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**YOUNG PEOPLE AND ROAD USER BEHAVIOUR:
ATTITUDES, JUDGEMENTS AND BEHAVIOUR.**

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ABSTRACT.

The problem of the disproportionately high accident and offence rate of young drivers is a major area for concern in the field of road safety (Cameron, 1982, 1983; Jonah, 1986). Research suggests that young drivers have a propensity to become involved in risk-taking behaviours and that this may be due to both motivational factors (Schuman, et al, 1967; MacMillan, 1975; Wilde, 1982; Jessor, 1987), and the components of risk perception (Quenault et al, 1968; Quimby and Watts, 1981; Finn and Bragg, 1986; Mathews and Moran, 1986).

The present study employed two distinct methodologies (surveys and the relatively novel technique of interactive video) in order to examine the attitudes, judgements and behaviours of a sample of young drivers (17-19 years) and pre-drivers (11-18 years).

The questionnaire surveys and the Interactive Video Driving Programme (I.V.D.P.) revealed that distinct attitudes towards driving are held as early as 11 years of age, and that there are several attitudinal, judgemental and behavioural dimensions along which the sexes and/or the developmental groups within the driver and pre-driver sample, could be discriminated. These dimensions related to perceptions of driving offences, risk-taking attitudes and behaviours, hazard perception and evaluation, and road environment awareness.

The use of the I.V.D.P. allowed the examination of driving behaviours and judgements in simulated decision situations. Results indicated that there were some differences in the results produced by the two methodologies. Results tend to suggest that the more interactive and pictorial modes of information presentation may be more successful in assisting young people to develop more accurate mental representations of the road traffic environment.

The results are discussed in terms of their implications for the design and implementation of school-based pre/driver education programmes. Specifically, issues such as information content and presentation, and the targeting of information at young people of different developmental stages are addressed.

LIST OF CONTENTS.

<u>VOLUME ONE.</u>		<u>Page</u>
Title Page.		I
Abstract.		II
List of Contents.		III
Acknowledgements.		X
Dedication.		XI
<u>Chapter 1.</u>	<u>Introduction.</u>	<u>1</u>
1.0	Overview.	2
1.1	Young Drivers and Road Traffic Accidents.	2
1.1.1	Outline Of The Problem.	2
1.1.2	Experience and Exposure	5
1.2	Introduction To Research On Risk-Taking.	7
1.2.1	Accidents and Violations.	7
1.2.2	Observational Studies.	10
1.2.3	Survey Studies.	18
1.2.4	Laboratory Studies.	34
1.2.5	Summary and Integration of Research Into Young Drivers' Risk-Taking Behaviours.	46
1.2.6	Remedial Actions: Introduction.	50
1.3	Driver/Pre-Driver Education and Training.	53
1.3.1	Introduction.	53
1.3.2	Evaluation Studies Of Driver Education and Training Programmes.	56
1.3.2.1	Methodological Problems With Evaluation Studies.	64
1.3.3	Summary.	67
1.4	Rationale and Aims Of This Study.	68
<u>Chapter 2.</u>	<u>Methodology.</u>	<u>71</u>
2.0	Overview.	72
2.1	Objectives Of The Research.	75
2.1.1	Particular Issues For Investigation.	76
2.1.2	Implications For Research Design.	79

2.2	The Non-Driver and Driver Questionnaire Studies.	80
2.2.1	The Sampling Strategy.	80
2.2.2	Development Of The Survey Instruments.	81
2.2.2.1	In-depth Interviews.	81
2.2.2.2	Generation Of Questionnaire Items.	84
2.2.3	The Pilot Questionnaire.	85
2.3	Overview Of The Questionnaires.	85
2.3.1	Non-Driver Questionnaire I.	87
2.3.2	Non-Driver Questionnaire II.	90
2.3.3	Driver Questionnaire I.	94
2.3.4	Driver Questionnaire II.	97
2.4	Administration Of The Questionnaires.	100
2.4.1	The Non-Driver Questionnaires.	100
2.4.2	The Driver Questionnaires.	100
2.5	Comparison Of Items Between The Non-Driver and Driver Questionnaires.	101
2.6	The Interactive Video Study.	102
2.6.1	Interactive Video As A Methodology To Study Attitudes, Judgements and Behaviours In Road Safety.	102
2.6.2	The Equipment.	105
2.6.3	The Sampling Strategy.	106
2.6.4	Development and Design Of The Interactive Video Driving Programme.	106
2.6.5	The Interactive Video Driving Programme.	110
2.6.5.1	Instructions Given To Subjects.	110
2.6.5.2	The Practice Scenes.	110
2.6.5.3	The Order Of Scenes Contained In The Interactive Video Driving Programme.	112
2.6.6	The Use Of Verbal Protocols.	115
2.6.7	Administration Of The Interactive Video Programme.	119
2.6.8	Comparison Between Interactive Video and Questionnaire Data.	120
2.7	Treatment Of Data.	121
2.7.1	Univariate Procedures.	121
2.7.2	Multivariate Procedures.	121
2.7.3	Statistical Techniques For Meta-Variable Construction.	123
Chapter 3.	Non-Driver Questionnaire Results.	126
3.0	Introduction.	127
3.1	Overview.	127

