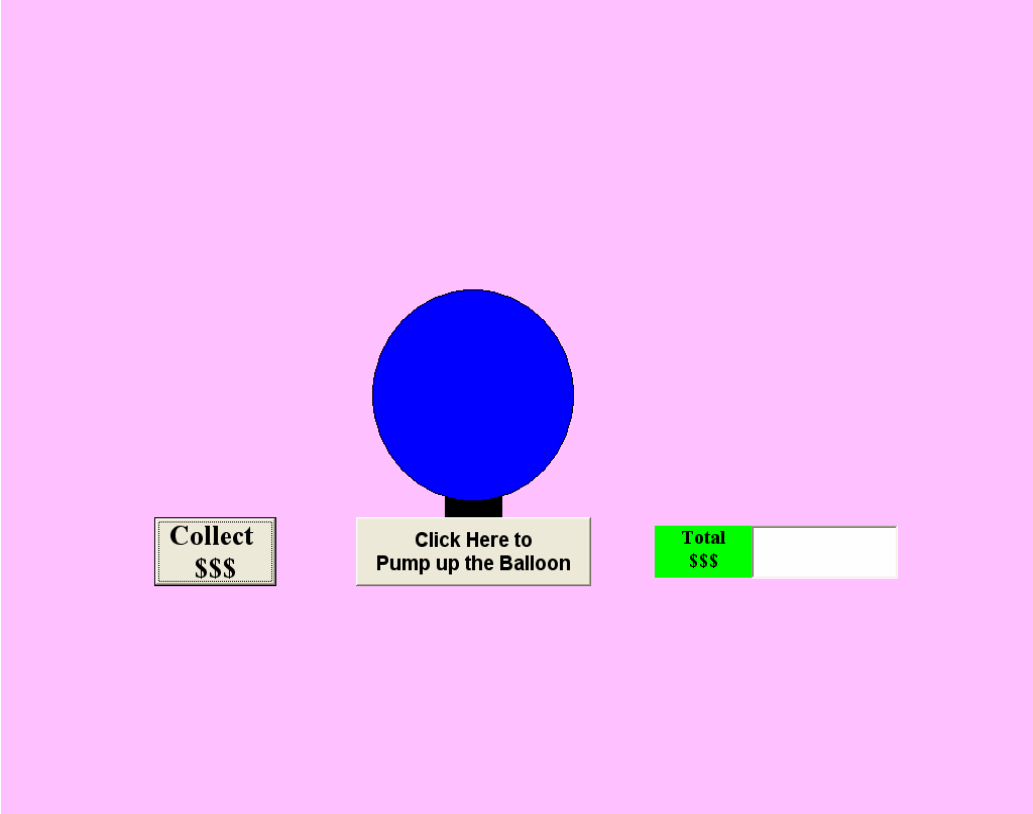

Figure 1. A view of the BART at the beginning of each trial.

Procedure

Upon arriving at the computer lab, participants were assigned a unique subject number to identify them and were invited to be seated at a computer. A consent form (Appendix L) was placed in front of the computers and participants were asked to read and sign the forms (reminding them of their right to withdraw from the study at any time).

Each computer was set up with the first page of the survey already open. There were two versions of the survey, A and B, so that the effects of order could be controlled for. Both versions began with the Demographics and the Driver Risk Taking questionnaires, and finished with the BART. Driving Survey A presented

the other questionnaires in the following order: Driving Violations, Accident Concern, DAQ, PRAI, RISK, Marlowe Crowne Scale, and the Barratt Impulsivity Scale. Driving Survey B presented those questionnaires in the reverse order. Participants who were assigned an odd subject number completed the A survey while those with an even subject number completed the B survey. The only exception was subject number 20 who actually ended up completing the A survey.

Appendix M contains the information that was provided to the participants once they were seated at a computer. At the conclusion of the survey, the BART programme opened immediately and participants were presented with information about the task on the computer screen (see Appendix M). Following these instructions, a summary of the main points was then presented to remind participants of what was required of them for the BART. At the completion of the BART, participants were provided with a $10 MTA voucher, and their participation in the present study was complete.

Data analysis and statistical consideration

First, it was decided that the terms ‘convictions’ and ‘warnings’ in the demographics questionnaire should be viewed as equivalent, because they are only distinguishable by the action that the police officer took at the time (i.e., giving a ticket or just a warning). In other words, they are both instances where a driver was caught violating. Therefore, convictions and warnings were combined into a single variable called *violations*. The only exception was for parking offences, which was excluded because a police officer is not involved, and mainly because it is the only offence that does not involve some element of risk taking.

The number of near hits in the last 12 months was excluded from the analysis because it was too subjective and could not be assumed a reliable variable for this sample. A case in point is one participant reported 700 near hits in the last 12 months, while the next highest number was 50 near hits. Different drivers clearly have different perceptions of what constitutes a near hit.

The responses to the number of kilometres driven in a typical week were also excluded from the analysis because there was much doubt about whether individuals could reliably estimate their weekly mileage.

The participants' scores for each of the items (reverse scored where appropriate) on the DRT and DAQ questionnaires were summed to obtain general attitude scores, with higher scores reflecting more disapproving attitudes towards violations, therefore a safer driving attitude. In addition to the total scores on these questionnaires, separate scores were also obtained for the individual components, or sub-scales. These were the components for dangerous overtaking, close following, drink-driving, speeding, and cell phone use.

The scores on responses for each of the items (reverse scored where appropriate) on the Barratt Impulsivity Scale questionnaire were summed to obtain general impulsivity scores, with higher scores reflecting greater levels of self-reported impulsivity. The questionnaire scores were also broken up into three separate components, known as *attentional*, *motor* and *non-planning*.

Mean scores were calculated for the Driving Violations questionnaire, the PRAI Sport and Health components, and the physical and psychological components of the RISK questionnaire. High mean scores on the Driving Violations questionnaire represent a high intention to commit driving violations in the future. High scores for the PRAI components indicate that participants

associated many activities with a high level of physical risk. High scores on the RISK components represent attitudes in agreement with risk taking.

Results from the BART yielded three variables: the average adjusted number of pumps, the total money earned, and the number of trials in which a balloon exploded. The average adjusted number of pumps represents the average number of pumps excluding trials where the balloon exploded (that is, the average number of pumps on each balloon prior to money collection). High scores on any of these variables were expected to represent a high tendency for risk-taking.

Data was first transcribed on a Microsoft Excel 2003 spreadsheet, and then transferred to an SPSS for Windows (Version 12.0) spreadsheet, through which all of the data was analysed. One-way ANOVAs (or Kruskal-Wallis nonparametric tests, where appropriate) were conducted to determine the effects of age group (adolescents, young adults and older adults) on each of the questionnaire scores and the scores on the BART. The same tests were also done to compare the scores between those participants caught violating in the last 12 months versus those not caught, and those reporting an accident in the last 12 months versus those who had not.

An effort was made to use only parametric data analysis, however, this requires all of the distributions to be normal. In some cases, the data could be transformed by a special logarithm or square root formula, which would make the distributions more normal (see Pallant, 2001). Wherever the results are analysed using non-parametric tests, it should be assumed that one of the distributions could not be normalised to an acceptable level.

In some cases, a one-way ANOVA was believed to be an inappropriate measure for finding significant age differences. Although the three age groups

were treated as independent samples, they are not truly independent because they are defined by the increase in age. This means that a one-way ANOVA may show that the results do not vary significantly between age groups, even though there appears to be a linear trend in the results over age groups. To counter this, a one-way linear contrast analysis was used (see Rosenthal, Rosnow & Rubin, 2000). This analysis puts fixed weights (called *lambda* weights) on the group means; in the case of increasing scores over age, the weights were -1, 0, and +1 for the adolescent, young adult, and older adult groups respectively. A contrast is made between the group means and the predicted lambda weights, with the predictions based on what we would expect to find.

Using a contrast analysis can be a controversial approach, especially as it means there was an expectation that the data would increase or decrease linearly over age groups. Because of this, it was only used for a few cases where the graphs showed a definite linear trend unlikely to be found by a one-way ANOVA.

To test for correlations, a Pearson's Product-Moment Correlation (or Spearman's r_s Correlation, where appropriate) was conducted between each of the dependent variables, excluding the number of accidents.

Results

General

In the following, the results will generally be reported in the order of the expectations laid out in the Introduction. First, the key demographic information from the sample will be presented, which includes the ages, driving experience, ethnicity, accident involvement, and reports of violations. Then the descriptive data from each of the self-report measures and the BART will be reported on, as well as the Cronbach's alpha reliability values that were obtained for each scale with this sample.

Then, the results from the BART will be reported, including the correlations between the BART scores and the self-report measures, and the difference in BART scores between age groups.

The effect of age will then be presented, first by comparing the results from the self-reported measures of risk, then comparing the results from the driving related questionnaires. In addition, the prediction that a minority of adolescents account for the highest levels of risk taking will be considered by looking at the distributions of data within this group.

The next section will focus on the significant correlations found between measures of risk and the driving related questionnaires. The possible relationships between variables will be described briefly.

The focus will then turn to comparing drivers based on their involvement in accidents and being caught committing violations. The sample will be split into groups based on accident and violation involvement, in order to determine if they differ significantly on any of the measures.

Following this, the self-ratings of driving skill compared with the average driver will be compared between age groups and over the whole sample. An analysis will also be conducted to see if drivers who rate themselves better than the average driver score significantly differently on risk measures from those who do not.

Finally, the reliability and consistency of the questionnaires will be reported on, with a particular focus on what effect socially desirable responding may have on attitude related measures.

Driving history of the sample

Table 1 shows the demographics of the sample, including age, driving experience, accident involvement, and violations (being caught violating). The ethnic background of the sample (not shown on Table 1) consisted of 42 New Zealand Europeans, 4 Europeans, 2 Indians, one New Zealand Māori and one Sri Lankan.

Table 1.

Driving history of the sample, including the number in each age group, the mean ages, mean driving experience in months, the number of participants involved in an accident in the last 12 months, and the number caught with a violation in the last 12 months.

	Age Group			
	Adolescents	Young Adults	Older Adults	Total
n	25	8	17	50
Mean (SD) Age in Years	16.7 (0.5)	20.6 (0.5)	37.2 (8.5)	24.3 (10.6)
Mean (SD) Experience in Months	15.6 (4.6)	48.0 (16.8)	246.8 (129.0)	99.4 (130.5)
Number (%) in Accident	5 (20%)	2 (25%)	5 (29%)	12 (24%)
Number (%) Violators	9 (36%)	4 (50%)	7 (41%)	20 (40%)

The distribution of ages for the adolescent and young adult groups was very even, as can be seen from the mean ages shown in Table 1. The older adult group, as expected, showed more variation in age. The ages in this group ranged from 25 to 53 years old, with a mean age of 37.2 years.

Because the demographic questionnaire required participants to indicate when they had received their most recent driver's licence, there was the potential problem of underestimating the amount of driving experience a person had. This would occur whenever a participant had only received their full licence fairly recently but had had several years of experience driving with a restricted licence. Therefore, it was decided that the safest approach was to add 12 twelve months to the date that people obtained their full drivers licence, since a restricted licence must be held for at least 12 months before a full licence can be obtained. Some of the older drivers would have obtained their full licence before the Graduated Driver Licensing System had been introduced, but it was decided that this would not have too much effect on the results.

The driving experience of the whole sample ranged from 7 to 480 months. The mean level of driving experience in months for each age group is shown in Table 1. For most cases, the level of experience in months was reflected in the age of the participant, so it was deemed fair to use experience in the correlation analyses as a substitute for age.

The number of violations in the last 12 months ranged from 0-15, though most of the participants reported zero. Table 1 shows the number and percentage of participants in each age group that had been caught with a violation at least once in the last 12 months. Table 1 also shows the number and percentage of participants in each group that had been involved in an accident in the last 12

months. Most participants were accident free, and none of the participants reported more than one accident.

Descriptive data obtained from the measures

The means and standard deviations obtained for each of the driving-related questionnaire measures between age groups are shown in a table in Appendix N, while the results from the Marlowe Crowne scores, the self-report measures of risk, and the BART are shown in Appendix O. These Appendices may be consulted to compare the data from each age group; however, whenever a significant result is reported, the means and standard deviations are also mentioned in the text. They may also be consulted to find descriptions for the dependent variables.

The reliability of each scale is also presented in Appendices N and O, as the Cronbach's alpha value. An alpha value of at least 0.7 is needed to confirm that the scale used is reliable, that is, all of the items are relevant to the construct that is being measured. Not all of the individual components of the driving attitude questionnaires reached the alpha level, but they did when combined to achieve a total driving attitude score. The Cronbach's alpha values show that both the PRAI and RISK measures had internal reliability, along with the Barratt Impulsivity Scale, once the components were combined. The Marlowe Crowne scale, however, appeared to have a low reliability with the sample used in this study.

The correlations between the BART scores and the self-report measures

The scores obtained on the BART did not appear overall to have any correlation with the scores obtained from the self-report measures of risk, or the driving questionnaires. A series of Pearson Product-Moment Correlations revealed that the only significant relationship was a low negative correlation between the total money earned on the BART (*BART$$*) and the *DRTClosefollow* score ($r = -.294$, $p < .05$). This suggests there was a tendency for participants to earn larger amounts of money on the BART when their attitude towards close following was positive (that is, in favour of it). The correlation between the total money earned and the DAQ equivalent measure of close following (*DAQClosefollow*) was similar, but did not reach significance ($r = -.246$, $p > .05$). The only other correlation that could have reached significance was between the total number of explosions (*BARTEx*) and accident concern ($r = -.280$, $p > .05$). Therefore, there may have been a slight tendency for participants who were less worried about being involved in an accident to pop the balloon more often than those who were worried about having accidents.

The differences in BART scores between age groups

The comparisons of the average adjusted number of pumps, the total money earned, and the total number of explosions between age groups are shown in Figures 2, 3 and 4 respectively. All three of the Figures seem to suggest that age group had little influence on any of the BART scores. A Shapiro-Wilk test for normality showed that the distribution of all three scores for the older adult group was not normal, and since no form of data transformation could change this,

nonparametric data analysis was used to compare the BART scores between age groups.

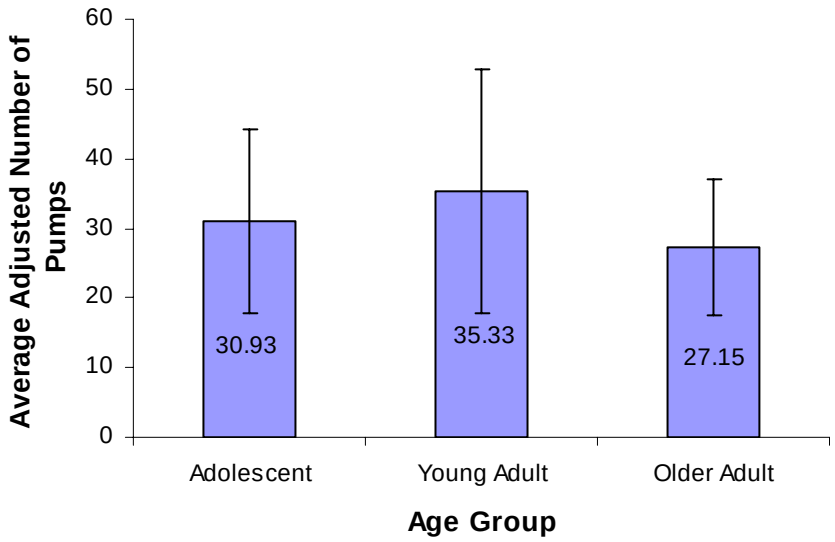

Figure 2. The mean average adjusted number of pumps (average number of pumps on trials where the balloon was not popped) on the BART between the three age groups. The shaded bars show the mean scores and the vertical bars represent the standard deviation from the mean.

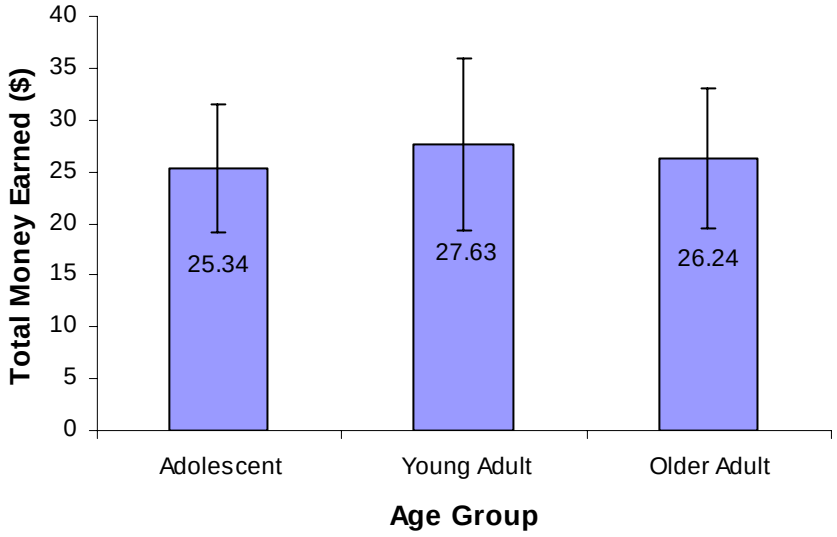

Figure 3. The mean total money earned in dollars on the BART between age groups.

A Kruskal-Wallis test showed that there was no significant difference (p = .512) in the average adjusted number of pumps between the adolescent (median = 31.62, interquartile range (IQR) = 21.18), young adult (median = 34.35, IQR = 31.33) and older adult (median = 23.70, IQR = 27.89) groups.

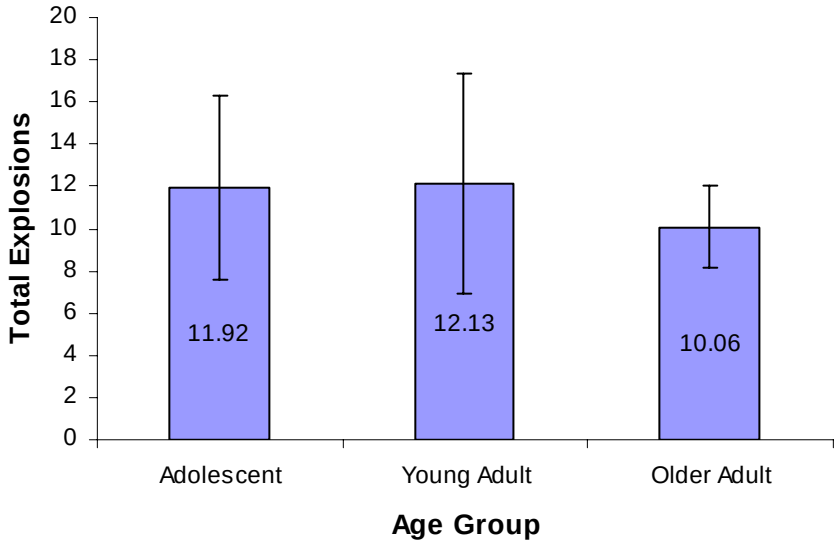

Figure 4. The mean number of trials in which a balloon exploded on the BART between age groups.

A Kruskal-Wallis test found no significant difference (p = .635) in the total money earned between the adolescent (median = 27.50, IQR = 10.12), young adult (median = 29.55, IQR = 12.22) and older adult (median = 23.85, IQR = 14.37) groups. There was also no significant difference (p = .286) in the total number of explosions between the adolescent (median = 11, IQR = 6.5), young adult (median = 11.5, IQR = 9.75) and older adult (median = 10, IQR = 2.5) groups.

A series of Pearson Product-Moment correlations showed that the average adjusted number of pumps was highly correlated with both the total money earned

($r = .814$, $p < .01$) and the total number of explosions ($r = .942$, $p < .01$). The total money earned correlated highly with the total number of explosions ($r = .647$, $p < .01$). This means that all three of the measures are equivalent to each other, and theoretically any one of them could be used as the score representing risk taking on the BART.

These results suggest that age had no effect on the scores achieved on the BART. The level of risk taking as measured by the BART did not appear to be any different between younger and older male drivers.

The effect of age on self-report measures of risk

Two self-report risk measures were found to produce significantly different scores between age groups. These were the Barratt Impulsivity Scale (particularly the attentional component), and the physical risk component of the Attitude Towards Risk (RISK) questionnaire.

Figure 5 shows that the adolescent group (mean = 20.44, SD = 3.87) had a higher mean Barratt Attentional Score (*BISAttention*) than the young adult (mean = 18.88, SD = 2.48) and older adult (mean = 18, SD = 2.74) groups. A Shapiro-Wilk test for normality showed that the distribution for the young adult BISAttention scores was not normal ($p < .05$), so a Kruskal-Wallis test was used. This test showed that the difference in BISAttention scores between age groups was significant ($p = .05$).

Since the most likely difference was between the adolescent and older adult groups, a two-sample independent t-test could be used to compare the two. This test revealed that the difference between these two groups was significant ($t(47) =$

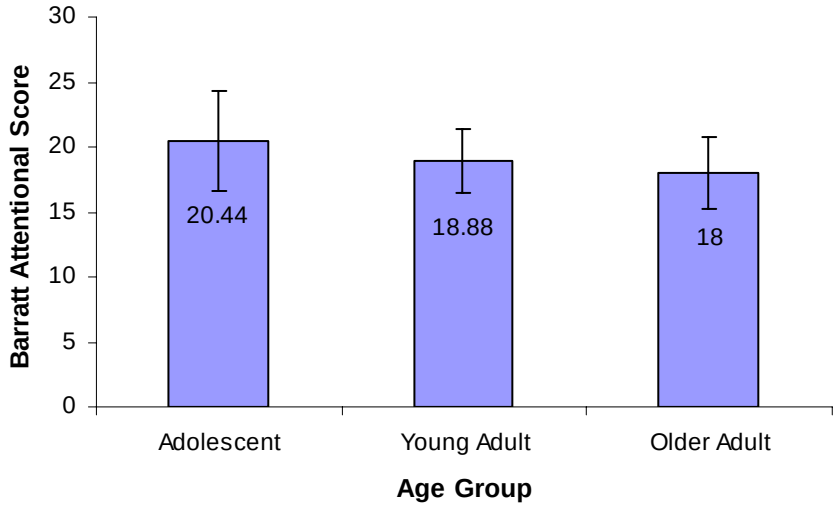

Figure 5. The mean scores on the attentional component of the Barratt Impulsivity Scale between age groups.

2.240, $p < .05$). High scores on this component of the Barratt Impulsivity Scale (BIS) represent a high level of self-reported impulsiveness in situations that demand attention or concentration. Therefore, the adolescent group in this sample was shown to be more impulsive than older adults in this regard.

The total Barratt Impulsivity Scores (*BISTotal*) over age groups are presented in Figure 6. In this case, it appears that the BISTotal score decreases linearly over age groups. A one-way ANOVA showed that the difference between age groups approached significance ($F(2,47) = 2.552$, $p = .089$). However, when a contrast analysis was used to test for a linear pattern, the effect of age group on the BISTotal score was significant ($F(2,47) = 5.022$, $p < .05$). This means there was a linear relationship between age group and impulsivity, with the total impulsivity scores decreasing over the three age groups.

The differences between age groups on the physical component of the Attitude Towards Risk (RISK) questionnaire (*AttPhysical*) are shown in Figure 7. The

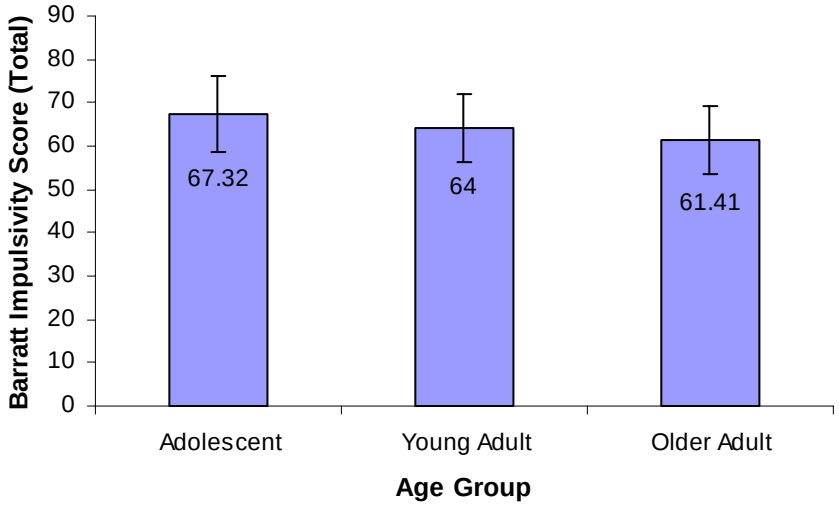

Figure 6. The mean Barratt Impulsivity scores between age groups. Higher scores represent high reported impulsivity overall.

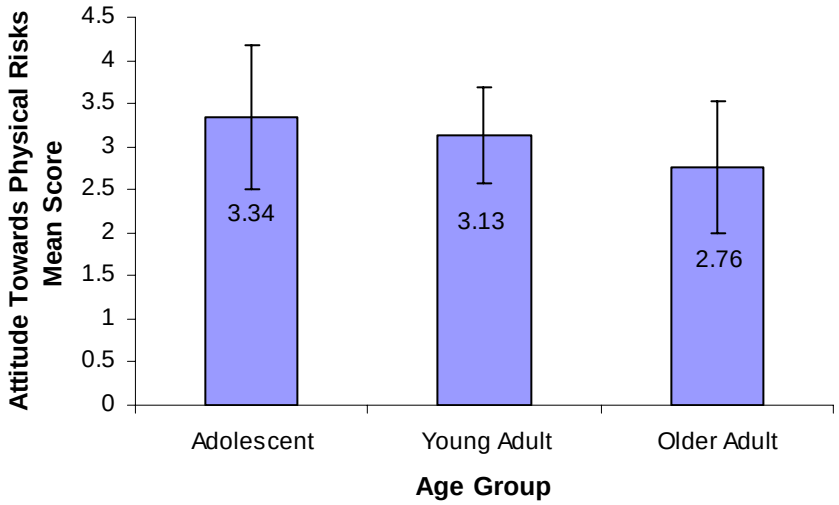

Figure 7. The mean scores on the physical component of the Attitude Towards Risk (RISK) questionnaire between age groups. Higher scores represent a positive attitude towards taking physical risks.

score on this measure appears to decrease over age groups (adolescent M = 3.34, SD = .834; young adult M = 3.13, SD = .55; older adult M = 2.76, SD = .76), with the adolescent group reporting the most positive attitudes towards taking physical risks. A one-way ANOVA showed that the age group difference approached

significance ($F(2, 47) = 2.854$, $p = .068$). Once again, however, a contrast analysis of linearity showed that age group did have an effect on the AttPhysical scores ($F(2,47) = 5.705$, $p < .05$). Therefore, there was a linear relationship between the three age groups and this measure. Because the scale used for this measure was based on whether participants agreed with the risk-related statements, it can be suggested here that the attitudes towards taking physical risks become less positive as one grows older. Since the midpoint of the scale was three, it appears that by older adulthood, people were less likely to say the risk-related statements sounded "like me".

The results from this sample show that impulsivity decreases with age, as does the level of agreement with taking physical risks. Adolescents can be said to be relatively riskier than adults at least in terms of being more impulsive, and having more positive attitudes towards physical risks.

The effect of age on self-reported driving attitudes and intentions

Four of the variables related to driver risk taking and attitudes were shown to be significantly different between the age groups. These were the attitudes towards using a cell phone while driving and the attitudes towards dangerous overtaking (both according to the DRT), the intention to commit driving violations in the future, and the ratings of gaining a thrill from driving.

Figure 8 shows how the age groups differed in their responses to the statements on the DRT related to using a cell phone while driving (*DRTCellPhone*). A Shapiro-Wilk tests for normality revealed that the distribution of DRTCellphone scores for the adolescent group was not normal ($p < .05$). Therefore, to satisfy the

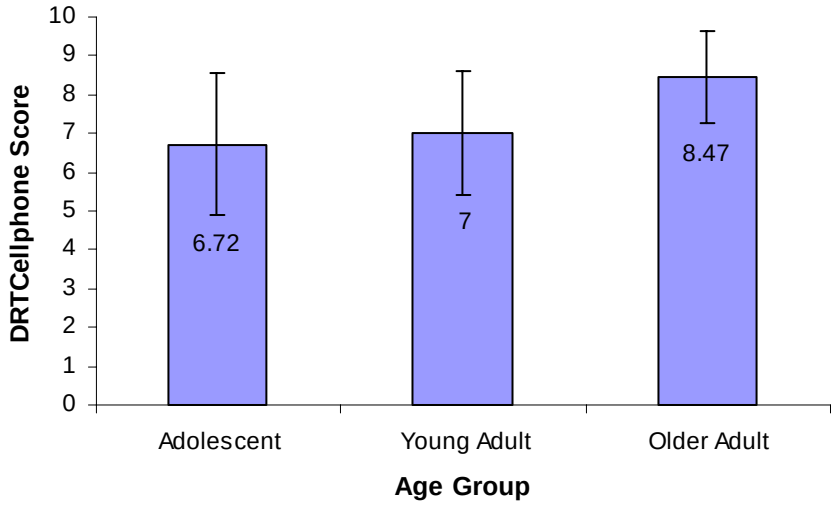

Figure 8. The mean scores on the cell phone use component of the Driver Risk Taking questionnaire between age groups. Higher scores represent less favourable attitudes towards using a cell phone while driving.

test for normality, a 'reflect and square root' formula was applied to the data. A one-way ANOVA showed that the DRTCellPhone scores were significantly different ($F(2,47) = 6.353$, $p = .004$) between at least two of the age groups. Post-hoc comparisons of the means using the Scheffe test showed that the older adult group ($M = 8.47$, $SD = 1.18$) scored significantly higher than the adolescent group ($M = 6.72$, $SD = 1.82$). A one-way contrast analysis was also conducted to see if there was a significant linear effect of age. This test revealed that the DRTCellPhone score did increase in a linear fashion over the three age groups ($F(2,47) = 12.220$, $p = .001$). Therefore, attitudes towards cell phone use while driving became less approving over age.

Figure 9 shows how the age groups differed in their responses to the statements on the DRT related to dangerous overtaking (*DRTOvertake*). A one-way ANOVA showed that the mean DRTOvertake scores were significantly different ($F(2, 47)$

= 4.973, p < .05) between at least two of the age groups. Post-hoc comparisons of the means using the Scheffe test showed that the older adult group (M = 21, SD = 2.52) scored significantly higher than the adolescent (M = 18.64, SD = 3.11) and young adult (M = 17.50, SD = 3.21) groups. Therefore, older adults responded with attitudes less approving of dangerous overtaking than adolescents and young adults, according to the DRT.

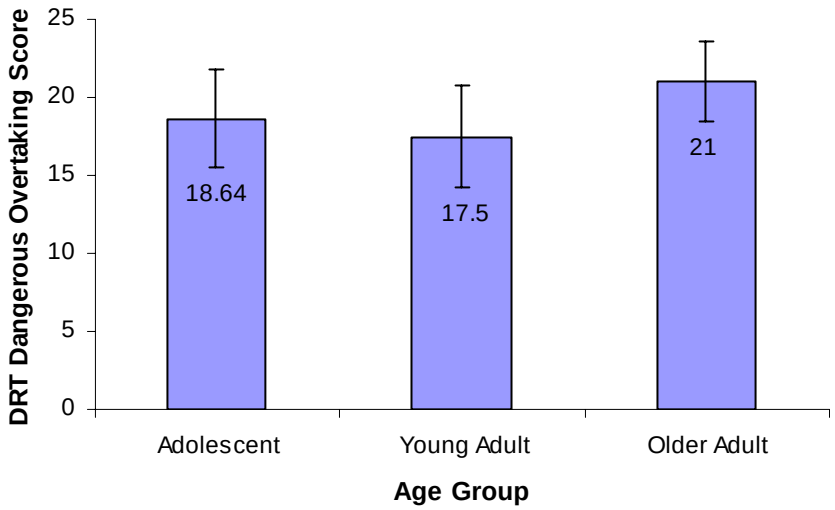

Figure 9. The mean scores on the dangerous overtaking component of the Driver Risk Taking questionnaire between age groups. Higher scores represent less approving, or safer, attitudes towards dangerous overtaking.

Figure 10 shows how the mean scores on the Driving Violations questionnaire differed between age groups. High scores on this questionnaire indicate that drivers intend to commit driving violations frequently in the future. A one-way ANOVA showed that the mean scores were significantly different (F(2, 48) = 3.584, p < .05) between age groups. Post-hoc comparisons of the means using the Scheffe test showed that the adolescent group (M = 1.26, SD = .69) scored significantly higher than the older adult group (M = .80, SD = .47). However, the

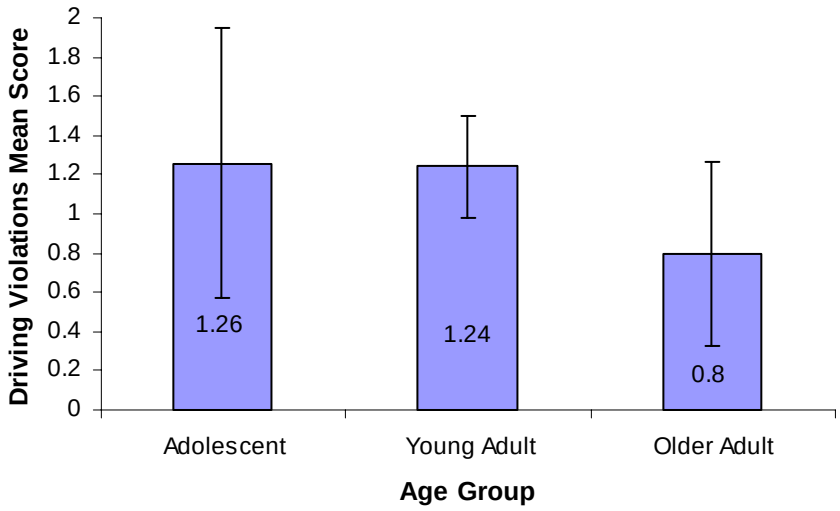

Figure 10. The mean scores on the Driving Violations questionnaire between age groups. These scores reflect how often participants intended to commit driving violations in the future, on a scale from 0-5.

difference between either group and the young adult group (M = 1.24, SD = .26) was not shown to be significant (p = .208). A contrast analysis was not judged to be appropriate since the young adult group scored very similarly to the adolescent group. Therefore, adolescents aged 16-17 years reported that they intended to commit driving violations more frequently in the future compared with older adults aged 25 years and over. According to the labels that were used on the scale for this questionnaire, adolescents technically reported that they would commit violations somewhere between 25-50% of the time, while older adults reported that they would commit violations less than 25% of the time.

The scores produced by the statement, "I often get a thrill from driving" (*Thrill*) for each age group are represented in Figure 11. High scores on this item represent a high level of agreement with the statement, suggesting that driving

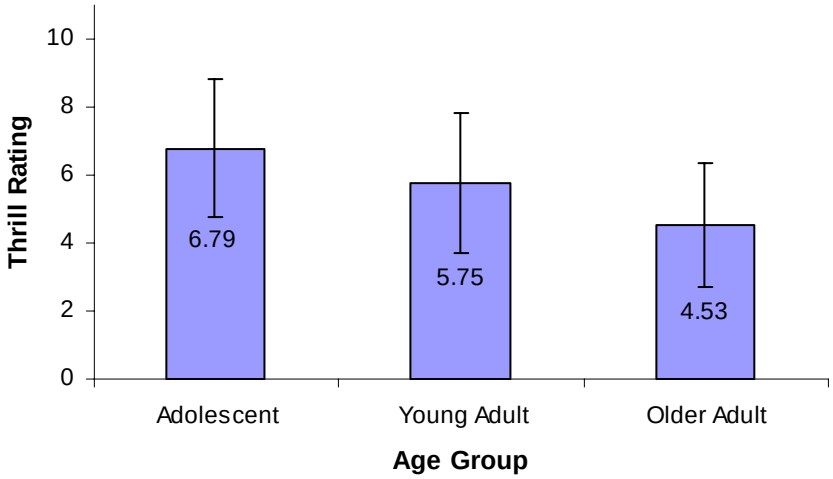

Figure 11. The mean ratings between age groups on the response to the statement, "I often get a thrill from driving." Higher values represent a high level of agreement.

may be used as a form of thrill seeking. Since this measure was based on a rating system, the data was treated as ordinal, so a Kruskal-Wallis test was used. This test showed that the differences in the Thrill scores were significantly different (chi-square (2) = 13.579, $p = .001$) between age groups. A series of Mann-Whitney tests revealed that the adolescents gave significantly higher ratings of thrill than the older adults did ($Z = -3.567$, $p < .001$). It would also appear that the level of thrill associated with driving tends to decrease with age.