3.2	Results Section 1: Sample Characteristics.	130
3.3	Results Section 2: Creation Of Driving Behaviour, Accident, and Offence Related Meta-Variables.	131
3.4	Results Section 3: Examination of Group Differences Across Driving Behaviour, Accident and Offence Related Variables.	143
3.5	Summary Of The Non-Driver Questionnaire Results.	160
<u>Chapter 4.</u>	Driver Questionnaire Results.	162
4.0	Introduction.	163
4.1	Overview.	163
4.2	Results Section 1: Sample Characteristics.	166
4.3	Results Section 2: Creation Of Driving Offence, Behaviour and Attitude Related Meta-Variables.	169
4.4	Results Section 3: Examination Of Group Differences Across Driving Behaviour, Accident and Offence Related Variables.	175
4.5	Results Section 4: Examination Of Group Differences Across Ratings Of Skill For 'Self' and 'Others'.	195
4.6	Summary Of The Driver Questionnaire Results.	197
<u>Chapter 5.</u>	The Perceived Seriousness Of Driving Offences: A Direct Comparison Between The Driver and Non-Driver Questionnaire Results.	199
5.1	The Perceived Seriousness Of Driving Offences.	200

5.2	Summary Of The Comparison Between Drivers and Non-Drivers.	204
<u>Chapter 6.</u>	Interactive Video Results.	205
6.0	Introduction.	206
6.1	Overview.	207
6.2	Results Section 1: Sample Characteristics and Representativeness.	210
6.3	Results Section 2a: Creation Of Hazard Evaluation and Risk-Taking 'Rating' Variables.	213
6.4	Results Section 2b: Examination Of Group Differences Across Hazard Evaluation and Risk-Taking 'Rating' Variables.	215
6.5	Results Section 2c: Examination Of Group Differences Across Risk-Perception 'Rating' Variables.	218
6.6	Results Section 3: Examination Of Group Differences Across Hazard Perception and Risk-Taking 'Interactive' Variables.	222
6.7	Results Section 4a: Creation Of 'Road Environment Awareness' Meta-Variables From The Verbal Commentary Task Scenes.	226
6.8	Results Section 4b: Examination Of Group Differences Across 'Road Environment Awareness' Meta-Variables.	229
6.9	Summary Of The Interactive Video Results.	231
<u>Chapter 7.</u>	Discussion	233
7.0	Introduction.	234
7.1	Driving Offences and Law Enforcemment.	235

7.1.1	Summary of Results.	235
7.1.2	Discussion of Results.	236
7.2	Risk-Taking Behaviours.	239
7.2.1	Attitudes Towards Risk-Taking.	239
7.2.1.1	Summary of Results.	239
7.2.1.2	Discussion of Results.	240
7.2.2	Speeding.	242
7.2.2.1	Summary of Results.	242
7.2.2.2	Discussion of Results.	244
7.2.3	Overtaking Behaviours.	246
7.2.3.1	Summary of Results.	246
7.2.3.2	Discussion of Results.	246
7.2.4	Close-following.	248
7.2.4.1	Summary of Results.	248
7.2.4.2	Discussion of Results.	248
7.2.5	Specific Driver Age Effects For Risk-Taking Behaviours.	248
7.3	Risk Perceptions and Hazard Evaluation.	250
7.3.1	Perceptions of Skill.	250
7.3.1.1	Summary of Results.	250
7.3.1.2	Discussion of Results.	251
7.3.2	Accident Likelihood and Seriousness.	253
7.3.2.1	Summary of Results.	253
7.3.2.2	Discussion of Results.	254
7.3.3	Hazard Perception and Evaluation.	258
7.3.3.1	Summary of Results.	258
7.3.3.2	Discussion of Results.	258
7.4	Attitudes Towards Drink-Driving.	259
7.4.1	Summary of Results.	259
7.4.2	Discussion of Results.	260
7.5	Road Environment Awareness.	261
7.5.1	Summary of Results.	261
7.5.2	Discussion of Results.	262
7.6	General Discussion.	264
7.6.1	Of Age Effects.	264
7.6.2	Of Sex Effects.	269
7.7	Comparison of Methodologies.	272
7.8	Discussion of The Mediators of Risk-Taking.	275

7.9	Generalization of The Results.	281
7.10	Conclusions.	281
7.10.1	Implications For Pre-/Driver Education.	281
7.10.2	Implications For Future Research.	288
<u>References.</u>		291

VOLUME TWO.

<u>Appendices.</u>		311
Appendix A1	Non-Driver Questionnaires I and II.	312
Appendix A2	Driver Questionnaires I and II.	331
Appendix A3	Interactive Video Driving Programme Format.	354
Appendix B1	The Creation of Driving Behaviour, Accident and Offence-Related Meta-Variables: Statistics Tables For Non-Driver Questionnaire Principal Components and Reliability Analyses.	365
Appendix B2	Descriptions of Non-Driver Questionnaire Variables Used In Principal Component, Reliability and Discriminant Function Analyses.	389
Appendix B3	The Examination Of Group Differences Across Driving Behaviour, Accident and Offence-Related Variables: Details of Discriminant Function Analyses On Non-Driver Questionnaire Data.	408
Appendix C1	The Creation of Driving Offence, Behaviour and Attitude Meta-Variables: Statistics Tables For Driver Questionnaire Principal Components and Reliability Analyses.	437
Appendix C2	Descriptions of Driver Questionnaire Variables Used in Principal Components, Reliability and Discriminant Function Analyses.	447

Appendix C3	The Examination of Group Differences Across Driving Offence, Behaviour and Attitude Variables: Details of Discriminant Function Analyses on Driver Questionnaire Data.	460
Appendix C4	The Examination of Group Differences Across Ratings of Skill For 'Self' and 'Others': Details of Analysis of Variance Tests, Means and Standard Deviations.	497
Appendix D1	The Examination of Group Differences Across Variables Measuring The Perceived Seriousness of 15 Driving Offences: Details of Means, Standard Deviations and Analysis of Variance and Tukey HSD Tests.	504
Appendix E1	The Examination of Group Differences Across Hazard Evaluation, Risk-Taking and Risk Perception 'Rating' Variables: Details of Analysis of Variance Tests, Means and Standard Deviations on Interactive Video Data.	531
Appendix E2	The Examination of Group Differences Across Hazard Perception and Risk-Taking 'Interactive' Variables: Details of Analysis of Variance Tests, Means and Standard Deviations on Interactive Video Data.	546
Appendix E3	The Creation of 'Road Environment Awareness' Meta-Variables: Statistics Tables For Reliability Analyses on The Interactive Video Data.	576
Appenndix E4	The Examination of Group Differences Across 'Road Environment Awareness' Meta-Variables: Details of Analysis of Variance Tests, Means and Standard Deviations on The Interactive Video Data.	585

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DEDICATION.