On the measures of driver risk taking, older adults were shown to have less approving attitudes towards dangerous overtaking compared with adolescents and young adults. Older adults also reported they intended to commit violations in the future less frequently than the adolescents did. There were also two linear trends found, with the attitudes towards cell phone use and driving becoming less approving with age, and the level of thrill associated with driving also decreasing over age groups.

The distribution of risk taking among adolescents

One of the predictions for this study was that a minority of adolescent drivers would be responsible for the highest levels of risk taking. The best method of testing this prediction in this sample is to look at the skewness of the score distributions obtained from the adolescent group. SPSS for Windows Version 12.0 suggests that a skewness greater than twice the standard error of the skewness statistic indicates that the distribution is not symmetrical. A positive skewness statistic indicates a long right tail, and a negative skewness statistic indicates a long left tail. So if, for example, the relevant measure was how people rated their driving skills compared with the average driver, a positive skew would suggest that there are small number of people who rate themselves as much more skilful than the average driver. On the other hand, there are not a corresponding number of people who consider themselves much less skilful than the average driver.

Table 2 shows the skewness statistics for each of the measures obtained from the adolescent group. The distribution of scores on the Sport component of the PRAI (PRAISport) and the ratings of Thrill were both negatively skewed. That is, in the first case, the majority of the PRAISport scores were clustered around the higher values and a small number of adolescents scored much lower on this measure. The PRAISport score represents the overall level of physical risk that participants associate with various sport-related activities. Therefore, a small number of participants in the adolescent group gave very low very low ratings of physical risk for sport-related activities.

In the second case, the majority of Thrill scores were clustered around the higher values, and a smaller number of adolescents scored much lower on this measure. The Thrill score reflects how much of a thrill a participant gets from

Table 2

Distribution of scores for the adolescent group, including the mean, standard deviation, the skewness and the standard error of the skewness.

	Mean	SD	Skewness	Standard error of
DRTOvertake	18.64	3.11	-.594	.464
DRTDrink	19.40	3.49	-.224	.464
DRTClosefollow	17.24	2.91	-.303	.464
DRTSpeed	14.40	2.93	-.408	.464
DRTCellPhone	6.72	1.82	-.819	.464
DRTTotal	76.40	9.45	.037	.464
DVMean	1.26	.69	.679	.472
AccConcern	4.46	1.69	-.215	.472
Thrill	6.79	2.04	-1.23*	.472
AccLikely	4.88	1.75	-.269	.472
Skill	6.96	2.01	-.463	.472
DAQDrink	16.58	3.50	-.071	.472
DAQClosefollow	17.00	3.72	.410	.472
DAQOvertake	15.00	2.52	.196	.472
DAQSpeed	14.08	3.01	-.255	.472
DAQTotal	62.67	7.23	.516	.472
PRAISport	3.09	.82	-1.36*	.481
PRAIHealth	4.08	1.23	.333	.481
AttPsycho	2.67	.83	-.527	.464
AttPhysical	3.34	.83	-.700	.464
BISAttention	20.44	3.87	-.195	.464
BISMotor	23.20	3.74	.618	.464
BISNon-plan	23.68	3.51	-.346	.464
BISTotal	67.32	8.89	.365	.464
AvAdjPumps	30.93	13.20	.289	.464
BART$$	25.34	6.21	-.623	.464
BARTEx	11.92	4.35	.208	.464

* indicates a significant negative skewness in the distribution

driving. The Thrill ratings were fairly high for the adolescent group, with both the mean (6.79) and the median (7) showing that on average, adolescents agreed that they do get a thrill from driving (the midpoint for this scale was 5). Therefore, the negative skewness suggests that although the majority of adolescents tended to agree or strongly agree that they get a thrill from driving, a small number were much less likely to agree.

Skewness statistics for the other age groups were also considered, and only one was found to be relevant. The distribution of the DRTTotal scores was found to be positively skewed (skewness = 1.138, standard error = .550) for the older adult group. The higher the DRTTotal score, the more positive and safe the overall attitude one has towards driving (according to the DRT). In this case, a small number of older adults had driving attitudes that were much safer than the majority of other older adults.

Another method of determining whether a minority of adolescents represent the highest levels of risk taking is to look at the frequency of adolescents who scored noticeably high on certain risk measures (that is, much higher than the mean for that group, and also high compared with the maximum for any other group). This process was used for both the driving attitude questionnaires and the driving violations questionnaire, since these were the best measures of driver risk taking.

Figure 12 shows the distribution of mean scores on the Driving Violations questionnaire for the adolescent group. It should be noted that there are four (out of 24) adolescents who had a mean score of 2.0 or higher. This is interesting when you take into consideration that the maximum mean score for both the adult groups was 1.55. These adolescent participants, according to the scale used for this measure, reported an overall intention to commit driving violations more than

50% of the time. In comparison, no one in either of the adult groups reported intentions this high.

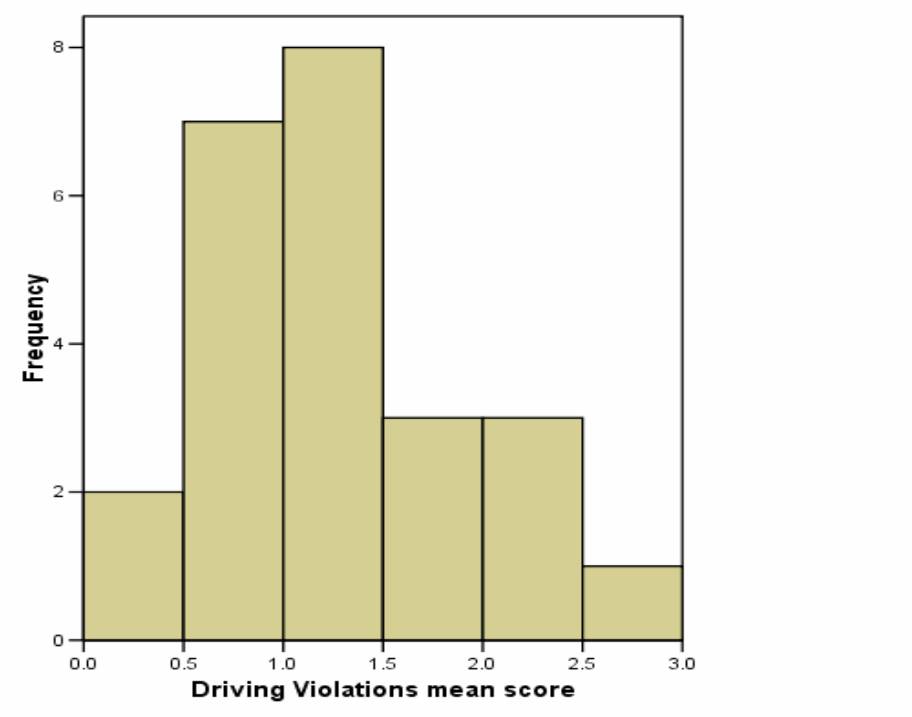

Figure 12. Histogram showing the distribution of mean scores on the Driving Violations questionnaire over the adolescent group.

The same trend cannot really be found with the driving attitudes measured. The distribution of DRT and DAQ scores for the adolescent group are shown in Figures 13 and 14 respectively. In both cases, one adolescent scored lower than 50% (less than 60 points on the DRT and less than 50 points on the DAQ), suggesting they have very unsafe attitudes towards driving overall. However, even though no one in the adult groups scored less than 50% on the DRT, the minimum scores for the DAQ were actually lower among the young adult (48) and older adult (47) compared with the adolescent group (49).

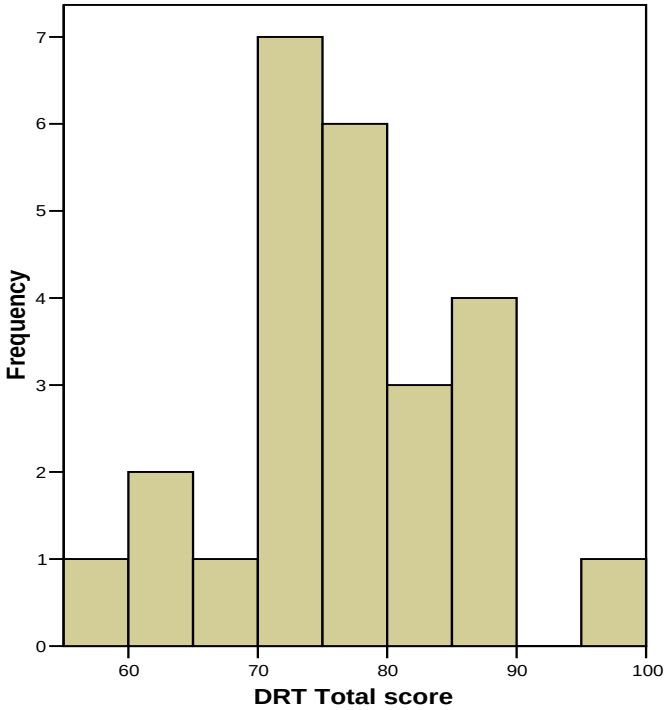

Figure 13. Histogram showing the distribution of scores on the Driver Risk Taking Questionnaire over the adolescent group. Scores could range from 24-120.

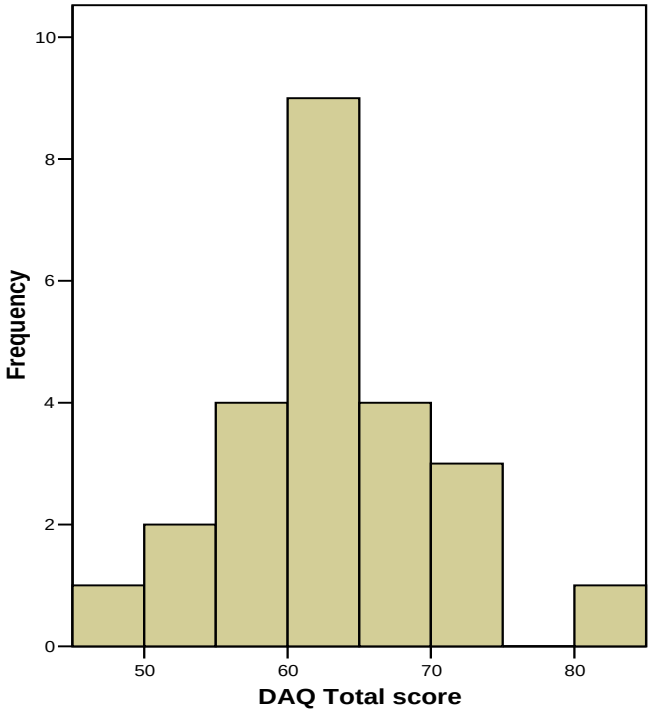

Figure 14. Histogram showing the distribution of scores on the Driver Attitude Questionnaire over the adolescent group. Scores could range from 20-100.

Therefore, in regards to the prediction that a minority of adolescents would be responsible for high levels of risk taking, a few examples can be given. A minority of adolescents gave very low ratings of physical risk to sport-related activities. There were also a small number of adolescents who reported particularly high intentions to commit violations in the future, compared with the other participants. The level of thrill gained from driving, however, did not support the prediction. The majority of adolescents reported that they got a thrill from driving, while a small number suggested that they did not get as much of a thrill.

Correlations between self-report measures of risk and the driving questionnaires

Table 3 shows the correlations between the scores on self-reported measures of risk and the scores on driving questionnaires. The number of violations, experience, and the Marlowe Crowne scores are not included in Table 3 as they will be discussed later, and none of the BART variables were included, as they have already been mentioned. A Pearson's Product-Moment correlation was used in each instance, with the exception of Accident Concern, Thrill, Accident Likelihood, and Skill. These four measures were based on rating scales and were viewed as ordinal data, therefore a Spearman's r_s correlation was used instead.

First, the total Barratt Impulsivity Scale score (*BISTotal*) was found to have a low negative correlation with the DRTCellPhone score ($r = -.287$, $p < .05$), and a medium negative correlation with the DRTTotal score ($r = -.313$, $p < .05$), the DAQSpeed score ($r = -.338$, $p < .05$), and the DAQTotal score ($r = -.342$, $p < .05$). In addition, there was a medium positive correlation between the BISTotal score

and the Driving Violations mean score ($r = .451$, $p < .01$). This suggests that there is some kind of a relationship between impulsivity and driving attitudes, where people who are more impulsive have less safe attitudes towards driving, and a higher intention to commit driving violations frequently in the future.

In terms of the BIS in relation to other self-report measures of risk, the BISTotal score had a medium negative correlation with the PRAISport score ($r = -.392$, $p < .05$) and a medium positive correlation with the AttPsycho score ($r = .392$, $p < .01$). This suggests that high impulsivity is correlated with a tendency to give low ratings of physical risk for sport-related activities, and a tendency to report positive attitudes towards taking risks of a psychological nature (disregard of social approval).

Regarding the scores from the RISK questionnaire, the AttPsycho score was shown to have a medium negative correlation with the DRTDrink score ($r = -.305$, $p < .05$), the DRTSpeed score ($r = -.381$, $p < .01$), and the DRTTotal score ($r = -.391$, $p < .01$). There was also a medium positive correlation between the AttPsycho and Driving Violations mean score ($r = .439$, $p < .01$). This suggests that the attitude towards taking psychological or social risks is reflected in the attitudes a person has towards driving, particularly in regards to speeding and drink-driving, and their intention to commit violations frequently in the future.

The AttPsycho score also had a medium positive correlation with both Thrill ($r_s = .311$, $p < .05$) and accident likelihood ($r_s = .318$, $p < .05$) ratings. This suggests that positive attitudes towards taking psychological risks were correlated with getting a thrill from driving, and interestingly, the perception that one is more likely than the average driver to be involved in an accident.

Table 3. Intercorrelations among each of the self-report measures of risk and the driving questionnaires

	Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	DRTOvertake	-																							
2	DRTDrink	.188	-																						
3	DRTClosefol	**.467****	.068	-																					
4	DRTSpeed	**.535****	**.390****	**.330***	-																				
5	DRTPhone	**.466****	.138	.147	**.408****	-																			
6	DRTTotal	**.793****	**.577****	**.568****	**.814****	**.568****	-																		
7	DV Mean	**-.429****	-.315	-.177	**-.664****	**-.508****	**-.620****	-																	
8	AccConcern	.248	.153	.154	.137	.199	.273	.027	-																
9	Thrill	**-.450****	.045	-.194	**-.386****	-.223	**-.322***	**.498****	-.020	-															
10	AccLikely	-.053	-.144	-.017	-.065	.027	-.006	.211	.276	**.288***	-														
11	Skill	.023	-.191	-.023	.035	.089	-.012	-.065	-.209	-.045	-.004	-													
12	DAQDrink	.205	**.669****	.002	**.342***	.157	**.439****	-.272	.014	-.001	-.031	.162	-												
13	DAQClosefol	**.357***	.059	**.662****	.215	.063	**.405****	-.083	.278	-.058	.116	-.170	.107	-											
14	DAQOvertake	**.654****	.237	**.285***	**.529****	**.337***	**.622****	**-.442****	.290	**-.321***	.108	.029	.200	**.339***	-										
15	DAQSpeed	**.361***	**.347***	**.293***	**.597****	**.451****	**.606****	**-.499****	.187	**-.393****	-.053	-.054	**.350***	.180	**.371****	-									
16	DAQTotal	**.576****	**.513****	**.456****	**.621****	**.366****	**.770****	**-.476****	.266	-.221	.022	.029	**.662****	**.609****	**.687****	**.700****	-								
17	PRAISport	.094	**.446****	-.028	**.289***	.185	**.307***	**-.384****	**.365***	.098	.143	**-.389****	.154	.064	.196	.175	.219	-							
18	PRAIHealth	.144	**.603****	-.041	.253	.012	**.328***	-.203	.143	-.013	-.092	-.200	**.410****	.085	.264	**.308***	**.407****	**.646****	-						
19	AttPsycho	-.261	**-.305***	-.110	**-.381****	-.223	**-.391****	**.439****	.263	**.311***	**.318***	-.041	-.212	.023	-.032	-.239	-.178	-.259	**-.319***	-					
20	AttPhysical	-.133	-.101	-.018	-.177	**-.331***	-.205	**.433****	.020	.197	.203	-.007	-.097	-.071	.033	-.153	-.112	-.003	.211	**.444****	-				
21	BISAttention	-.089	-.105	-.045	-.051	-.099	-.113	**.335***	.098	.143	.061	-.240	-.236	-.032	-.099	-.163	.-205	-.225	-.143	.261	-.034	-			
22	BISMotor	-.128	-.066	-.224	-.241	-.216	-.247	**.398****	-.017	.149	.171	.048	-.171	**-.307***	-.075	**-.375****	**-.350***	-.212	-.082	**.414****	**.349***	**.479****	-		
23	BISNon-plan	-.276	**-.325***	-.189	-.191	**-.369****	**-.387****	**.367****	-.168	.165	.038	-.002	-.160	-.210	-.175	**-.286***	**-.311***	**-.381****	**-.346***	.278	.084	**.608****	**.354***	-	
24	BISTotal	-.207	-.210	-.195	-.200	**-.287***	**-.313***	**.451****	-.049	.137	.108	-.083	-.232	-.226	.145	**-.338***	**-.356***	**-.342***	-.241	**.392****	.163	**.857****	**.747****	**.821****	-

Note. All correlations with AccConcern, Thrill, AccLikely, and Skill are Spearman's r_s correlations. Otherwise the values come from Pearson's Product-Moment correlations.
*****$p < .05$. ****** $p < .01$.

In comparison, the AttPhysical score was shown to have a medium negative correlation with the DRTCellPhone score ($r = -.331$, $p < .05$), as well as a medium positive correlation with the Driving Violations mean score ($r = .433$, $p < .01$). This suggests that positive attitudes towards taking physical risks were correlated with attitudes more in favour of using a cell phone while driving, and higher intentions to commit violations.

Therefore, it appears that both of the RISK components were related to the intention to commit driving violations in the future, but the two differ in the types of driving attitudes they are correlated with. While the attitudes towards psychological risks (disregard of social approval) were reflected in the attitudes towards speeding and drink-driving in particular, the attitudes towards physical risk (disregard of danger) were reflected in the attitudes towards using a cell phone while driving.

Regarding the scores from the PRAI, medium positive correlations were found between the PRAISport scores and the DRTDrink score ($r = .446$, $p < .01$), the DRTSpeed score ($r = .289$, $p < .05$), the DRTTotal score ($r = .307$, $p < .05$) and the accident concern rating ($r = .365$, $p < .05$). There were also medium negative correlations between the PRAISport scores and the Driving Violations mean ($r = -.384$, $p < .01$) and the Skill rating ($r = -.389$, $p < .01$). This suggests that people who gave relatively high ratings of physical risk to sport-related activities have safe attitudes towards driving, particularly in regards to speeding and drink-driving. These people also tend to report they would not commit violations frequently in the future, are not much less likely than the average driver to have an accident, and do not rate themselves as much more skilful than the average driver.

In comparison, the PRAIHealth had a high positive correlation with DRTDrink scores ($r = .603$, $p < .01$), and a medium positive correlation with the DRTTotal score ($r = .328$, $p < .05$), the DAQDrink score ($r = .410$, $p < .01$), the DAQSpeed score ($r = .308$, $p < .05$), and the DAQTotal score ($r = .407$, $p < .01$). This suggests that people who give relatively high ratings of physical risk to activities that might affect their health have safe attitudes towards driving, particularly in regard to speeding and drink-driving. The PRAIHealth measure appears to be particularly relevant in relation to the attitudes towards drinking and driving, because both the DRTDrink and the DAQDrink scores correlated positively with the PRAIHealth score.

Therefore, both components of the PRAI correlated well with the attitudes towards driving, meaning people who gave high ratings of physical risk to risky activities were likely to have positive or safe driving attitudes. Speeding and drink-driving attitudes were the factors that were most related to the ratings of physical risk. The ratings of physical risk for activities that might affect our health were highly correlated with the attitudes towards drink-driving. The intent to commit violations in the future, however, was only related to the ratings of physical risk for sport-related activities, and not health-related activities.

Regarding the questions from the Accident Concern questionnaire, accident concern (feeling worried about being in an accident), accident likelihood, and skill ratings were not shown to be correlated with any of the driving attitudes scores or the Driving Violations mean score. On the other hand, the Thrill rating (getting a thrill from driving) was shown to have a medium negative correlation with the DRTOvertake score ($r_s = -.450$, $p < .01$), the DRTSpeed score ($r_s = -.386$, $p < .01$), the DRTTotal score ($r_s = -.322$, $p < .05$), the DAQOvertake score ($r_s = -.321$, p

< .05), and the DAQSpeed score (r_s = -.393, p < .01). This suggests that people who strongly agreed they get a thrill from driving were likely to report less safe attitudes towards driving, particularly in relation to overtaking and speeding. Thrill ratings and the Driving Violations mean score also had a medium positive correlation (r_s = .498, p < .01), so people who strongly agreed they get a thrill from driving were likely to report a high intention to commit driving violations in the future. The Thrill ratings and accident likelihood ratings were also found to be lowly correlated (r_s = .288, p < .05), meaning people who strongly agreed they got a thrill from driving also tended to report they had a high likelihood of having an accident compared with the average driver.

Finally, experience as a dependent variable was found to correlate with the same measures that were significant between age groups. As can be seen in Table 5, experience was correlated with the DRTOvertake score, the DRTCellPhone score, the DAQOvertake score, the Driving Violations mean score, Thrill, the BISAttention score, and the BISTotal score. Self-rated driving skill was also shown to have a medium positive correlation (r = .319, p < .05) with experience. This means that the more experience people had, the more likely they were to rate their driving skill highly compared with the average driver.

To summarise, most of the self-reported measures of risk were related to the driving attitudes in some regard or another. The Barratt Impulsivity Scale was correlated with the attitudes towards cell phone use and speeding, with high impulsivity associated with relatively unsafe attitudes towards these behaviours. The attitude towards taking psychological risks (disregard of social approval) appeared to be correlated with the attitudes towards speeding and drink-driving. On the other hand, the attitude towards taking physical risks (disregard of danger)

had more of a relationship with the attitude towards cell phone use. Both components of the PRAI showed relationships with driving attitudes overall, with the ratings of physical risk for health-related activities particularly relevant to the attitudes towards drink-driving.

Attitudes towards speeding and dangerous overtaking, and intentions to commit violations were correlated with the ratings of getting a thrill from driving, while accident concern, accident likelihood, and driver skill ratings were not related to any driving attitude differences or the intent to commit driving violations in the future. All of the other measures, with the exception of the PRAIHealth score, reflected differences in the intent to commit violations in the future. Finally, experience as a variable tended to reveal many of the same differences in attitudes and intentions that were found between age groups.

Comparing drivers based on violation and accident involvement

In order to observe the relationship between the self-report measures and the reported driving behaviour over the last 12 months, two approaches were used. The first approach was to conduct a Pearson's Product-Moment correlation between each of the measures and the number of times a driver was caught violating (excluding parking offences) in the last 12 months. However, since the maximum number of accidents reported was one, it was not appropriate to use a similar correlation analysis with the number of accidents. The second approach was to differentiate the sample into two independent groups based on whether 1) drivers had been caught violating at least once in the last 12 months (violators and

non-violators), and 2) had been involved in an accident in the last 12 months. Table 1 includes the number of participants involved in each of these groups.

The numbers of violations in the last 12 months was found to have a medium negative correlation ($r = -.375$, $p < .01$) with the DAQClosefollow score. This suggests that the number of times a driver is caught violating is reflected in their attitude towards close following, according to the DAQ. That is, people were caught violating more often when their attitude was more in favour of close following. None of the other measures were significantly correlated with the number of violations in the last 12 months.

Similarly, when the sample was split into the groups of violators and non-violators, only one significant difference was found. Figure 15 shows the difference in the DAQClosefollow scores between violators ($M = 15.32$, $SD = 3.13$) and non-violators ($M = 17.60$, $SD = 2.87$). An independent samples *t*-test showed that this difference was significant ($t(47) = 2.621$, $p < .05$). Drivers who had been caught violating at least once in the last 12 months scored lower on the DAQClosefollow measure than drivers who had not been caught violating. This suggests that drivers in this sample who had not been caught violating had relatively safer attitudes towards close following (according to the DAQ) than drivers who had been caught.

There were no significant differences between the drivers involved in an accident and those that had not in regard to any of the measures used in this study.

Therefore, in terms of the relationship between the risk-taking measures used in this study and the driving history of participants in the last 12 months, only one measure was shown to be relevant. The attitude towards close following according

to the DAQ appears to be related to the tendency to be caught committing violations.

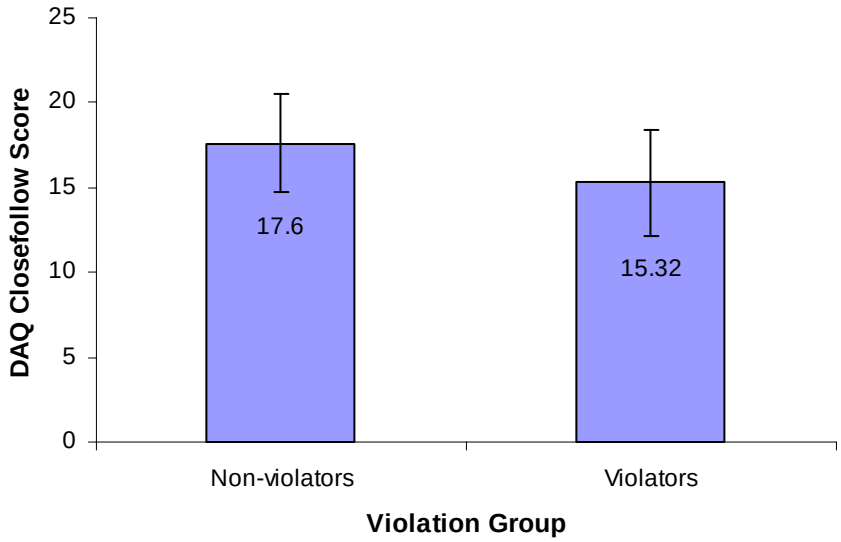

Figure 15. The mean scores on the close following component of the Driver Attitude Questionnaire between participants who had not been caught violating in the last 12 months and those that had.

Self-ratings of driving skill compared to the average driver

One of the expectations was that the majority of people would rate themselves as more skilful than the average driver. Table 4 shows how people responded to the Skill question in terms of whether they rated themselves less skilful, more skilful, or about the same as the average driver. It should be noted that one of the adolescent participants failed to answer this question, so the number in each group was 24, 8, and 17 for the adolescents, young adults, and older adults, respectively.

Over the whole sample, the majority of people (67%) rated themselves as more skilful than the average driver. Only four people (8%) rated themselves as less skilful than the average driver, and one quarter (25%) of the participants felt they

were about the same as the average driver. Both the mean (7.22) and median (7) ratings of skill suggests that on average people rated themselves at least a little more skilful than the average driver (the midpoint for this scale was 6).

Table 4.

How participants rated their skill compared to the average driver.

Skill compared to average driver	Age Group			
	Adolescent	Young Adult	Older Adult	Total
Less	3	0	1	4
Same	6	3	3	12
More	15	5	13	33

In terms of the age groups, 63% of the adolescent group rated themselves as more skilful than the average driver (the same percentage was also found for young adults, but the size of the group is too small to consider the significance of this). In comparison, 76% of the older adults rated themselves as more skilful than the average driver. Therefore, it appears that in this sample, older adults were more likely than adolescents to rate their driving skill better than the average driver. A similar result was also found when the relationship between experience and self-rated driving skill was considered (see Table 3). Ratings of driving skill tended to increase with experience.

The effect of driver skill rating on the other measures was tested by dividing the sample into two groups, based on those who rated themselves more skilful than

the average driver, and those who reported being less skilful or about the same. None of the measures were found to be significantly different between the groups, although an independent *t*-test showed that the difference in DAQClosefollow scores approached significance ($t(47) = 1.841$, $p = .072$). Therefore, it is possible that drivers who rated themselves as more skilful than the average driver also tended to have attitudes more in favour of close following than those who rated themselves as less skilful or about the same.

To summarise, the majority of people rated themselves as more skilful than the average driver. This was slightly more common among the older adult participants compared with the adolescents. In terms of how the driving skill rating is reflected in the driving attitudes, only the attitude towards close following was likely to have any possible relationship.

The consistency and honesty of questionnaire responses

The results from each of the self-report measures are limited by the level of honesty that participants put into their answers. Some participants may be responding truthfully while others tend to choose responses that they believe are the most socially desirable. When this occurs, we are left with an unrealistic measurement of a participant's attitudes and intentions. The use of scales to measure a person's attitude towards something is also put into question when the responses over two occasions are not consistent. Both of these issues are considered here.

The 13-item Marlowe Crowne scale was included in this study to test for socially desirable responding among participants. Figure 16 shows the differences

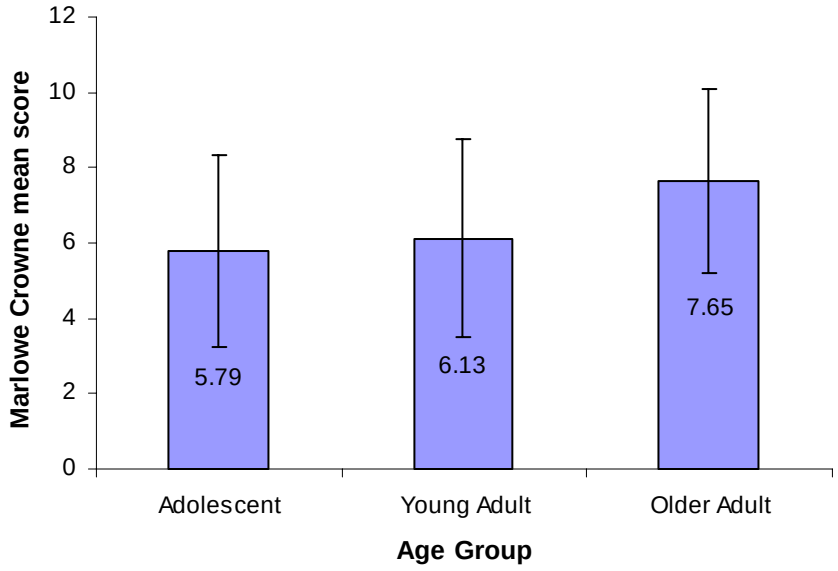

Figure 16. The mean score on the Marlowe Crowne Social Desirability Scale between age groups.

between age groups on this measure. The score on the Marlowe Crowne scale appeared to increase over age groups (adolescents: M = 5.79, SD = 2.55; young adults: M = 6.13, SD = 2.64; older adults: M = 7.65, SD = 2.42). A one-way contrast analysis revealed that the Marlowe Crowne scores increased linearly with age ($F(2,46) = 5.383$, $p < .05$). This suggests that, according to the Marlowe Crowne scale, the tendency to show socially desirable responding increased over the three age groups.

Correlations were found between the Marlowe Crowne score and experience ($r = .322$, $p < .05$), the DRTDrink score ($r = .299$, $p < .05$), the Driving Violations mean score ($r = -.454$, $p < .01$), the PRAISport score ($r = .325$, $p < .05$), the AttPsycho score ($r = -.449$, $p < .01$), the AttPhysical score ($r = -.307$, $p < .05$), and the Barratt Impulsivity score ($r = -.511$, $p < .01$). These were all correlations that

suggest that safer driving attitudes and low reported levels of risk taking were both reflected in high levels of socially desirable responding.

The correlation between the score on the Marlowe Crowne scale and these measures may not necessarily be noteworthy, since the alpha reliability for this questionnaire was only .592 (see Appendix O). This means that the scores on the Marlowe Crowne scale for this sample do not necessarily reflect socially desirable responding. In addition, many of the correlations may have occurred simply because older adults tended to score highly on the Marlowe Crowne scale. Because of this, the effect of socially desirable responding on the self-report measures is confounded by the effects of age.

Consistency in the answers related to driving attitudes was checked by comparing how well the DRT and DAQ scores correlated with each other. As can be seen from Table 3, each of the DRT scores showed high positive correlations ($r > .500$) with their equivalents on the DAQ. However, this result does not prove that the responses to both the DRT and DAQ were entirely consistent. Many results mentioned earlier showed that significant effects could be found on one version of the driving attitude components but not the other (for example, a significant age effect was found for DRTOvertake scores, but not for the DAQ equivalent. See Appendix N).

The honesty and reliability of answers given on the self-report measures could not be made clearer through the use of this social desirability scale. Despite the finding that many measures of low-risk taking were correlated with higher levels of socially desirable responding according to the Marlowe Crowne scale, there is a confounding factor of age, which makes these correlations less surprising. In addition, the alpha reliability for the Marlowe Crowne scale was not at an

acceptable level with this sample. Therefore, it can be suggested that overall, the self-reports were not affected by social desirability. However, the consistency of attitude-type responding is uncertain, since the effects found on one driving attitude questionnaire were not always found on the other.

Summary of the results

The results obtained from the BART did not follow the expectations of this study. As a predictor of risky driving behaviour, the only possible example was a low negative correlation between the total money earned on the BART and the attitude towards close following. That is, more money tended to be earned when the attitudes were more in favour of close following. The scores on the BART did not correlate with any other self-report measures of risk, and were not found to be significantly different between age groups.

On the self-reported measures of risk, the age groups were found to differ on two measures – the Barratt Impulsivity Scale and the attitude towards taking physical risks (according to the RISK questionnaire). Impulsivity was found to decrease over the age groups, with the adolescents being the most impulsive, according to the Barratt scale. The attitude towards physical risks also changed over age groups, with older adults the least likely to agree with taking physical risks. Therefore, in terms of the effect of age on risk-related constructs, there were two examples that suggested younger drivers are riskier than older drivers are.

On the driver risk taking questionnaires, age differences were found for four of the measures. First, the attitude towards using a cell phone while driving becomes less approving with age. The adolescent group was the most likely to underrate

the seriousness of using a cell phone while driving. With regard to dangerous overtaking, older adults had safer attitudes than adolescents and young adults, that is, they rated overtaking as a more serious risk than younger participants did. On the Driving Violations questionnaires, adolescents reported an intention to commit violations in the future more frequently than the older adults did. Finally, getting a thrill from driving is something that appears to decrease with age, with adolescents the most likely to report getting a thrill from driving.

The expectation that a minority of adolescents would be responsible for the highest levels of risk taking was possibly confirmed by a few results in particular. A skewed distribution suggested that a relatively small number of adolescents gave very low ratings of physical risk to sport-related activities, compared with the rest of the group. There was also a small group of adolescents who reported they would commit violations at least fifty percent of the time. This was much higher than the mean for the group, and higher than the maximum found in either of the adult groups.

Most of the self-reported measures of risk showed some correlation with the driving measures. The Barratt Impulsivity Scale showed a relationship with the attitudes towards cell phone use and speeding. The attitude towards physical risks (disregard of danger) was correlated with attitudes towards speeding and drink-driving, while the attitude towards psychological risks (disregard of social approval) appeared to be related to attitudes towards cell phone use and driving. Both components of the PRAI showed correlations with driving attitudes overall, but the Health component was particularly significant in relation to drink-driving attitudes. However, this component was the only self-reported measure of risk that did not correlate with the intention to commit violations in the future.

As expected, getting a thrill from driving was a better predictor of driving behaviour than ratings of accident concern and accident likelihood. The thrill ratings were correlated with attitudes towards speeding and dangerous overtaking, and the intent to commit violations in the future. In comparison, accident concern, accident likelihood, and surprisingly, driver skill ratings did not correlate with driving attitudes and intentions.