To Andy and Becky,

. . . . for making it all worthwhile.

CHAPTER ONE

INTRODUCTION.

CHAPTER 1

INTRODUCTION.

1.0 OVERVIEW.

Chapter One begins with an outline of the problem of young drivers and their involvement in road traffic accidents, and a summary of some associated factors.

Leading on from this there is an introduction to research on risk-taking behaviours and young drivers. An examination is made of young drivers' accident and violation rates prior to a review of the literature on young drivers risk-taking behaviours. Three main methodological approaches to the study of risk-taking behaviours on the road are defined (observational, survey and experimental), and a selection of studies within each are reviewed.

The following section presents a summary and integration of research into young drivers risk-taking behaviours. The next section presents an introduction to remedial measures aimed at reducing the road traffic accident rate of young drivers. This is followed by an evaluation of studies into driver/pre-driver education and training. Some of the particular methodological problems encountered in the driver education and training evaluation studies are discussed.

The final section outlines the main aims and objectives of the study and the rationale behind it.

1.1 YOUNG DRIVERS AND ROAD TRAFFIC ACCIDENTS.

1.1.1 Outline of The Problem.

Injuries and deaths associated with road traffic accidents present a major public health problem world-wide. A major concern in western countries is the young driver (under 25 years), for whom road traffic accidents are the single most common cause of death (Karp and Williams, 1983; Statistics Canada, 1984; Sleet, 1984; Finn and Bragg, 1986). In great Britain in 1984, 10,229 drivers aged 17-19

years were injured in road traffic accidents compared with 10,810 drivers aged 40-49 (Department of Transport, 1985a). There is proportionately a higher accident severity among younger than older drivers; this is partly explained by the fact that young drivers are involved in many more accidents at night, where casualties are often serious or fatal (Broughton, 1988). Of all demographic groups, the young male driver has the worst accident record. Road accident statistics indicate that younger drivers are involved in proportionately more road traffic accidents and have significantly higher violation rates compared to drivers in older age groups, even when quality and quantity of exposure to risk is controlled (Goldstein, 1972; Johnson, 1972; Mayhew, Donelson, Beirness and Simpson, 1986; Broughton, 1988). In addition to this, accident statistics show clearly that male drivers, particularly young male drivers, are involved in a higher percentage of accidents than female drivers (Hodgdon, Bragg and Finn, 1981; National Accident Sampling System, 1981; Storie, 1977). Some statistics on the accident rates of young drivers, broken down by sex, are presented below.

Research by Broughton (1988) showed that in 1985 accident involvement and casualty rates per driver among young males (17-20 years old) were 2.4 and 3.2 times greater than the average rates for male drivers. For female drivers the rates were 2.0 and 2.4 times greater than the average female rates. In 1985, 1,034 male and 219 female car drivers were killed, while casualties were 55,900 for males and 28,300 for females. When considering the driving population under the age of 64 years, accident rates for female drivers were less than that for males of a similar age. In terms of the types of accident, in 1985 more young male drivers, aged 17-20 years, were injured in single-vehicle accidents than in any other type. In his study Broughton, considered accident data between 1979 to 1985; one associated problem with this was that pre-1982, the only available age data was in pre-coded age categories, thus prohibiting a more detailed analysis by age.

A number of reviews have been published over the last few years (Jonah, 1986, Cameron, 1982, 1983) which have considered young drivers' accident risk and associated factors. It could be expected that young people would be more likely to misperceive and misjudge hazardous road traffic situations due to their inexperience. Importance has also been placed upon the association between youthfulness, sensation seeking, autonomy development and the effect of these factors upon young drivers' acceptance of risk (Douvan, 1974). Research has suggested that drivers aged between 16 and 30 years of age are the most aggressive, inexperienced drivers with the highest

accident and incident rate (MacMillan.J., 1975). Furthermore, evidence tends to indicate that age is the most important variable affecting driver attitudes, and that young male drivers are more competitive, engage in higher speed driving and are more willing to take risks (MacMillan, 1975; Jonah, 1986). It has also been suggested that young drivers are more likely to be involved in accidents due to their over-inflated perception of their own skill (Svenson, 1981). Evidence would suggest that, objectively, young drivers are less skilled in many respects, when compared to their older counterparts (Finn and Bragg, 1986). Overall, young drivers, especially males, participate in more risk-taking, have a higher perceived level of skill and account for a proportionately higher accident-involvement rate than other groups. Unfortunately, in most research on young drivers, the independent and combined effects of age and exposure upon risk-taking are unclear because they are usually confounded in the population under study. A related problem is the often lack of control for years driving experience. This is particularly important when comparing groups of young drivers with older drivers. However, given that age and experience are two highly correlated variables it may be impossible to separate the two.