The ability to use accident involvement and violations as indicators of risky driving was limited by the relatively low occurrence of these within this sample. Participants who had been involved in an accident in the last 12 months did not differ significantly from those who had not on any of the measures. Only the attitude towards close following according to the DAQ was found to have any relationship with being caught violating in the last 12 months.

The expectation that the majority of participants would rate themselves as more skilful than the average driver was confirmed here. This bias was actually more common among the older adult group than among the adolescents. However, self-ratings of driving skill did not appear to be correlated with any risk-related measures, nor was their any significant difference between people who rated their skills as better than the average driver and those that did not.

Finally, regarding the consistency and reliability of the self-report measures, there were several measures that had scores correlating with the scores on the Marlowe Crowne scale. This may lead to the assumption that people who were reporting low risk taking and safe attitudes were also responding in a socially desirable manner. However, since the reliability for this scale was low, and scores were affected by age, it is more likely that socially desirable responding was not an issue. Despite this, the consistency of responses to the attitude questionnaires

must be put into question, particularly since effects found with the DRT were not found with the DAQ.

In summary, the BART was not found to be a reliable measure of risky driving attitudes and intentions, nor did it correlate with self-reported measures of risk. In comparison, the PRAI, the RISK questionnaire, and the Barratt Impulsivity Scale were shown to correlate fairly well with measures of driver risk taking. Through these measures, it could be determined that adolescents differed in their attitudes towards risk and driving compared with older adults. Adolescents had higher impulsivity and a more positive attitude towards taking physical risks. In terms of driving, adolescents underrated the risks of cell phone use while driving, and dangerous overtaking, compared to adults. They also reported a greater intention to commit driving violations in the future, and were more likely than adults were to report getting a thrill from driving.

Discussion

The results did not support the main prediction of this study, which was that a behavioural measure of risk taking, the Balloon Analogue Risk Task (BART), would be a valid predictor of risky driving in male drivers. The measurement of risky driving was taken through self-reports of driving attitudes and intentions, because the reported level of real-world risky driving through accidents, convictions and warnings was too low in this sample to be relevant. Despite the problems with relying on self-report questionnaires of driving behaviour, it is still noteworthy that in this study, self-report measures of risk such as the Barratt Impulsivity Scale (BIS), the Physical Risk Assessment Inventory (PRAI), and the Attitude Towards Risk (RISK) were significantly correlated with driving attitudes and intentions, while the BART did not correlate significantly with any of these measures. The only relationship found was between the total money earned on the BART and the attitudes towards close following. It is also noteworthy that although the BART is often considered a task that measures risk-taking tendencies (e.g., Lejuez et al., 2003b), in this study, it did not correlate with the BIS, PRAI or RISK questionnaires, which are all self-report measures of risk taking tendencies.

The other focus of this study was to use a range of measures to determine how driver risk taking, and risk taking in general, could be affected by age. The expectation based on previous research was that adolescent drivers would show greater risk taking tendencies than older adult drivers. The results from the questionnaires used showed that impulsiveness decreased with age, and the attitude towards taking physical risks became less positive with age. In relation to driving, younger drivers were more approving of using a cell phone while driving,

and overtaking in risky circumstances. Adolescents also reported intentions to commit violations in the future more frequently than older drivers did, and the association of getting a thrill with driving was another thing that appeared to decrease with age. Therefore, there were many indications that adolescents were riskier and had less safe driving attitudes than older adults did.

The following discussion will be divided into two parts, preceded by a report on the characteristics of the sample used. The first part focuses on the BART and the unexpected results found in this study regarding this behavioural risk taking measure. It also focuses on whether the self-report measures of risk were valid predictors of risky driving, and generally what limitations have been encountered with the measures used in this study. The second part will discuss the age effects found in regard to risk taking and driving attitudes. It will also try to explain how certain models of risk taking fit into the issue of the young driver problem, and suggests some possible interventions that need to be considered in order to reduce the problem. The issue of brain development in young drivers will also be discussed.

The issue of the sample size and reliability should definitely be taken into consideration before any strong conclusions are drawn from this study. First, a sample of fifty participants could be regarded as too small to allow generalisation to the larger population of male drivers. It certainly means that the power of revealing statistically significant correlations could have been compromised, and there is always a possibility that other self-report measures of risk and driving attitudes could have been found to be significant between age groups with a bigger sample. However, it is certain that a larger sample size would not have made any difference to the absence of results supporting the BART as a predictor

of risky driving, because the *p* values obtained suggested the probability of making a type I error was very high for both the age effects and the correlation analyses.

In addition to a small sample size, the fact that the number of participants in each age group was uneven is also problematic. The young adult group, with only eight participants, could not really be treated as a representative sample of male drivers aged 20-21 years. In fact, it could be argued that this group of young adults was particularly risky compared to the population of such drivers. A good example is the absence of a linear effect of age on the attitudes towards dangerous overtaking. Young adults actually reported the least safe attitudes in this regard. Of course, there is always the possibility that young adults *are* riskier than adolescents in some aspects of their driving, possibly due to an increase in confidence through experience. However, to suggest this based on the results of this sample would only be a speculation.

The low prevalence of reported accidents in the last 12 months among this sample was definitely a methodological problem, since this meant that a key indicator of driving behaviour could not be closely studied and compared between groups. This was also the case with convictions and warnings. Again, a much larger sample could have alleviated this problem.

The confounding influence of experience over age is always a problem in any study that focuses on the effects of age on driving behaviour. This study is no exception, with the level of driving experience in months being directly related to the age of the participant. Very few, if any participants in this sample acquired their driving licence at a much later age. However, there is an abundance of evidence in the literature that shows that age has the greatest effect on driving

behaviour and accident risk, even after experience has been taken into account (e.g. Jonah, 1986; Mayhew et al., 2003).

One of the underlying themes of this study was that young drivers cannot be treated as a homogenous group, because there is a large variance in their attitudes, personality and lifestyle. The question must be asked whether the adolescents used in this sample were a good representation of 16-17 year old male drivers in New Zealand. The answer to this question is probably no. All twenty-five of the recruited adolescent participants were high school students who were currently involved in a life skills course that has a particular focus on driver education. This means these were all adolescents who had been given extra education about driver safety, education that was probably never available to the young adults, and certainly not to the older adults. The reliability of driving attitude questionnaires could also be reduced if adolescents are reporting the attitudes that their teacher would expect them to report, and not what they actually believe. If the knowledge gained from the course is forgotten over time, then these same adolescents may report different attitudes a year from now.

Even the fact that all of the adolescents involved in this study were still attending school makes this an unrepresentative sample of young male drivers. There is much evidence (MacDonald, 1994b; Murray, 1998) to suggest that accident involvement is correlated with academic achievement. Murray (1998) found that male car drivers involved in accidents tended to have school marks lower than the average of men in the population. This overrepresentation of low-educated men involved in accidents could not be explained by higher exposure (e.g. males not still attending school would have more time to drive). Therefore, this sample has excluded an important group of male drivers who have a high risk

of accident involvement - those who have already left school by the ages of 16-17 years. Dropping out of school could be considered a specific example of risk taking, where the possible benefits include getting employment earlier, but the consequences include the difficulty of gaining employment that requires qualifications. In other words, if all of the adolescents are still involved in school at the ages of 16-17, perhaps they are not a particularly 'risky' group of adolescents. Unfortunately, gathering the entire adolescent sample from a high school was the most practical and efficient way of recruiting participants in the time available.

The absence of any relationship between scores on the BART and driving behaviour was an unexpected result. It suggests that either there were no self-reported measures used that would correlate with the BART scores, or that the BART did not in fact provide a reliable measure of risk taking tendencies. The first thing to consider is whether there were any methodological problems with the way the BART was administered to this sample. The most salient issue appears to be whether participants were actually trying to achieve high scores in order to gain the benefit (in this case, a $50 MTA voucher). People with higher risk taking tendencies should have pumped the balloon to a greater level (at the expense of popping more balloons) than people with lower risk taking tendencies in order to earn a high total of money. However, this prediction assumes that the incentive was strong enough to make participants want to achieve high scores.

The incentives given in previous BART studies (Lejuez et al., 2002, 2003a, 2003b) were different in some way. In the first (Lejuez et al, 2002), participants were given gift certificates for the total amount of money earned (rounded up to the nearest $5) on the BART. In the other studies (Lejuez et al., 2003a, 2003b),

participants were told that if they reached an undisclosed amount of total money, they would receive a prize (either movie tickets or $20). To prevent disappointment, however, participants all received the same prize regardless of their performance.

In this study, the instructions were to earn as much money as possible, and completion of the task would result in the participant going in the draw for a $50 MTA voucher. One cannot be certain if every participant interpreted this instruction the correct way. Some may have had the perception that they should aim for a high score to go into the draw for the prize, while others had the perception that they would be put into the draw regardless of their performance and made no effort to gain a high score on the task. However, it is suspected that overall, the participants were making an effort, based on the fact that more than half of the participants, at the conclusion of the task, asked the experimenter what had been the highest score so far.

The failure to find any effect of age on the BART scores was not entirely surprising, since none of the previous studies found age effects with their samples either (e.g. Lejuez et al., 2002). This suggests that adolescents as a group do not display significantly higher risk taking tendencies than older adults. However, this is inconsistent with what the self-report measures found in this study. All of the measures were related to risk taking in some form or another, and age was found to have a significant effect on many of these. The BART on the other hand, did not give any support to the age differences in risk taking.

The absence of any correlation between the BART scores and any self-reported measures of risk may not be surprising. The results in two of the studies by Lejuez et al. (2003a, 2003b) did not show that the BART correlated well with other

measures of risk-related constructs such as impulsivity and sensation seeking. Their original study (Lejuez et al., 2002) did show that the BART correlated with at least four self-report measures of risk-related constructs, one of these being the Barratt Impulsivity Scale (BIS). However, the present study found no significant correlation between the BART and the BIS.

Where the BART has been most effective in the past was how it could predict differences in self-reported real-world behaviours, such as smoking. Lejuez et al. (2003b) found that with a small group of adolescents, the BART score was strongly correlated with the number of risk behaviours reported. The present study was limited here because there were only very few measures of reported real-world risk behaviours, with the exception of accidents and violations. These are unreliable though, since many people could have taken risks while driving and never had an accident, or been caught violating. The measure that was most likely to record self-reported risky behaviour was the Driving Violations questionnaire, which asked participants to indicate how often they would commit violations in the future, but there was no significant correlation between BART scores and the Driving Violations score. Perhaps what was needed was a questionnaire that simply asked if drivers had ever committed a range of risky driving behaviours, for example, driving on a road at a speed twice that of the speed limit. The total number of these risky driving behaviours reported could then be compared with the BART scores to determine if a relationship existed.

There is a possibility that the BART was not actually simulating a scenario of risk-taking in the traditional sense. In other words, the BART was not really a risk taking task. The way the BART was described in the Introduction is not consistent with how the original authors described it. This is because the author of the

present study would disagree with the description they have used. Here the BART was suggested to simulate scenarios where there are no specific negative consequences for risky behaviour, only the loss of a potential benefit that could have been gained. In comparison, Lejuez et al. (2002) suggested that the BART modelled real-world situations in which excessive risk can result in diminishing returns and increasing health and safety threats. Each successive pump of the balloon increases the amount to be lost due to an explosion, and decreases the relative gain of any additional pump.

Only part of Lejuez et al.'s BART description seems to be correct. While it is true that the relative gain decreases with each additional pump, there is nothing actually *lost* by pumping the balloon too much. Money from the temporary reserve is lost, but nothing is removed from the permanent reserve, meaning money that has already been earned is safe and cannot be taken away again. Whether someone earns a very small amount of money because they were too conservative, or because they popped too many balloons, the fact remains that they end up with more money than they started off with, and have lost nothing.

This is interesting since any textbook definition of risk taking is likely to describe it as instances where people are willing to do something to achieve a positive benefit when there is a possibility of suffering some negative consequences. Clearly, driver risk taking is no exception to this. One could speculate that there are instances of driving behaviour that are analogous to what the BART is simulating, such as speeding to reduce the journey time and reach a destination quickly. In this case, being successful results in getting to the destination quickly, but if the person is stopped by the police, they lose the time they would have gained by speeding. This would be analogous to pumping the

balloon on the BART. However, in most cases being caught speeding will also result in some negative consequence in the form of a ticket. The BART has no similar negative outcome for risky behaviour. In short, people are not taking risks when they pump the balloon on the BART.

In light of this, it is interesting to note the most likely form of driver risk taking to show a relationship with the BART scores was close following. A small but significant correlation was found between the total money earned on the BART and the attitudes towards close following. The attitude towards close following was something that did not differ between age groups, but it was different between drivers who had been caught violating and those that had not. Coincidently, the number of reported violations also correlated with the attitudes towards close following. Why the BART should be related to close following and not other forms of driver risk taking cannot be determined specifically, but some suggestions can be given.

If we accept that the BART is a task that simulates scenarios where few negative consequences arise from risky behaviour, then perhaps its relationship with close following behaviour may become clearer. There can be several perceived benefits of close following. Among these is the possibility that the driver in front will speed up, or preferably, pull over to allow the driver to pass. Following closely with a small gap is also advantageous for drivers who are trying to stay together, as it reduces the chances of another vehicle cutting in between them. The most likely negative consequence of close following is that the car in front will stop suddenly and a rear-end collision will occur. These kinds of accidents may not be viewed as serious as other types of accidents such as head-on collisions, and some people may feel there is little chance of any serious injury.

In addition to this, the illusion of control (see McKenna, 1993) that drivers have also gives them the belief that even if the car in front does stop, they still possess the skill and reaction time to avoid a collision. Therefore, close following may be most closely related to the BART because the negative consequences are not as salient as they are for other examples of driver risk taking. In addition, the success of the behaviour is determined by limits or thresholds (i.e. how much can you pump the balloon before it pumps and how close can you follow the vehicle in front).

In order to further study the relationship between the BART and close following, a realistic measure of behaviour is needed, in place of attitude questionnaires. The close following video test (McKenna et al., 2006) would be an acceptable tool for this purpose. In this test, participants view a film in which the camera car gradually approaches the car in front. They are required to press a button once when they reached the distance they would normally use, and a second time when they felt uncomfortably close. This would allow us to determine 1) what distance the driver was likely to use in the real world, and 2) what is the smallest following distance they would feel comfortable with. This is a more thorough examination of close following intentions than attitude questionnaires. The main problem with reported attitudes towards close following is that everyone has a different perception of what is ‘close’. Often, people may have very strong feelings against close following but do not realise the distances they use would actually qualify as following too close. Therefore, if risk taking on the BART does show a relationship with close following behaviour, then the close following video test would be the best measure to show this.

On that note, the inclusion of the video tests (McKenna et al., 2006) for driver risk taking would certainly have benefited this study. Earlier, it was suggested that the video tests are limited to specific scenarios, and do not provide an overall measure of risk. It would now appear that this is an advantage, not a limitation, especially since the main behavioural measure of risk, the BART, did not prove to be successful.

Unfortunately for this study, there is not a reliable behavioural measure of risk taking, only self-reports. At least the video speed test, for example, can give an indication of the speeds participants are likely to choose for a range of scenarios, rather than relying on what their self-reported attitudes towards speeding are. The theory of planned behaviour (TPB; Azjen, 1991) suggests that attitudes towards behaviour will give a reliable indication of the way people will actually behave in the future. This is the theory that justifies the driving attitude and behaviour questionnaires used by Parker et al. (1996). The video tests are arguably more valid because they can actually *show* how drivers behave in various scenarios, and we can compare it with their self-reported attitudes.

This study had the disadvantage of relying only on self-report measures, both for risk-taking tendencies and for driving behaviour. At the same time, assuming that all of the questionnaires are reliable, there are still many indications that driving attitudes and intentions are related to the self-reported risk taking tendencies. The BART showed no relationship with driver risk taking, while the BIS, PRAI, and RISK questionnaires were all related in some way to driver risk taking.

A social desirability scale was included in this study to see if responses to the questionnaires, particularly the driving attitude measures, were being influenced

by socially desirable responding. Many other studies, such as those conducted by Parker et al. (1996) did not incorporate a social desirability scale, and assumed that responses given on the driving attitude questions would be reliable and honest. In this study, the 13-item Marlowe Crowne scale (Reynolds, 1982) did not have a very high reliability. The correlation between high scores on this scale on positive driving attitudes was also confounded by the fact that older adults tended to be the ones scoring highest on the Marlowe Crowne scale. The scale is based on assumption that when the scores are high, people are not being honest in their answers and are trying to make themselves appear socially desirable. However, when you look closely at the statements used in the scale, it would be fair to say that these are socially desirable qualities that we would expect more from adults than from adolescents. Therefore, the scale might not necessarily reliable over different age groups.

A review of some of the literature on this matter shows that it is not clear whether age has an effect on social desirability scores. For example, some authors found that age had no effect on Marlowe Crowne scores (e.g. Andrews & Meyer, 2003; Fisher & Parsons, 1962), while others found that age accounted for a significant amounts of variability in the scores (e.g. Fraboni & Cooper, 1989).

Because the driving attitude questionnaires used in this study were originally created for UK participants, we must also take into consideration their validity for a sample of New Zealand drivers. The alpha reliability values found in this sample were high for the total scores on both the DRT and DAQ, but were not always high for the individual components. The drink-driving component of the DRT was probably the least reliable scale. Of course, a larger sample may have increased the alpha reliability values to a more acceptable level.

Every effort was made to ensure that the driving statements were relevant to the traffic laws of New Zealand; however, one statement in particular may have led to some confusion among participants. The second item on the Driving Violations questionnaire asked how often they would expect to 'become impatient with a slow driver in the outer lane and overtake on the inside'. This behaviour is not actually against the law in New Zealand, at least in regard to lanes on the motorway. Perhaps in the case of a single passing lane on the open road, this behaviour could be counted as unsafe driving, but otherwise drivers are not considered to be violating when they do this. This may affect the overall Driving Violation mean scores because some participants would report doing this frequently, because it is not against the law to do so.

An unexpected finding was that although the DRT and DAQ were significantly correlated with each other, it was often the case that effects could be found on one questionnaire and not the other. The reason for this may be that the chances of finding significant effects were greater on the DRT because it contained more items overall (for example, the DRT had one more overtaking item than the DAQ and this was where one of the age effects was found). On the other hand, the reason may be that people were not exactly consistent in their attitudes towards certain driving behaviours. For example, one might strongly agree with police clamping down on drink-drivers and then only mildly agree when presented with the same statement shortly afterwards.

Dahlen et al. (2005) suggested that the study of driving behaviour could benefit from the use of multiple predictors, that is, a range of risk-related constructs and measures of personality. This study chose impulsiveness (BIS), subjective risk assessments (PRAI), and the attitudes towards taking risks (RISK). The latter two

were partly chosen as alternatives to the Zuckerman Sensation Seeking Scale (SSS; Zuckerman, 1979), which has a number of items that have become outdated as measures of sensation seeking (e.g., "I would like to meet some persons who are homosexual"). The PRAI is a useful measure because it focuses on how participants perceive the risk involved in certain activities, but not necessarily the desire or preference to engage in them personally.

All three of these self-report measures of risk showed some correlation with various driving attitudes and intentions. The intention here will not be to discuss in great detail which risk measures were the best predictors of each kind of driving measure, especially since this was a small sample. Some of the correlations should be mentioned here because they provide some indication that different forms of driver risk taking may be influenced by different types of risk-related constructs.

The health component of the PRAI was found to have the strongest correlation with the attitudes towards drink-driving. This suggests that one of the major determinants of drink-driving could be the level of physical risk people associate with activities that can have an adverse effect on their health. Llewellyn (2003) associated health-risk behaviours with an 'anti-social' factor, identified by high social and physical risk propensity. Interestingly, the psychological risk component of the RISK questionnaire was also more likely to be related to drink-driving attitudes than the physical risk component. This suggests the behaviour of drinking and driving is more influenced by disregard of social approval and underestimating the risks of socially unacceptable activities, rather than disregard of danger and underestimating the risks of physical activities.

This finding opens up more possibilities for the use of multiple measures in determining risky driving behaviour. Separating this behaviour into different components (e.g. speeding, close following, overtaking, drink-driving and cell phone use) would allow us to determine more specifically which risk constructs have the most influence on each component of risky driving. It may be important to distinguish the types of driving violations that are committed because people may ignore the physical danger involved and the violations that are committed because people may ignore what society approves of. It may be unwise to put risk-taking drivers into one single category when different types of driver risk taking are moderated by different aspects of risk attitudes and perceptions. The categorisation of risk takers will be discussed further on in this section.

It should be noted that all of the self-reported measures of risk constructs except the health component of the PRAI correlated with the intentions to commit violations in the future. This allows us to see that there is a relationship between risk-related constructs and the willingness to take risks when driving. Put simply, people who are more accepting of risk taking are more likely to report risky driving intentions.

The results of this study were expected to show that adolescent male drivers were greater risk takers than older adult male drivers. In some respects, the results have supported this prediction. First, in terms of risk-related constructs, impulsivity is something that decreased over the three age groups in this sample. Adolescents reported the highest levels of impulsivity. This finding is consistent with other studies that have shown impulsivity to decrease with age (Green, Myerson & Ostaszewski, 1999). There is also a relationship between scores on the BIS and risky driving (Dahlen et al., 2005). Impulsiveness is said to deal with

one's *control* over one's thoughts and behaviours, while sensation seeking deals with one's *preference* for novel experience and taking risks (see Dahlen et al., 2005).

This result highlights the problem that young drivers have poor control over their own actions and are less likely to choose the safest options when a more immediately rewarding option is on offer. The attention component of the BIS was particularly significant between the age groups, suggesting that adolescents are more impulsive when concentration is needed to make the right decisions. Adolescents are probably more likely than adults to become bored when they are presented with complex problems, and will take the easiest option to deal with the problem. This is an important finding in light of the brain development issue that will be discussed later in this section.

The attitude towards taking physical risks was also found to change over age. The change was subjectively small, but enough to show that by older adulthood, people were less likely to associate themselves with taking physical risks. In other words, adolescents were probably the most likely to seek activities that involve some element of physical risk.

With increasing age, attitudes were found to become less in favour of using a cell phone while driving. Adolescents were the least likely to disapprove of cell phone use while driving. In New Zealand, there is no law that prevents drivers using a cell phone, but the issue has gained a lot of attention in the media recently (Savage, 2006). Recall that Vanlaar and Yannis (2006) found that people perceived driver cell phone use to be highly prevalent but did not believe that it carried a high risk.

There is much research that suggests using a cell phone while driving is much more serious than many people would believe. Studies have found that cell phone distraction can have an adverse effect on reaction times, often making response times three times longer than the impairment caused by blood alcohol levels just barely under the legal limit (Lamble et al., 1999). Another study that used an eye-tracking device found that although the drivers in the dual-task group (simulating a cell phone conversation) still fixated on the same features, they had much poorer recall of these features than the control group, suggesting they were looking but not paying attention (Strayer, Drews & Johnston, 2003). These studies also show that hands-free cell phones are no better than normal cell phones - it is the divided attention that has a deleterious effect on our driving.

The tendency of younger drivers to underestimate the risks of using a cell phone while driving is a concern because teenagers are probably more likely than adults are to prioritise their cell phone use. In other words, teenagers may be more likely than adults are to answer their phones or respond to text messages without pulling over and stopping first. This highlights how the difference in lifestyle can have an effect on driving behaviour.

The results from the Driving Violations questionnaire showed that adolescents reported an intention to commit violations in the future more frequently than older adults did. This is consistent with the findings of Parker et al. (1992), who suggest that younger drivers are more likely to view the positive aspects of the violations than older drivers are.

The finding that adolescents have greater intentions to commit violations surely goes against any theory that young drivers are overrepresented in car accidents mainly due to inexperience. As Parker et al. (1995) found, errors and lapses are

not predictive of accident involvement, but deliberate violations are. Therefore, younger drivers are not more at risk because their inexperience leads to mistakes in vehicle control or silly lapses, but because they intentionally take risks, knowing they are breaking the law. Common sense would arguably suggest that inexperience should not have the effect of making drivers more likely to deliberately commit violations. However, to confirm this we would need to study the rare group of drivers who do not acquire their licence until they are adults, in order to see if inexperienced adults also have high intentions to violate the road laws.

The tendency to report getting a thrill from driving was found to decrease over age groups in this sample. Adolescents were the most likely to report getting a thrill, in fact, only a minority of them reported that they did not get much of a thrill from driving. The thrill ratings were found to be better predictors of risky driving than accident concern or perceived accident likelihood, which is similar to what McKenna and Horswill (2006) found. In their study, driver thrill ratings correlated with the speeds chosen on the video test and with the Driving Violations scores. Therefore, drivers reporting they get a thrill from driving were more likely to choose higher speeds and had greater intentions to commit violations in the future. In the present study, high thrill ratings were associated with less safe attitudes towards overtaking and speeding, and high intentions to commit violations in the future.

Unlike the findings of McKenna and Horswill (2006), self-rated driving skill in relation to the average driver did not show any correlation with driving attitudes and intentions. Driver risk taking did not appear to be influenced by self-ratings of driving skill. The prediction that the majority of participants would rate

themselves more skilful than the average driver was confirmed in this sample. The proportion of about sixty-seven percent of people ratings their driving skills better than the average driver is very similar to what Delhomme (1991) found.

Still, it would have been interesting to expand on this by asking participants how they rate their skills compared to drivers from their own age group, and drivers from the other age groups. Horswill et al. (2004) found that young drivers rate themselves better than the peers and about the same as older drivers, while older drivers rate themselves about the same as their peers but better than younger drivers. In our sample, older drivers were slightly more likely than adolescents to rate themselves more skilful than the average driver. Unfortunately, it would have been difficult to determine what people's perception of the average driver is. Another factor that may have affected these self-ratings is the involvement of all the adolescents in a driver education course. As part of their learning, they may have been taught not to overestimate their driving skill (at least in terms of responding to surveys) when they have little driving experience.

Ratings of getting a thrill from driving have been shown to be a better predictor of risky driving than accident concern. McKenna and Horswill (2006) found that the factors most likely to influence risky driving were those related to positive gains, such as reduced journey time. Concern about having an accident had the weakest relationship with risk taking. They suggested that although policy makers often focus on health risk factors, it is probably the case that health risks are not prominent factors for those actually taking the risks. Instead, they regulate their risk taking based on the perceived benefits involved.

It was for this reason that the BART should have been the ideal simulation for risk-taking behaviour. The threat of negative consequences is not a factor

influencing behaviour on the BART, simply because there are no negative consequences as such. Instead, the level of positive benefit that is gained is based on how far participants are willing to push the limits (the balloon pump thresholds, not necessarily speed or alcohol limits).

Earlier, an analogy was given of the BART modelling speeding behaviour, and it was suggested that, unlike the BART, speeding does have negative consequences in the form of a speeding ticket. However, getting a speeding ticket is not the worst negative consequence that can happen; it is simply the one with the highest probability. People are more likely to perceive a direct link between speeding and being caught by the police or a speed camera than between speeding and having an accident (McKenna & Horswill, 2006). Therefore, in many respects, being given a speeding ticket may not necessarily be a particularly threatening negative consequence for speeding. This is especially true when we take into account that the consequence is not delivered immediately, with drivers having the option of paying their fines much later (or not at all), as it suits them. In the same manner, popping the balloon on the BART is not necessarily a punishing consequence, only a slight inconvenience.

An interesting finding is that the only measure that showed any relationship with the attitudes towards dangerous overtaking was the thrill rating. The negative correlation was actually quite high, suggesting that people who gave high ratings of thrill from driving were more likely to have attitudes more in favour of overtaking in risky circumstances. Of course, the interpretation of this correlation can be varied. We cannot ascertain whether drivers approve of dangerous overtaking because they are unaware of the risks they are taking, or because they *are* aware of the risks involved, and they get a thrill from taking the risks. On the

other hand, even safe overtaking tends to involve travelling at a speed faster than normal, depending on the situation. Because of this, the action of overtaking may be somewhat thrilling for people even when they are performing a perfectly safe overtaking manoeuvre.

It should be noted that it tended to be adolescents who gave higher ratings of thrill from driving, and had attitudes relatively more in favour of dangerous overtaking. They also reported greater intentions to commit violations in the future. Therefore, we are left with solving the question of why adolescents get more of a thrill from driving than older drivers do. It may be the case that adolescents get a thrill from driving because they often commit violations, which makes driving a more exciting activity. At the same time, one could argue that adolescents find driving thrilling simply because it is a novel experience and the thrill from driving begins to decrease with experience, to the point where older, experienced drivers tend to find driving to be mundane. Once again, we would need to study adults who have acquired their licences when they were much older, to see if older drivers get a thrill from driving when they have not had much experience.

Jonah (1986) proposed that a minority of young drivers account for the majority of driver risk-taking (e.g., non-seatbelt use, drinking, following too closely), and therefore contribute to the majority of accidents. This is a difficult proposition to support empirically, and very few studies have been able to find a method of supporting this. In this study, the intention was simply to see if a small minority of drivers in the adolescent group would exhibit risk-taking tendencies much greater than the rest of the sample. This may have been true at least in terms of intention

to commit driving violations in the future, with four of the adolescents reporting they would commit violations about 50% of the time.

It could be suggested that these four drivers would come under a category of high-risk drivers separate from their peers in their age group. Gregersen and Berg (1994) found that accident risk was extremely varied among young drivers, with one particular group having an accident risk at least eight times greater than that for adult drivers. In comparison, a different group was still more likely to have an accident than adult drivers were, but had an accident risk well below the standard expected for their age group.

The reported intention to commit violations in the future is an interesting measure when interpreted in the light of the four categories of risk takers described by Musselwhite (2006). These were unintentional risk takers; calculated risk takers, who took risks when they felt it was safe to do so; reactive risk takers, who took risks when reacting to stress; and continuous risk takers, who frequently took risks regardless of the situation. Of course, the Driving Violations questionnaire does not necessarily discriminate the reasons why drivers would intend to commit certain violations some of the time. Take the example of reporting an intention to drive fast about 25% of the time. We do not have any indication of why drivers would do so, and theoretically, they could fit into any of the risk taking categories.

An unintentional risk taker might drive fast 25% of the time because on some occasions they drive a vehicle (for example, their partner's vehicle) they are not used to driving, and therefore have poorer control. A calculated risk taker might drive fast on occasions when the road is straight and there is no traffic, and a

reactive risk taker might drive fast 25% of the time because they tend to be in a hurry getting to work on some days of the week.

However, continuous risk takers, almost by definition, would be expected to report intentions to commit violations much more frequently. The small group of adolescents who reported an intention to commit violations at least 50% of the time are the most likely to come under the category of continuous risk takers. These types of drivers take risks for their own sake, possibly to seek a thrill or receive approval from their peers. They do so regardless of the conditions or context, unlike the other three categories of risk takers.

Musselwhite (2006) briefly acknowledged the relevance of the Risk Homeostasis Theory (RHT; Wilde, 1982) to the categorisation of driver risk takers. The problem with the RHT is that so far there has been too much emphasis on risk taking at a population level, as Musselwhite (2006) stated, where individuals have been treated as a homogenous group. This is not helpful when it is clear that young drivers are definitely not a homogenous group. The theory describes how road safety interventions are ineffective because drivers will maintain a target level of risk, but there has been little focus on what factors influence this target level of risk in the first place.

The assumption would be that young male drivers maintain the highest target levels of risk overall. Of course, the target level of risk is simply a concept that cannot be measured directly. That is, there is not a physical value or score you can give for one's target level of risk. Then again, perhaps the BART could be the assessment most likely to provide us with a physical measurement of the target levels of risk.

Wilde (1982) however, suggested that the target level of risk is regulated by the cost-benefit ratio perceived by the individual. Taking speed choice as an example, drivers will make their choice based on the perceived benefits and costs for either speeding or not speeding. If adolescent drivers maintain a higher target level of risk than adult drivers, they possibly have a perception that speeding brings many benefits at little cost, while keeping to the speed limit brings very little benefit at a high cost.

The possibility that young drivers put different weight on the costs and benefits of risky driving highlights the need to consider the role of lifestyle and motivation when studying driving behaviour. For a start, not all young drivers have the same motives or goals for driving; in fact, not all young drivers have the same motives for getting a licence in the first place. Some will seek a licence because they need transport to school and work, some want a licence because they want to drive for recreational purposes (and possibly for thrill-seeking), and others may simply acquire a licence because they feel obliged to by their peers (i.e. it is what people expect others to do when they reach 15 years of age).

Clearly, when the motives for driving are different, so too will the perception of costs and benefits for risky versus safe behaviour (see Hatakka et al., 2002). For many adolescents, peer approval is a highly rewarding consequence, and at the same time, peer disapproval is a highly punishing consequence. The benefits of safe driving (e.g. economy, reduced wear and tear on the vehicle) are not as salient to an adolescent, and of course, like many drivers, the costs of risky driving are more likely to be perceived in terms of getting tickets, rather than the less likely consequence of having an accident.

Problem Behaviour Theory (PBT; Jessor & Jessor, 1977) was chosen as an appropriate theory of risk taking for the present study because it highlights the issue of adolescent risky behaviour, which may be more significant as a cause of young driver accident involvement than a lack of skills or inexperience. Adolescents who are most likely to display risky driving behaviour are also engaged most often in other risk-taking behaviours (Bina et al., 2006). The present study would have benefited by asking participants to self-report other risk behaviours, such as drug use (this would also have helped to determine whether the BART was working as a predictor of other risky behaviour, not just driving behaviour).

Some people may find the comparison of Problem Behaviour Theory with young drivers to be too extreme, especially since young drivers who are not involved in other risky behaviours are still frequently involved in accidents. However, the overall risky lifestyle associated with adolescence should not be ignored when studying driving behaviour. Jessor et al. (1997) found that the decrease in risky driving behaviour over time was not so much a result of increased experience, but from the progression from adolescence to adulthood, where perceptions and behaviour begin to change. For men especially, changes in behavioural conventionality were the most significant predictors of a decrease in risky driving behaviour. The construct of behavioural conventionality includes factors such as intolerance of deviance and delinquent-type behaviour. Other events that we associate with adulthood, such as marriage, also seem to influence a decrease in risky driving, particularly in females. This leads to some interesting (but confounding) possibilities with the findings of the present study. The majority of older adults in this sample were married, while none of the

adolescents were. This means that being married may have an effect on driving behaviour that cannot be determined without the confounding effect of other variables such as age.

The process of finding a suitable intervention for reducing risk taking in young drivers is complicated by the uncertainty of whether young drivers take risks because they are unaware of the danger or because they *are* aware of the danger and gain a thrill by putting themselves at risk. McKenna et al. (2006) studied the effects of hazard anticipation training on the risk-taking propensity of drivers. In one of the experiments, trained drivers were found to have an improved ability to respond to different scenarios with differential speed reduction. That is, they chose significantly slower speeds when the situations were more hazardous.

The above finding appears to support the other assumption of RHT, which is that drivers will adjust their behaviour to maintain a constant level of risk when the conditions become more hazardous. However, it seems that without specific training in hazard anticipation, drivers are less able to adjust their behaviour accordingly. Perhaps this is where experience plays a part, by improving a driver's ability to maintain a constant level of risk by matching their behaviour to the current situation.

If this were true, it might lead critics to suggest that experience is the most important predictor of accident involvement, and therefore people should learn to drive as early as possible. This is not necessarily true, because adolescents are more likely to have a higher target level of risk to begin with. Even with hazard perception training, they would still be accepting levels of risk greater than the levels adults would accept. Once again, it is likely that adolescents maintain

higher levels of risk because aspects of their lifestyle make risky behaviour more appealing.

The fact that drivers are less affected by the threat of low probability consequences such as accident involvement, and more influenced by the positive benefits available (McKenna & Horswill, 2006) gives us some insight into which factor influencing the target level of risk should be targeted. In simpler terms, the focus should not be on making the costs of risky driving more salient (for example, through the use of 'shock' media), but perhaps on downplaying the perceived benefits of risky driving, and making the benefits of safe driving more salient and rewarding.

Changing the attitudes adolescents have about the positive benefits of risky driving would not be an easy task. For example, attempting to suggest to adolescents that peer approval is meaningless in the long run sounds like an impossible feat. More research should be conducted in this area to see if a suitable intervention can be devised.