A further problem in the comparison of studies on young drivers is the varying definitions of 'young' drivers used. The ages that have fallen into this classification in the literature often range from 16 to 25 years, but the sub-divisions used within this are not constant: the varying age ranges of 16-17, 16-20, 18-20 and 18-25 years are often used. The variation in the age range employed is often a direct result of the purpose of the study (school driving programmes, alcohol-impaired drivers etc). In the light of this definition problem, the exact age ranges are given in discussion of all the studies below, where this data has been made available.

The different methodological techniques that have been employed in the study of young drivers have been subject to great variation. Often the same issues have been considered by different researchers, but using different methodologies. This may help to increase the validity of the data, where controlled comparisons can be made, but it also presents a between studies comparison problem.

This chapter will examine the issues of exposure, experience and risk-taking behaviour and attitudes of young drivers, followed by a review of studies which have attempted to evaluate the effectiveness of driver education and training measures, in reducing the road traffic accident rate of young drivers.

The next section below considers the role of exposure in explaining the over-representation of young drivers in road traffic accidents.

1.1.2 Experience and Exposure.

An issue often raised in relation to young drivers is whether their high accident involvement is due to an increased exposure. Studies by Lauer (1952), Burg (1967) and Pelz and Schuman (1971b) indicate that this is not necessarily the case. Pelz and Schuman found that even after exposure (in terms of the number of miles driven) has been taken into account, young drivers still have proportionally more accidents. After controlling for exposure it was found that 16-24 year olds had worse accident rates than 35-44 age group, with the 18-19 year olds having the worst accident rates of all. It has been suggested that novice drivers (16-17 years) are more cautious when they start driving, but after a few years become overconfident about their driving skills leading them into higher risk situations (Brown, 1982). Another study by Schwarz (1960), with a sample of army drivers found that those aged 20 years had a much higher accident rate per 100 million miles driven, than the 21-23 age group or the 24-28 age group. Both Lauer's (1952) and Burg's (1967) data indicate that the accident rate (per number of miles driven) for the 15-24 age group is considerably higher than that for drivers aged between 25-70 years.

Pelz and Schuman (1971) also considered the quality of exposure in their study of 3000 young drivers in south eastern Michigan. They found that there were also many personal characteristics associated with the amount of miles driven. Results indicated that single teenage males did more of their driving after midnight, whereas males aged 23-24 years living with a spouse, tended to drive more miles per year. Single women aged 22-24 years drove more miles than the younger groups, and tended to do more night-time driving than married women. Pelz and Schuman suggest from their data that some of the exposure effects may be as much due to the kinds of people doing the driving, as to the dangers of driving high mileage or driving in certain environments.

In 1963 Penn estimated that in the same year, Californian drivers aged between 15-24 years were over-represented in single vehicle accidents by a factor of 5.15 times their proportion of miles driven.

Lawson and Stewart (1981) calculated the number of

accidents by miles travelled, by age groups. They found that the relative risk of an accident was highest for 16-19 year olds, decreasing thereafter with age.

So far the evidence presented would tend to suggest that young drivers, particularly young male drivers, are statistically over-represented in road traffic accidents even after the quality and quantity of exposure has been accounted for.

The problem of considering the role of driving experience in the risk of an accident is that driving experience and exposure to risk are often confounded (Brown, 1982). Some studies have attempted to separate the effects of experience and exposure. Pelz and Schuman (1971) examined accident and violation rates for individual age groups (by year), controlling for exposure (miles travelled) and experience (years driving). They found that the highest rate of accidents and violations occurred between 18-19 years. They concluded that age was more important in predicting accident risk than experience or exposure.

As driving experience is somewhat correlated with age (Brown, 1982), previous research has suggested that the over-representation of young drivers in accidents is mainly due to inexperience (Harrington, 1972). However, data from a recent study by Laberge-Nadeau, Maag and Bourdeau (1992), does not confirm this hypothesis. Laberge-Nadeau et al (1992) studied the accident-injury rates, age and experience of young drivers in Quebec, using 1985 data from the Societe de l'Assurance Automobile du Quebec. Results from a trend analysis confirmed an age effect on accident-injury rates, independent from an experience effect. They found that there was a high accident rate for drivers under 21 years, peaking at 19 years: the accident rate was fairly stable across years of driving experience. Results showed that for male drivers at the ages 18-19 years, the lowest accident rate was with 0.5 years experience, but increased with greater driving experience, up to 2.5 years experience when the accident rate began to decline again. For women, the safer level is attained in less than two years driving experience. The authors state the fact that a higher driving experience, up to a certain level, is associated with higher accident rates may be an artefact: it may be assumed that drivers with less than one years experience accumulate lower mileage than the more experienced drivers (although this was not tested). From this study Laberge-Nadeau et al concluded that age appeared to have most effect on drivers' accident-injury rates.

While both exposure to accident risk and driving inexperience both influence the accident-involvement of drivers, other variables associated with driver age may

account for the higher accident risk for the younger age groups: the role of risk-taking as such a variable is considered next.

1.2 INTRODUCTION TO RESEARCH ON RISK-TAKING.

The following section attempts to describe research on the risk-taking behaviour of young drivers by categorising the studies in terms of the general methodological approach employed. Firstly, studies examining the general outcome of risk-taking behaviour (i.e. accidents and violations) will be discussed. These studies generally look at large-scale databases where only the minimum amount of biographical information is included. The next category of studies examines observations of actual driving and attempts to relate 'risky' driving behaviour to driver characteristics. In this section some of the studies have attempted to include some information on driver attitudes. Following on from this, large-scale survey studies of driver attitudes and behaviour (including risk-taking) will be examined. The final section reviews research focusing on specific details of risk-perception performed in laboratory settings.

1.2.1 Accidents and Violations.

Accident statistics show that young drivers are involved in proportionally more road traffic accidents than are drivers in older age groups, even when exposure is controlled for (Johnson, 1972).