Increasing the benefits of safe driving behaviour for adolescents would probably be a more practical approach, though it may be costly and undoubtedly controversial. Baum (1994) described how many people are reluctant to support the use of rewards to strengthen desirable behaviour, and much prefer to punish those who behave inappropriately. This is despite the evidence that positive reinforcement of good behaviour is much more effective that punishment for bad behaviour. Unfortunately, for adolescents, who are characterised as reward-seeking (Weinberger et al., 2005), there is no obvious positive reinforcement for keeping to the road laws. There is no incentive for driving according to the law when the rewards for breaking the laws are so much greater (and arguably, they

have little chance of being caught). More research should be done to see if adolescents would decrease their risky driving if they could be rewarded for safe driving instead.

However, any intervention to reduce risky driving may still only have a small effect, since the high-risk groups targeted by the intervention are often the least likely to be affected by it. Ulleberg (2002) found that the most deviant high-risk cluster of drivers were the least satisfied by the driving safety campaign presented to them, while the low-risk cluster of drivers evaluated the campaign the most positively. This means that researchers need to be very wary of the significance of 'successful' driving interventions. A significant decrease in risky driving may occur over the majority of the sample, but the small minority that accounts for the majority of risk taking in the first place may be entirely unaffected by the intervention.

The present study was part of a larger project that was also focusing on what role the executive functions of the brain play in the risk taking of drivers. If the brain is still developing at the time when people first learn to drive, then it is likely that young drivers lack some of the cognitive skills that older drivers have, and this puts them more at risk of having accidents.

It was suggested earlier that the decrease in risky driving over time is correlated with the changes in perception and behaviour that occur as people mature into adulthood. It may seem careless to put forward this theory as well as the theory that frontal lobe development has the biggest influence on driving behaviour. However, it is likely that these two theories are compatible. Both are related to the same idea, except the differences are based on whether we wish to focus from a physiological or cognitive viewpoint, or from a viewpoint of psychosocial and

behavioural constructs. In any case, they are both theories that acknowledge that age is probably the main contributing factor to higher levels of risky driving compared with adults. When we talk about age as a factor, perhaps we should consider the underlying factors associated with age.

Young novice drivers are less able to adjust their behaviour to meet the changes in conditions, compared with older, experienced drivers (MacDonald, 1994b). Again, according to RHT, they have a poorer ability to maintain a constant target level of risk. The question is whether experience is the factor that improves a driver's ability to adjust their driving to the conditions, or whether the brain development that occurs through adolescence and young adulthood is the reason why these skills improve. The results of this present project may help to answer this question.

One focus point that can be mentioned now is the difference in decision-making abilities of young drivers. Adolescents tend to be able to make wise decisions in controlled situations when they are not under any stress or experiencing strong emotions, but under different conditions, they will make poor decisions (Dahl, 2004). This means that adolescents may be more likely to allow their driving to be affected by their mood and by their level of arousal at the time of driving. Perhaps what occurs in adolescent drivers is a failure to understand that safe driving must persist regardless of the context. That is, the same attitudes and approach towards driving that are maintained when driving alone and relaxed should also be maintained when driving with peers, and under high arousal or stress.

A wide range of factors related to risk taking in young drivers has been discussed here. In the sample used in the present study, we found that adolescents reported to take more risks than adults do because they were more likely to

approve of using a cell phone while driving, and overtaking in risky circumstances. They also had a higher intention to commit violations in the future, and reported they get a thrill from driving. In addition, young adults were often found to fall between adolescents and older adults on these measures, suggesting there was a linear pattern of decreased reported risk taking over age. The suggestion here based on the collected data is that driving experience cannot be the main influencing factor that determines driver risk taking in these respects. Instead, there are age-related factors that result in adolescent drivers taking greater risks than adult drivers do. These factors include a lack of the higher brain functions needed for safe driving, a tendency for adolescents to have greater tolerance of deviant behaviour, and an overall lifestyle where the positive benefits for taking risks (such as peer approval) are much greater than those encountered during adulthood.

Future studies of adolescent driving behaviour need to incorporate a range of measures and need to take a holistic approach, as there are more factors contributing to driving behaviour than we would expect. An intervention purely based on improving driving and hazard detection skills may be ineffective if the skills are overridden by factors related to brain development (adolescents may lack the higher-order functions necessary for learning to drive safely), or factors related to the adolescent lifestyle (safe driving is less rewarding when peers are present, so may be abandoned at certain times).

Self-report measures of attitudes and driving intentions were suitable to some extent, but there is a need for these to be complemented by delving further into the lifestyle of the individual. The motives a person has for driving and in what contexts they normally drive are very important in helping us determine how

much at risk they are. Self-report measures of other types of risk taking are also essential since risky driving is associated with risk taking in other forms. In addition, a range of behavioural measures should be incorporated, which should avoid any issues of dishonesty or socially desirable responding. The video tests used by Horswill and McKenna (1999) would be ideal for allowing us to observe how drivers respond to real-life situations, particularly in terms of speed choice, close following distance, and gap acceptance. However, the failure of the BART to predict differences in driver risk taking in this sample highlights the need to continue developing a behavioural task that will allow us to measure physically the risk-taking tendencies of individuals. Perhaps what this behavioural task would measure is what is termed the target level of risk that people are willing to accept in various situations.

The present study showed that the BART was unable to predict driving related risk taking, although one of the BART measures did have a small correlation with the attitudes towards close following. Due to the low occurrence of self-reported accidents and violations, it was difficult to compare self-report measures of risk with the actual driving history of individuals. However, a number of correlations were found between self-report measures of risk and the self-reported driving attitudes and intentions. It is possible that multiple predictors of risk taking should be incorporated because different risk-related constructs were found to correlate with different aspects of driving behaviour. One example was the finding that low ratings of physical risk for health-related activities were correlated with attitudes more in favour of drinking and driving.

According to the self-report measures used in this study, adolescent drivers have greater risk-taking tendencies than adult drivers in several respects.

Adolescents were found to be more impulsive than older adults were, and had more positive attitudes towards taking physical risks. They were also more approving of using a cell phone while driving, overtaking in risky circumstances, had greater intentions to commit violations in the future, and were more likely than adults to report getting a thrill from driving. Within this small sample, it could also be suggested that a small minority of adolescents were much riskier than the rest of the sample, particularly in terms of intending to commit violations.

Both Risk Homeostasis Theory (RHT) and Problem Behaviour Theory (PBT) were relevant to the findings that adolescent driver take more risks than older drivers do. RHT allows us to suggest that adolescents maintain a higher target level of risk. This high level probably occurs due to adolescents perceiving highly positive benefits for risk taking, such as peer approval and gaining a thrill. PBT suggests that risky driving comes under the same category as other adolescent problem behaviours, and is influenced by the same factors. The inability of young drivers to adjust their behaviour when conditions change (and therefore maintain a constant level of risk), as well as the tendency to deliberately take driving risks, is most likely not due to inexperience, but to a range of age-related factors such as brain development and the adolescent lifestyle.

In the context of the present study's findings, a combination of lifestyle changes and increased brain development may lead to a decrease in impulsiveness and a less positive attitude towards taking physical risks. As people get older, they may begin to show better self-control and begin to perceive the dangers of seeking immediate rewards when the risks are high. As a result of this, they may become less willing to commit violations on the road and tend to have a better awareness of the risk involved with certain driving behaviours, such as overtaking and using

a cell phone while driving. At the same time, the motives for driving change and people may be less likely to use driving as a form of thrill-seeking. In summary, older drivers may have a greater awareness of risk and have lower risk-taking tendencies than younger drivers, while there may also be lifestyle factors (associated with the progression into adulthood) that change the perception of the positive benefits involved in taking risks on the road. This may be the main reason why young drivers as a group are overrepresented in road crash statistics.

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Appendix A

Advertisement

Thinking and driving: A study assessing male driving behaviour

What is this study about?

- The study looks at how different men plan, assess risk and make decisions and how this effects our driving.
- We will be using an online survey and carrying out some one to one tasks
- Your participation is voluntary (your choice)
- The study is being conducted by Dr. Robert Isler, Dr. Nicola Starkey, Dr. Andrea Hodgetts and Mark Gordon in the Department of Psychology, University of Waikato.

Am I eligible to take part?

- You have a valid full or restricted car driver licence for more than six months
- Are male, aged between 16-17, 20-21, 25 years and over
- Can speak and read NCEA Level 1 English

What am I being asked to do?

- To fill out an anonymous on-line survey, which will take around 30-45 minutes
- To complete a series of one to one tasks, which will take 60-75 minutes
- To cover your expenses we will give you a $20 MTA voucher

Who can I speak with about my participation in this project?

- Call Nicola Starkey on 021 1290 403, 856 2889 extension 8954, or email at drivingproject@waikato.ac.nz.

Appendix B

Information Sheet

Thinking and driving: A study assessing male driving behaviour

Information Sheet

What is this study about?

You are invited to participate in a research project investigating how different men plan, assess risk and make decisions and how this effects our driving.
Your participation is voluntary (your choice). The main aim of this study is to assess drivers, their background, driving behaviours, and decision making skills. We will be using two research methods; an online survey and one to one tasks.

This study is being conducted by Dr. Robert Isler, Dr. Nicola Starkey, Dr. Andrea Hodgetts and Mark Gordon from the Department of Psychology at Waikato University.

Am I eligible to take part?

You are eligible to take part in this study if you have a valid full or restricted car driver licence for more than six months; male, aged between 16 to 17, 20 to 21, or 25 years and older; can speak and read NCEA Level 1 English.

What am I being asked to do?

This study is in two parts. **Firstly**, if you agree to take part, you will be asked to fill out an anonymous on-line survey. This survey contains questions about you, your background, your driving experiences, and how risky you rate various types of recreational activities. This will take around 60 minutes to complete. **Secondly**, you will be asked to complete a series of one to one tasks which assess your mood, concentration and attention and how you make decisions. These tasks will take 60 minutes to complete.

There are no right or wrong answers to the survey questions or the one to one tasks. Refreshments will be provided and in total your participation will involve no more than two hours. To cover your expenses relating to your involvement in this

project we will give you a $20 MTA voucher. You may be placed in a draw to win a $50 MTA voucher.

What will happen to my information?

Be assured that no one will be able to identify you. All returned on-line surveys are to be stored on a password protected computer and the paper-based one to one tasks are to be stored in a locked cabinet, in the Department of Psychology at Waikato University. The research team will conduct the analysis of the data. At the end of the study the paper-based forms will be destroyed. We will send an electronic summary of our findings to the participants who have indicated they would like to receive this information.

What can I expect from the researchers?

If you decide to participate in this project, the researchers will respect your right to:

- ask any questions of the researchers about the study at any time during participation;
- decline to answer any particular question and tasks in the on-line survey or in the one to one tasks;
- withdraw from the study;
- provide information on the understanding that it is completely confidential to the researchers. All on-line surveys are identified by a code number, and are only seen by the researchers. It will not be possible to identify you in any articles produced from the study;
- be given an electronic summary of the findings

Who can I speak with about my participation in this project?

If you have any further questions or concerns, please call Andrea Hodgetts on 07 8562889 ext 8954 or email at drivingproject@waikato.ac.nz. If you have any concerns about this project, you may contact the convenor of the Research and Ethics Committee (Linda Nikora; 07 8562889 ext 8200. email l.nikora@waikato.ac.nz)

Appendix C

Demographics Questionnaire

Driving Project

Instructions Please provide the following information by typing your response in the appropriate boxes

1. What is your date of birth?

☐ ☐ ☐
Day Month Year

2. Please indicate which best describes your ethnic background:

☐ New Zealand European
☐ New Zealand Māori
☐ Asian
☐ Pacific Islander
☐ None of the above, please specify_____

3. Are you currently

☐ single
☐ in a relationship
☐ married / civil union
☐ divorced
☐ widowed

4. What type of drivers licence do you hold?

☐ restricted for car
☐ full for car

5. What date did you obtain your restricted / full **car** driving licence?

☐ ☐
Month Year

6. How many kilometers do you drive in a usual week?
☐ km

Instructions
Almost every driver becomes involved in an adverse traffic event (accident or near-hit) of some sort during their driving years. We would like to know how often people experience such events. Please tell us how many ACCIDENTS or NEAR HITS that you have been involved in during **the last twelve months.**

7. In the last twelve months, how many accidents have you been involved in?
An *accident* is any collision that occurred *on the public roads* (but not private property), while you were the driver of the vehicle and irrespective of who was at fault.

☐ accidents

8. In the last twelve months, how many near hits have you experienced?
A *near hits* is when you narrowly avoided being in an accident on public roads, while you were the driver of the vehicle and irrespective of who was at fault.

☐ near hits

Instructions
Nearly all drivers commit traffic offences and we would like to estimate how often these happen. Please let us know whether you have committed any traffic offences **in the last twelve months.** For each of the offences below indicate approximately **how many times** these happened. **Please write the number of times in the space provided.**
A conviction is when your offence has legal consequences resulting in a fine and / or demerit points.
A warning is when you are stopped by the police regarding your driving but no further action is taken.

Offence type	**Convictions**	**Warnings**
Speeding		
Racing		
Reckless driving		
Drinking or drug related e.g. driving under the influence		
Dangerous overtaking e.g. overtaking with limited visibility		
Following too close		
Roundabout offences e.g. using the wrong lane, inappropriate signals		
Failing to obey road signs (e.g. a stop sign)		
Traffic signal offence e.g. running a red light		

Parking offence e.g. parking in disabled parking, on footpath		
Failing to stop e.g. for police, after an accident		
Vehicle defects e.g. broken headlamp, noisy vehicle		
Uncertified vehicle modification e.g. lowered suspension		
Seatbelt offence		
Taking a vehicle without consent		
Driver Licence offense e.g. driving whilst disqualified, outside of license restrictions		
Driving without a warrant of fitness		
Driving without registration		

Other, please provide a detailed list

Appendix D

Driving Violations Questionnaire

Driving Project

Instructions
Every driver makes occasional mistakes. Even the best drivers make errors or bend the rules sometimes. For each of the statements below indicate how likely you are to engage in this type of behaviour **in the future**. If you would never engage in that behaviour **click 0**, if you think you will carry out the behaviour very frequently or most of the times that you drive **click 4**. Use the remaining numbers to indicate the varying likelihood of your carrying out that behaviour.

In the future, how often would you expect to do each of the following?

Hardly ever/ 0% of the time	**Close to 25% of the time**	**Close to 50% of the time**	**Close to 75% of the time**	**Nearly 100% of the time**
0	**1**	**2**	**3**	**4**

1.	Drive especially close to the car in front as a signal to its driver to go faster to get out of the way	0	1	2	3	4
2.	Become impatient with a slow driver in the outer lane and overtake on the inside	0	1	2	3	4
3.	Cross a junction knowing that the traffic lights have already turned against you	0	1	2	3	4
4.	Angered by another driver's behaviour, you give chase with the intention of giving him/her a piece of your mind	0	1	2	3	4
5.	Disregard the speed limits late at night or very early in the morning	0	1	2	3	4
6.	Drive even though you realize you may be over the legal blood-alcohol limit	0	1	2	3	4
7.	Have an aversion to a particular class of road user, and indicate your hostility by whatever means you can	0	1	2	3	4
8.	Get involved in unofficial 'races' with other drivers	0	1	2	3	4
9.	Exceed the 100 km/h speed limit on the open road	0	1	2	3	4
10.	Drive fast	0	1	2	3	4
11.	Exceed the 50 km/h speed limit in built-up areas	0	1	2	3	4

Appendix E

Accident Concern Questionnaire

Driving Project

Instructions
Please rate how strongly you agree or disagree with the following statement by clicking the appropriate number.

1. I sometimes feel worried that I will be involved in an accident

1	2	3	4	5	6	7	8	9
Strongly Disagree				Neither Agree/ Disagree				Strongly Agree

2. I often get a thrill from driving

1	2	3	4	5	6	7	8	9
Strongly Disagree				Neither Agree/ Disagree				Strongly Agree

3. How likely are you to be involved in accidents in the future compared with the average driver?

1	2	3	4	5	6	7	8	9	10	11
Much less likely					About the same					Much more likely

4. How skilful do you think you are compared with the average driver?

1	2	3	4	5	6	7	8	9	10	11
Much less skilful					About the same					Much more skilful

Appendix F

Manchester Driving Attitude Questionnaire (DAQ)

Driving Project

Instructions
To what extent do you agree or disagree with each of the following statements? Please read each statement carefully, and then **click** the number that corresponds to your reply.