A study by Pelz and Schuman in the United States (1971), as mentioned earlier, considered the effect of age, sex and driving exposure on the accident and traffic violation rates of a sample of 3,000 drivers. Results indicated that when the effect of annual mileage had been controlled for, younger drivers (16-19 and 22-24 years) still had a higher rate of accident-involvement and convictions for driving offences, than did older drivers (35-44 years). Results relating to the sex of the driver suggested that women had less accidents and committed less traffic violations than did male drivers. The data on accident rates showed that women only had one quarter of the number of accidents as their male counterparts did. However, women also drove 50% less miles per year than the male drivers. In light of the exposure data, it would seem that women have less accidents but as they also drive less miles per year they are not necessarily safer drivers.

An earlier study by Ferdun, Peck and Coppin in 1967 was conducted a study to determine if the accident and violation rates were worse between 16-17 years than between 18-19 years, to assist in determining whether legislation should be changed to raise the minimum licensing age to 18 years. They found no differences in the accident frequency according to age (when exposure was not taken into account), but did find that moving violations increased steadily until 18 years, then decreased. When exposure was included in the analysis, results did show that the number of accidents per mile was related to age, with the older subjects having the lower rates.

The study by Ferdun et al (1967) was extended by Harrington (1971), using the same group of drivers. Harrington's study was a longitudinal study over the first four years of driving, to assess the effects of age and experience on driving record. In his study, Harrington collected data on both driver record and biographical information. The total sample was 13,915, of which males comprised 58.4%. All 16-17 year olds who were licensed in five Californian counties in 1963 were selected. Accident and conviction data was collected from Driver and Motor Vehicle files from 1963-67. In addition to accident and violation files, questionnaires were sent out and personal interviews with subjects conducted. One of the problems with the data collection method used here, is that many minor accidents are not reported to the police.

Results showed that overall, only a minority of subjects did not have an accident in the first four years of driving. Conviction rates increased slightly, or remained constant, in the first three years, and then declined in the fourth year. The average number of accidents showed little change in the first four years of driving. No significant differences were found between the accident means of 16-17 year olds and 18-19 year olds. The findings did not provide evidence to support the raising of the licensing age. However, when adjusted for mileage, the accident rate was found to decrease with increasing age. Harrington argued that "the discrepancy between accident and conviction trends, and the increase in mileage across years without a corresponding increase in accidents, provide evidence that young drivers learn a great deal about accident avoidance with increasing practice, but seem to show little change in attitudes towards traffic laws until their fourth year of driving" (p.234).

In addition to the above results, it was found that speed was the most frequent violation and also the factor most frequently involved in fatal and injury accidents.

Although, the high frequency of speeding would seem to account for it occurring in conjunction with an accident, rather than it necessarily being the most dangerous violation (Harrington and McBride, 1970).

Whereas the above studies have focused largely upon age as a mediator of accident and violation rates, some evidence specifically on the sex of drivers, as well as the type of accident-involvement, is presented by Storie (1977). Storie studied 2,654 accident-involved male and female drivers. Storie analysed accidents in terms of four categories of behaviours involved: driver impairment; errors of perception; lack of skill and the manner of execution of a manoeuvre. Results showed that proportionally there were no sex differences in relation to the total accident rate, but that differences did exist in the contributory factors. Female drivers were found to be twice as likely as their male counterparts to be involved in accidents due to lack of skill, and were also more prone to distraction and often failed to see hazards (errors of perception). The evidence from Storie's research would indicate that as accident-involved females drove less miles per year than accident involved males, the factor of exposure played a central role. Male drivers were more likely than female drivers to be involved in an accident due to impairment. When considering the manner of execution of a manoeuvre, female drivers were more likely to be involved in an accident due to lack of care when undertaking a manoeuvre than males. Storie suggested that this lack of care when undertaking a manoeuvre was also related to lack of skill and experience. On the other hand, male drivers' accidents were more likely to be the result of risk-taking, partly due to driving too fast and overtaking unsafely. Hence, evidence from the male subjects would seem to suggest that accident rates cannot be totally accounted for by lack of skill and errors of perception alone. These results and other evidence would tend to suggest that certain attitudinal components are at play here too.

A further type of accident-involvement that has been considered in accident and violation statistics, is that of driving while impaired by alcohol. Despite the implementation of the Road Safety Act of 1967, which introduced the limit of 80 mg/100 ml of alcohol in drivers' blood, alcohol impairment is still involved in a large number of road accidents in Great Britain, particularly with respect to younger drivers. Research has shown that over 50% of drivers in fatal accidents are intoxicated, that drink-driving is three times more prevalent in men than in women, and is most prevalent in 18-24 year old men (Farrow, 1985). Brown and Maghsoodloo (1981) reported from the National Fatal Accident Reporting System (1977), that the 15-24 year age group accounted for

just under 45% of the fatal accidents in which alcohol was involved in the United States. Lawson et al's (1982) review of studies found that the age distribution of drink-drivers varies between studies, but that the more recent trends are towards a downward shift in the age of drink-drivers. The above selection of research suggests there is a problem of driving while impaired by alcohol, in young, and particularly male drivers.

As can be seen from the above studies, it would appear that young drivers are identified as being over-represented in road traffic accidents and violations, even when exposure has been taken into account. The next section examines some observed driving behaviours that are potentially related to accident and violation involvement.

1.2.2 Observational Studies.

Observational studies of driving behaviour have often been employed in an attempt to relate reported attitudes and behaviour to objective measures of driving behaviour. Several methods of observation are frequently employed in the field of road user behaviour, in-car observational and road-side observational techniques being the most prevalent. In-car observational techniques usually involve one or more observers seated in a car observing the behaviour of a subject driving along a predetermined route, either on the road or on a test-track. This approach is open to observer bias (hence two or more observers allows for an examination of inter-rater reliability), and may have an intrusive influence upon subjects' 'normal' driving behaviour. Road-side observational techniques usually involve an observer (sometimes with a video-recorder) positioned near the side of a road, observing particular driver behaviours/manoeuvre during specified time periods. Problems with this method of observation revolve around the need to infer certain driver characteristics and provide no underlying reasons for the behaviours observed.

This section presents the results of some observational studies into driving behaviour, highlighting those results which pertain specifically to young drivers. The methodologies are outlined and the implications for the results are evaluated.

The first study to be examined employed pure road-side observational techniques, designed to provide objective data on driving behaviours. There were no other methods employed (such as survey techniques) to assess the attitudes or perceptions of these (or a similar sample of)

drivers. In this study Evans and Wasielewski (1983) examined the effects of age and sex, among other factors, upon risk-taking. In one part of this particular study the element of risk examined was the following distance to the vehicle in front that drivers adopted. They observed the following distances of over 12,000 motorists in freely flowing traffic in the United States. The biographical details of the drivers were obtained from state records by tracing the licence plates of the observed vehicles. Results indicated a statistically significant relationship between driver age and headway adopted: younger drivers drove with smaller following distances than older drivers. Overall, they found that younger drivers, driver of newer vehicles, and drivers with more convictions for motoring offences adopted shorter headways. There was not a statistically significant relationship between sex of the driver and following distances adopted.

In another part of the same study, Wasielewski (1984) focused on speed as the variable to assess the level of risk. They found a statistically significant relationship between the age of the driver and driving speeds adopted: the statistical significance of the decrease in speed with age was established by a linear regression, for which $p < 0.0001$. Speed was also noted to increase with the mass of the vehicle and the number of driving convictions. There was no significant sex effect on average speeds when other independent variables which also affect speed were taken into account.

Both parts of the above study would suggest that younger drivers adopted a "riskier" style of driving than did older drivers.

One drawback of these studies resides in the single methodology employed. The use of observational data provided objective measures of driver behaviours, but did not allow the collection of data on the associated attitudes and perceptions, hence risk was defined without reference to intentionality. These studies do not discriminate between deliberate and non-deliberate risk-taking. More direct methods of risk assessment are needed. The level of risk adopted by different groups of drivers was inferred indirectly by the headways and speeds that they adopted. This did not take into account the drivers' subjective level of risk: drivers may have been objectively measured as risk-taking, when subjectively they may not have considered themselves to have been driving dangerously. When considering remedial measures to reduce accidents caused by risk-taking, a distinction needs to be made between deliberate and non-deliberate risk-taking. In designing remedial measures, the subjective measurements of risk and the level of risk acceptance need to be assessed, as opposed to the pure

objective measures obtained by Evans and Wasielewski.

The studies previously cited by Evans and Wasielewski (1983) and Waiselewski (1984) indicated that when driver and vehicle characteristics were taken into account there was no difference between the sexes in terms of risk-taking, but that age was an important factor with the younger drivers adopting riskier styles of driving. However, as stated earlier, from the measures these researchers employed, the intentionality of risk-taking could only be inferred. Additionally, they only measured objective risk-taking on the freeway, and this only represents one part of the total environment in which drivers have open to them to 'display their skills'.

The following study by Wilson (1987) combined the methodologies of in-car observation and questionnaires in examining the role of age and sex upon driving behaviour and attitudes with a sample of 42 drivers. The design of the study was such that the interview and observation data was obtained from the same set of subjects. Results from the in-car observation study indicated that young drivers used safer overtaking strategies than older drivers, and proceeded with more caution in potentially hazardous situations. However, in other circumstances, young drivers were observed to drive in a potentially more dangerous manner than older drivers. These behavioural measures also indicated that male drivers were more likely to drive in a forceful manner in certain situations and were more likely to drive quickly in all situations.

Data from the questionnaires indicated that young drivers rated themselves as being more rash, faster and less compliant than older drivers. There was some evidence from the questionnaire data to suggest that young drivers were more inclined to take risks than older drivers. The results on the sex of the drivers indicated that male drivers were more likely to overtake than female drivers, were more likely to drive quickly and were more willing to take chances when driving. The evidence presented by Wilson (1987) is a more useful indicator providing direct evidence that female drivers are less inclined to take risks than male drivers, than the evidence presented by Wasielewski and Evans (1983). Similar results have been found by Jeffcoate et al (1973), that female drivers are less inclined to take risks when overtaking than male drivers.

Harris (1987) conducted a road-side observational and questionnaire study of driver overtaking behaviour. This study attempted to provide observational data on drivers' overtaking strategies, and quantitative questionnaire data on their associated attitudes and perceptions. It should be noted however, that a different set of subjects were

used in the two parts of the study, hence subject representativeness between the observation and questionnaire studies cannot be assumed. In contrast to Wilson's study, Harris found that young drivers exhibited riskier strategies than did older drivers. In particular, younger male drivers were more likely to use a "third lane" overtaking manoeuvre. This manoeuvre was perceived by all drivers in the sample to be the strategy that was most likely to result in an accident. In line with previous research on risk-taking, it would seem that these young drivers did perceive the risk involved, but that they had a higher risk threshold than other groups which may be influenced by their perceived level of skill. High mileage drivers were also found to be likely to undertake "third lane" manoeuvres, and there was a moderately high negative correlation between age and high mileage. From the questionnaire data, it was suggested that a large proportion of 'third lane overtakers', who were predominantly young, male high mileage drivers, were deliberately engaging in a manoeuvre that they believed had a high probability of resulting in an accident. It may be that if subjects were asked the likelihood of *their* involvement in an accident when undertaking 'third lane manoeuvres', the rating would be much lower. Results such as these, highlight the need for researchers to distinguish between risk for oneself and that for 'other' drivers.