Strongly disagree	**Disagree**	**Neither agree or disagree**	**Agree**	**Strongly agree**
1	**2**	**3**	**4**	**5**

1.	Some people can drive perfectly safely after drinking three or four pints of beer	1	2	3	4	5
2.	People stopped by the police for close following are unlucky because lots of people do it	1	2	3	4	5
3.	I would welcome further use of double white lines to let me know when it is unsafe to overtake	1	2	3	4	5
4.	Speed limits are often set too low, with the result that many drivers ignore them	1	2	3	4	5
5.	I think the police should start breathalysing a lot more drivers around pub closing times	1	2	3	4	5
6.	It is quite acceptable to take a slight risk when overtaking	1	2	3	4	5
7.	Close following isn't really a serious problem at the moment	1	2	3	4	5
8.	I know exactly how fast I can drive and still drive safely	1	2	3	4	5
9.	Some drivers can be perfectly safe overtaking in situations which would be risky for others	1	2	3	4	5
10	Even one drink makes you drive less safely	1	2	3	4	5
11	I would favour stricter enforcement of the speed limit on 50 km per hour roads	1	2	3	4	5
12	Some people can drive perfectly safely even when they only leave a small gap behind the vehicle in front	1	2	3	4	5
13	The aim of the police should be to stop as many people as possible overtaking in risky circumstances	1	2	3	4	5
14	Even driving slightly faster than the speed limit makes you less safe as a driver	1	2	3	4	5
15	It's hard to have a good time if everyone else is drinking	1	2	3	4	5

	but you have to limit yourself because you're driving					
16	I would be happier if close following regulations were more strictly applied	1	2	3	4	5
17	Stricter enforcement of speed limits on 50kmph roads would be effective in reducing the occurrence of road accidents	1	2	3	4	5
18	Even driving slightly too close to the car in front makes you less safe as a driver	1	2	3	4	5
19	I think it is O.K. to overtake in risky circumstances as long as you drive within your own capabilities	1	2	3	4	5
20.	The law should be changed so that drivers aren't allowed to drink any alcohol	1	2	3	4	5

Appendix G

Driver Risk Taking Questionnaire

Driving Project

Instructions
Sometimes the laws of the road seem either too strict or not strict enough. Tell us how you feel about each of these laws. For each statement **click** the number indicating to what extent you **agree** or **disagree.**

Strongly disagree	**Disagree**	**Neither agree or disagree**	**Agree**	**Strongly agree**
1	**2**	**3**	**4**	**5**

1.	I think it is OK to overtake in risky circumstances as long as you drive within your own capabilities	1	2	3	4	5
2.	The law should be changed so that drivers aren't allowed to drink any alcohol	1	2	3	4	5
3.	It is quite acceptable to drive after only one or two drinks	1	2	3	4	5
4.	On the whole people aren't aware of the dangers involved in close following	1	2	3	4	5
5.	Even overtaking in a slightly risky situation makes you less safe as a driver	1	2	3	4	5
6.	I would be happier if the speed limits were more strictly enforced	1	2	3	4	5
7.	The aim of the police should be to stop as many drink drivers as possible	1	2	3	4	5
8.	People stopped by the police for risky overtaking are unlucky because lots of people do it	1	2	3	4	5
9.	Harsher penalties should be introduced for drivers who drive too close to the car in front	1	2	3	4	5
10.	It's OK to drive faster than the speed limit as long as you drive carefully	1	2	3	4	5
11.	I know exactly what risks I can taken when I overtake	1	2	3	4	5
12.	Random breath testing of drivers should be introduced	1	2	3	4	5
13.	People stopped by the police for speeding are unlucky because lots of people do it	1	2	3	4	5
14.	I think the stopping distances in the Road Code are too great for people to take notice of them	1	2	3	4	5
15.	I would be happier if there was a clamp down on dangerous overtaking	1	2	3	4	5

16.	Speeding is one of the main causes of road accidents	1	2	3	4	5
17.	I think I know exactly how much I can drink and still be under the limit	1	2	3	4	5
18.	I think it is OK to send text messages whilst driving	1	2	3	4	5
19.	It is quite acceptable to drive close to the car in front than is recommended	1	2	3	4	5
20.	Sometimes you have to drive in excess of the speed limit in order to keep up with the flow of traffic	1	2	3	4	5
21.	I would favour a clamp down on drivers who drive too close to the vehicle in front	1	2	3	4	5
22.	Risky overtaking isn't really a serious problem as the moment	1	2	3	4	5
23.	The amount of alcohol you're allowed to drink before driving is too high	1	2	3	4	5
24.	It is dangerous to talk on your mobile phone whilst driving	1	2	3	4	5

Appendix H

Physical Risk Assessment Inventory (PRAI)

Driving Project

Instructions
Click the appropriate number for each of the following activities to indicate their level of physical risk to an average person. In each case **click** any number from **0** (**No Physical Risk**) to **6** (**Extreme Physical Risk**).

		No Physical Risk			**Moderate Physical Risk**			**Extreme Physical Risk**
		0	**1**	**2**	**3**	**4**	**5**	**6**
1	Mountain climbing	0	1	2	3	4	5	6
2	Smoking marijuana	0	1	2	3	4	5	6
3	Water skiing	0	1	2	3	4	5	6
4	Eating fatty foods	0	1	2	3	4	5	6
5	Parachute jumping	0	1	2	3	4	5	6
6	Skiing fast down a mountain	0	1	2	3	4	5	6
7	Being sexually promiscuous	0	1	2	3	4	5	6
8	Scuba diving	0	1	2	3	4	5	6
9	Driving recklessly	0	1	2	3	4	5	6
10	Heavy drinking	0	1	2	3	4	5	6
11	Rock climbing	0	1	2	3	4	5	6
12	Hang gliding	0	1	2	3	4	5	6
13	Using hallucinogenic drugs	0	1	2	3	4	5	6
14	White water kayaking	0	1	2	3	4	5	6
15	Using illegal stimulants	0	1	2	3	4	5	6
16	Smoking cigarettes	0	1	2	3	4	5	6
17	Mountain biking	0	1	2	3	4	5	6
18	Having unprotected sex	0	1	2	3	4	5	6
19	Piloting a small plane	0	1	2	3	4	5	6

20	Using cocaine	0	1	2	3	4	5	6
21	Surfing	0	1	2	3	4	5	6
22	Not exercising regularly	0	1	2	3	4	5	6
23	Driving after drinking alcohol	0	1	2	3	4	5	6
24	Horse riding	0	1	2	3	4	5	6

Appendix I

Attitude Towards Risk (RISK) Questionnaire

Driving Project

Instructions
Indicate using a 5 point scale the degree to which each of the following statements describes you.
Click 1 to indicate it does not describe you at all (**not like me**) and **click 5** if the description is a very good description of you (**like me**). Use remaining numbers to indicate the varying degrees that the statement is like you or not like you.

Please read each statement carefully and then click the number that corresponds to your reply.

Not Like Me **Like Me**

1 **2** **3** **4** **5**

1	I like the feeling that comes with taking physical risks	1	2	3	4	5
2	While I don't deliberately seek out situations or activities that society disapproves of, I find that I often end up doing things that society disapproves of.	1	2	3	4	5
3	I often do things that I know my parents would disapprove of	1	2	3	4	5
4	I consider myself a risk-taker	1	2	3	4	5
5	Being afraid of doing something new often makes it more fun in the end	1	2	3	4	5
6	The greater the risk the more fun the activity	1	2	3	4	5
7	I like to do things that almost paralyse me with fear	1	2	3	4	5
8	I do not let the fact that something is considered immoral stop me from doing it	1	2	3	4	5
9	I often think about doing things that I know my friends would disapprove of	1	2	3	4	5
10	I often think about doing things that are illegal	1	2	3	4	5

Appendix J

Marlowe Crowne Scale

Driving Project

Instructions
Listed below are a number of statements concerning personal attitudes and traits. Read each item and **click** whether the statement is **True** or **False** as it pertains to you personally.

		True	False
1	It is sometimes hard for me to go on with my work if I am not encouraged	**T**	**F**
2	I sometimes feel resentful when I don't get my own way	**T**	**F**
3	On a few occasions, I have given up doing something because I thought too little of my ability	**T**	**F**
4	There have been times when I felt like rebelling against people in authority even though I knew they were right	**T**	**F**
5	No matter who I'm talking to, I'm always a good listener	**T**	**F**
6	There have been occasions when I took advantage of someone	**T**	**F**
7	I'm always willing to admit it when I make a mistake	**T**	**F**
8	I sometimes try to get even rather than forgive and forget	**T**	**F**
9	I am always courteous, even to people who are disagreeable	**T**	**F**
10	I have never been irked when people expressed ideas very different from my own	**T**	**F**
11	There have been times when I was quite jealous of the good fortune of others	**T**	**F**
12	I am sometimes irritated by people who ask favours of me	**T**	**F**
13	I have never deliberately said something that hurt someone's feelings	**T**	**F**

Appendix K

Barratt Impulsivity Scale

Driving Project

Instructions
We all act and think differently in day to day situations. Please read each statement and click the answer that best describes the way you act and think. Do not spend too much time on any one statement. **Answer quickly and honestly.**

Rarely/Never **Occasionally** **Often** **Almost always/always**

1 **2** **3** **4**

1.	I plan tasks carefully	1	2	3	4
2.	I do things without thinking	1	2	3	4
3.	I am happy-go-lucky	1	2	3	4
4	My thoughts race	1	2	3	4
5	I plan trips well ahead of time	1	2	3	4
6	I am self-controlled	1	2	3	4
7.	I concentrate easily	1	2	3	4
8.	I save regularly	1	2	3	4
9.	I find it hard to sit still for long periods of time	1	2	3	4
10.	I am a careful thinker	1	2	3	4
11.	I say things without thinking	1	2	3	4
12.	I like to think about complex problems	1	2	3	4
13.	I change jobs	1	2	3	4
14.	I act on impulse	1	2	3	4
15.	I get easily bored when solving though problems	1	2	3	4
16.	I have regular medical/dental check ups	1	2	3	4
17.	I act on the spur of the moment	1	2	3	4
18.	I am a steady thinker	1	2	3	4
19.	I buy things on impulse	1	2	3	4
20	I finish what I start	1	2	3	4
21.	I walk and move fast	1	2	3	4
22.	I solve problems by trial and error	1	2	3	4
23.	I spend or charge more than I earn	1	2	3	4
24.	I talk fast	1	2	3	4
25.	I have outside thoughts when thinking	1	2	3	4
26.	I am more interested in the present than the future	1	2	3	4
27.	I am restless in class/groups	1	2	3	4
28.	I plan for the future	1	2	3	4

Appendix L

Consent form

University of Waikato
Psychology Department
Consent Form

Thinking and driving: A study assessing male driving behaviour

Dr Robert Isler, Dr Nicola Starkey, Dr Andrea Hodgetts & Mark Gordon

I have received the Information Sheet for this study or the researcher has explained the study to me. My questions about the study have been answered to my satisfaction and I understand that I may ask further questions at any time.

I agree to participate in this research project and I understand that I have the right to withdraw from the study at any time. I agree to provide information to the researchers on the understanding that it is completely confidential. I also understand I will receive a $20 MTA voucher for participating in this study. I also understand that I may be placed in a draw to win a $50 MTA voucher.

If I have any concerns about this project, I may contact the convenor of the Research and Ethics Committee (Linda Nikora; 07 8562889 ext 8200. email l.nikora@waikato.ac.nz)

I would like to receive an electronic copy of the summary of the results of this study, once it is completed. Please circle the following and print your email address stating where you would like this summary to be sent to.

Yes **No (Please circle)**

Email Address:_____

I wish to participate in this study under the conditions set out on the information sheet.

Signed: _____

Name: _____

Researcher: _____

Date: _____

Appendix M

Participant instructions

"The study we are conducting focuses on how different males plan, assess risk and make decisions and how this affects our driving. Your participation in this study involves two parts – the first is on an online survey, and the second is a series of one to one tasks. The online survey contains questions related to your background, your driving experiences, and how you feel about various situations. The one to one tasks will assess your mood, concentration, attention, and how you make decisions. Both parts should each take approximately an hour to complete, and in total, your participation will not involve more than two hours of your time. To cover your expenses relating to your involvement in this project we will give you $20 worth of MTA vouchers. You also have the opportunity today to be placed in the draw for a $50 MTA voucher also. You will be notified by email if you are the winner of this draw"

"At the top of each page there is box for you to type in your subject number – please ensure you do so for each page before you submit your results. It will not be possible to go back to make additions or changes after each questionnaire has been submitted. Most items only require you to click the box that most applies to you; however, some items do require you to enter numbers or text. For the driving record questions, ensure that you type '0' in each of the boxes that do not apply to you. Follow the instructions carefully and try to answer each question honestly". Following the questionnaires, a program will open that will give you instructions for a computer-based task. Read the instructions carefully before beginning the task, and feel free to ask me for help if you are unsure. Please use the headphones

available and ensure that you do not communicate with the other participants while you are completing this task. At the conclusion of this task, please inform me so that I can then arrange with you a suitable time for the one to one tasks."

At the beginning of the BART task, the following information was provided on the screen:

"Now you're going to see 30 balloons, one after another, on the screen. For each balloon, you will use he mouse to click on the box that will pump up the balloon. Each click on the mouse pumps the balloon up a little more.

"BUT remember, balloons pop if you pump them up too much. It is up to you to decide how much to pump up each balloon. Some of these balloons might pop after just one pump. Others might not pump until they fill the whole screen.

"You get MONEY for every pump. Each pump earns 5 cents. But if a balloon pops, you lose the money you earned on that balloon. To keep the money from a balloon, stop pumping before it pops and click on the box labelled "Collect $$$".

"After each time you collect $$$ or pop a balloon, a new balloon will appear.

"The aim is to collect as much money as possible. When you complete the task, you will go into the draw for a $50 MTA voucher"

Appendix N

Descriptive data from driving measures

	Adolescents	Young Adults	Older Adults	
		Mean (SD)		Cronbach's alpha
Driver Risk Taking				
DRTOvertake	18.64 (3.11)	17.50 (3.21)	21.00 (2.53)	.580
DRTDrink	19.40 (3.49)	18.25 (2.49)	18.00 (2.92)	.408
DRTClosefollow	17.24 (2.91)	16.50 (2.20)	17.41 (2.03)	.568
DRTSpeed	14.40 (2.93)	13.88 (1.73)	15.18 (4.00)	.603
DRTCellPhone	6.72 (1.82)	7.00 (1.60)	8.47 (1.18)	.735
DRTTotal	76.40 (9.45)	73.13 (7.04)	80.06 (9.84)	.778
Driving Violations Mean Score	1.26 (0.69)	1.24 (0.26)	0.80 (0.47)	.823
Accident Concern Questionnnaire				
AccConcern	4.46 (1.69)	5.75 (1.49)	5.24 (2.05)	NA
Thrill	6.79 (2.04)	5.75 (2.05)	4.53 (1.84)	NA
AccLikely	4.88 (1.75)	5.63 (1.30)	4.47 (2.53)	NA
Skill	6.96 (2.01)	6.75 (0.71)	7.82 (1.55)	NA
Driving Attitude Questionnaire				
DAQDrink	16.58 (3.50)	14.25 (3.73)	16.00 (3.37)	.584
DAQClosefollow	17.00 (3.72)	16.00 (3.12)	16.65 (2.29)	.577
DAQOvertake	15.00 (2.52)	15.13 (3.09)	16.29 (2.97)	.543
DAQSpeed	14.08 (3.00)	13.63 (2.67)	15.29 (2.82)	.691
DAQTotal	62.67 (7.23)	59.00 (7.98)	64.24 (9.44)	.737

Note. The descriptions for these variables are shown below:

The scores on the Driver Risk Taking and Driving Attitude Questionnaires represent the level of disapproval for risky driving (therefore how safe their attitude is)

DRTOvertake	Attitude towards dangerous overtaking on the DRT questionnaire. The scale ranges from 6-30.
DRTDrink	Attitude towards drink-driving on the DRT questionnaire. The scale ranges from 6-30.
DRTClosefollow	Attitude towards close following on the DRT questionnaire. The scale ranges from 5-25.
DRTSpeed	Attitude towards speeding on the DRT questionnaire. The scale ranges from 5-25.
DRTCellPhone	Attitude towards using a cell phone while driving on the DRT questionnaire. The scale ranges from 2-10.
DRTTotal	The overall attitude towards driving on the DRT questionnaire. The scale ranges from 24-120.

Driving Violations Mean Score	Mean rating for intention to commit violations in the future. The rating scale ranges from 0-5.
AccConcern	Rating of feeling worried about being in an accident, on a scale from 1-9.
Thrill	Rating of getting a thrill from driving, on a scale from 1-9.
AccLikely	Rating of accident likelihood compared to the average driver, on a scale from 1-11.
Skill	Rating of driving skill compared to the average driver, on a scale from 1-11.
DAQDrink	Attitude towards drink-driving on the DAQ. The scale ranges from 5-25
DAQClosefollow	Attitude towards close following on the DAQ. The scale ranges from 5-25.
DAQOvertake	Attitude towards dangerous overtaking on the DAQ. The scale ranges from 5-25.
DAQSpeed	Attitude towards speeding on the DAQ. The scale ranges from 5-25.
DAQTotal	The overall attitude towards driving on the DAQ. The scale ranges from 20-100.

Appendix O

Descriptive data from other measures

	Adolescents	Young Adults	Older Adults	
		Mean (SD)		
				Cronbach's alpha
Marlowe Crowne Score	5.79 (2.55)	6.13 (2.64)	7.65 (2.42)	.592
Physical Risk Assessment Inventory				
PRAISport	3.09 (0.82)	3.44 (0.62)	3.42 (1.23)	.892
PRAIHealth	4.08 (0.72)	3.97 (0.28)	3.71 (1.22)	.877
Attitude Towards Risk Questionnaire				
AttPsycho	2.67 (0.83)	2.30 (0.81)	2.22 (0.92)	.817
AttPhysical	3.34 (0.83)	3.13 (0.55)	2.76 (0.76)	.850
Barratt Impulsivity Scale				
BISAttention	20.44 (3.87)	18.88 (2.48)	18.00 (2.74)	.691
BISMotor	23.20 (3.74)	23.13 (3.04)	21.76 (3.23)	.531
BISNon-plan	23.68 (3.51)	22.00 (3.63)	21.65 (4.05)	.501
BISTotal	67.32 (8.89)	64.00 (7.78)	61.41 (7.85)	.804
BART				
AvAdjPumps	30.93 (13.20)	35.33 (17.41)	27.15 (9.77)	NA
BART$$	25.34 (6.21)	27.63 (8.22)	26.24 (6.81)	NA
BARTEx	11.92 (4.35)	12.13 (5.25)	10.06 (1.95)	NA

Note. The descriptions for these variables are shown below:

Marlow Crowne Score	Social desirability score on the Marlowe Crowne scale, Ranging from 0-13.
PRAISport	Mean rating of physical risk for sport-related activities, ranging from 0-6.
PRAIHealth	Mean rating of physical risk for health-related activities, ranging from 0-6.
AttPsycho	Mean score for attitudes towards taking psychological risks, ranging from 1-5
AttPhysical	Mean score for attitudes towards taking physical risks, ranging from 1-5.
BISAttention	Impulsivity score on the Attention component of the Barratt scale. This score ranges from 8-32.
BISMotor	Impulsivity score on the Motor component of the Barratt scale. This score ranges from 10-40.
BISNon-plan	Impulsivity score on the Non-planning component of the Barratt scale. This scores ranges from 10-40.

BISTotal	Total impulsivity score on the Barratt scale. This score ranges from 28-112.
AvAdjPumps	The average adjusted number of pumps on the BART. This is the average number of pumps on trials in which the balloon did not pop.
BART$$	The total money earned on the BART in dollars
BARTEx	The number of trials where a balloon was popped.