The discrepancy between this study and Wilson's could be due to the possible bias introduced by the very nature of in-car observations: young subjects may have been less likely to over-take in their usual manner with an observer present. A word of caution from Harris's study is also needed though: the age of subjects in the observational study had to be estimated from a road-side video recording of passing cars. The accuracy of this cannot be treated with confidence.

A much earlier study by Quenault, Golby and Pryer (1968) combined in-car observational techniques with a two-fold survey technique (interviews and a card-sort task). Quenault et al employed a four category classification of driver typology in a study contrasting the driving behaviour of a sample of 20 young drivers (under 20 years old) with a sample of 20 old (over 60 years old) drivers. The four fold classification used in this study was produced by Quenault in 1967 and is as follows:-

- (1) Safe - These subjects showed an absence of unusual manoeuvres and non-occurrence of near accidents. These subjects were well aware of the information presented necessary for safe driving and showed anticipation.
- (2) Injudicious - These subjects exhibited unusual manoeuvres and had a high incidence of near accidents. Mirror usage with these subjects was high but not always

appropriate.

(3) Dissociated Active - These subjects also exhibited unusual manoeuvres and had a high frequency of near accidents. In contrast to the above group, these subjects exhibited a low frequency of mirror usage and overtook four times more frequently than they were overtaken. This category of driver also tended to be unpredictable and impatient.

(4) Dissociated Passive - These subjects exhibited unusual manoeuvres and had a high frequency of near accidents, and also exhibited a low frequency of mirror usage, but were overtaken five times as much as they overtook. This category of driver tended to be patient and stolid, and showed a set pattern of driving behaviour which was often divorced from the situation in being.

In the 1968 study (Quenault et al), the drivers drove a set course on public roads with an in-car observer, were interviewed about their attitudes towards various aspects of driving and were required to complete a card sort task. In the card sort task the drivers were presented with 50 cards with statements about various actions while driving. The drivers were required to sort these into three piles: a pile which always applied to the subject; one which sometimes applied; and one which never applied.

Results from the in-car observational study showed that there were no differences between the number of young and old drivers who were classified as either "safe" or "injudicious", but that there were differences in relation to the "dissociated active and passive" classifications. Young drivers were over-represented in the "active dissociated" category, whereas older drivers were over-represented in the "passive dissociated" category. A breakdown of the results showed that the young drivers took less time to complete the course, were more likely to drive faster in 30mph speed limits, and were less likely to have minor lapses while driving than the older drivers. The young drivers also overtook more than twice as frequently as the older drivers did. A word of caution is also required here as the same methodological issue of the introduction of bias through in-car observers mentioned earlier, applies to this study. The presence of an observer in a car may affect the 'normal' driving behaviour of a driver. Research by Baxter et al (1990) provides some evidence that different groups of drivers do drive differently when there is a passenger in a car, and that the observed driving patterns vary according to the age and sex of both driver and passenger. Although many drivers may be used to driving with a passenger (and the effect that this may have on their driving style), very few would be used to driving with an observer. As subjects would be aware that their driving was being observed and assessed, it may be suggested that in

Quenault et al's 1968 study, the subjects reduced the number of perceived risky manoeuvres. It may be that they overtook less than under 'normal' circumstances because they perceived which manoeuvres were 'risky', but did not keep within a 30mph speed limit as they did not perceive a higher speed as 'risky'. However, they may well have reduced the amount by which they exceeded the speed limit while under observation. As such, it may be fair to infer that the negative driving behaviours highlighted by in-car observational techniques, are more frequently displayed under normal circumstances, and possibly that the positive behaviours observed are 'produced' by drivers especially for the observers.

The post-test drive interviews and card-sort task indicated that there were several attitudinal differences between the younger and older drivers. Firstly, young drivers were found to experience frustration more than older drivers. This trait was predominant within the "dissociated active" drivers, which contained more young drivers than older drivers. Secondly, young drivers also expressed pleasure in overtaking other drivers and displeasure in being overtaken. Despite this, some young drivers admitted to feeling nervous and lacking in confidence when overtaking other cars. When describing overtaking manoeuvres, older drivers were more likely to emphasize care than pleasure. When asked about overtaking manoeuvres, 65% of young drivers stated that they often took risks. This may be linked with the finding that they also experience more frustration while driving.

These results would seem to indicate that, at least some of the time, young drivers are willing to take risks in order to undertake certain manoeuvres. The suggestion of deliberate risk-taking from Quenault et al's study has important implications for remedial actions. While education may be effective for some groups of drivers, for others, countermeasures such as increased penalties or increased perceived likelihood of detection or accident-involvement in relation to certain driving behaviours, may be more effective. From the above studies it would appear that for young drivers education would be better aimed at road safety attitudes and the likelihood of (and actual) consequences of certain driving behaviours, rather than a pure skills-instructional approach. Education which places emphasis on the likelihood of accident-involvement, the likelihood of police detection, and the severity of the consequences for particular dangerous driving behaviours, may have more impact upon young drivers' perception of risks associated with driving behaviours.

A later study by Quimby and Watts (1981) presented below, provides rich data on the issue of young drivers and

risk-taking behaviour, as it combines the methodologies of questionnaires and in-car observational techniques with the less used method of simulation.

Quimby and Watts (1981) used in-car observational techniques, a simulated driving task and questionnaires in a study of 60 drivers of various ages, focusing on their attitudes towards driving and other road users. Results from in-car observations and the simulated driving task showed that young drivers chose to drive with smaller safety margins and had longer reaction times to potentially hazardous situations. From these results and those obtained from their questionnaire data, they attributed this to the inexperience of younger drivers in an ability to "read the road". The questionnaire data showed that the younger drivers had some poor attitudes to road safety and that they perceived less risk in any given driving situation. Young drivers were also found to be fairly insensitive to any changes in the level of risk within any given driving situation. In line with earlier research (Schuman, Pelz, Ehrlich and Selzer, 1967), they also found that young drivers were more likely to drive fast in order to "let off steam" than were their older counterparts. It would appear from their research, that Quimby and Watts found similar results from their in-car observational data to their simulated driving task data, suggesting that young drivers do indeed often adopt a 'risky' driving style, and that this may be due to their inaccurate perceptions and evaluations of risk in the road environment. The similar findings from the observation and simulation techniques employed, may provide some evidence for the validity of using certain simulation tasks and methods as a means for data collection.

The next study reported below has examined the issue of drink-driving, an issue not considered by the previous studies. The study presented here by Sabey, Everest and Forsyth (1988) has been included in the 'observational studies' section, as it employs the nearest methodology to an observational technique that can be applied to the study of drink-driving in real-world settings. The observational method used here involved the road-side sampling of drivers in order to obtain breath measurements of drivers' blood-alcohol levels.

Sabey et al (1988) conducted a roadside survey in the United Kingdom into drinking and driving. The experiment was carried out in the spring of 1988 in Sussex and Warwickshire. Subjects were surveyed between 10pm and 3am on Thursday, Friday and Saturday nights over a period of eight weeks. The study was based around questionnaires and breath-tests. The sample included 1,790 males and 684 females, with the following age group distribution: 16-19 years = 215, 20-24 years = 498, 25-29 = 392. Results

showed that out of the sample of drivers who had been drinking, 72.4% were men, and out of the sample of drivers who had drunk over half the legal limit, 83.3% were men. Drivers under 20 years and over 60 years were under-represented in those over the legal limit (2.8% and 0.0% respectively). The proportion of drivers from the 25-29 age group, and to a lesser extent, the 30-39 age group, who were over the legal limit were high in comparison with other groups as a whole.

These results indicate that the risk-taking behaviours of young drivers (those under 25 years, and especially those under 20 years) in the area of drink-driving, is less than that displayed by their older counterparts. The attitudes and perceptions of young drivers in relation to drink-driving is considered again in more detail in the next section concerned with 'survey methods'.

Overall, from the evidence presented by the above 'observational' studies into risk-taking and young drivers, it would appear that young drivers tend to drive in a potentially more dangerous fashion than older drivers, and as a result are over-represented in road traffic accident statistics. Evidence has been presented by: Evans and Wasielewski (1983) to suggest the young drivers (and in particular young male drivers) are more likely to exhibit risk-taking than other groups (in terms of following distance); Harris (1987) to suggest that young drivers adopt more dangerous overtaking strategies; Quimby and Watts (1981) to indicate that young drivers drive with smaller safety margins, and take longer to recognize potential hazards; Quenault et al (1968) to suggest that young drivers were more likely to drive faster and to overtake more frequently. However, in terms of drink-driving behaviour, the observational study by Sabey et al (1988) suggests that drivers under 25 years (and in particular those under 20 years) are less likely to be impaired due to alcohol than older drivers.

All of the above studies have employed observational techniques in the process of data collection on driving behaviours (and some have supplemented this with survey and simulation techniques). The observational data can be used to provide objective measures of driving behaviours, while the survey data assists in providing some insight into the reasoning behind these behaviours. As can be seen from the above observational studies, the more informative information is provided where extensive interviewing was also performed on the driver. This is because not only does one wish to identify undesirable behaviours, but psychological researchers should also examine underlying reasons for these behaviours. The following section reviews large-scale survey studies on reported behaviours and related beliefs.

1.2.3 Survey Studies.

Survey studies, generally the most popular method of investigating road user behaviour, often involve the use of self-completion questionnaires or structured interview techniques. One of the main disadvantages of survey methods in the field of road user behaviour lie in their ability to accurately measure reported behaviours: the validity of reported behaviours may be open to question. Repetition of behavioural items in a questionnaire may be desirable to allow an examination of inter-item reliability. The advantages of survey methods include the ability to obtain a large sample size relatively quickly and cheaply; the ability to obtain high quality and quantitative data, and the facility to provide complementary attitudinal data to observational data. The data generally created by survey methods is designed to be quantitative in nature to allow the statistical analysis of the relationships between variables (e.g., between age, exposure and reported driving speeds). As survey techniques allow the quantification of attitudes, perceptions and judgements in relation to driving behaviour, they also provide a potential method of interpreting the driving behaviours quantified through observational or laboratory studies. The studies presented below have been selected for the information they provide on the driving-related attitudes and perceptions of young drivers.

Schuman, Pelz, Ehrlich and Selzer, (1967), surveyed 288 young single male drivers, aged 16-24 years. Each subject was interviewed on a variety of issues relating to driving behaviour, including risk-taking and accident involvement. The number of subjects who admitted to 'daredevil' driving practices declined as the age of the subject increased: the proportion of the sample admitting to 'daredevil' practices declined from 40% at the age 16 years, to 15 % at the age 24 years. Thirty percent of drivers aged 16 years admitted to deliberately taking chances when in a car with friends, while only 12% of drivers aged 24 years did. While 40% of 16 years olds admitted to driving fast to 'let off steam' after an argument, only 15% of 24 year olds reported doing this. There was also a slight decrease in frustration experienced while driving (e.g., red traffic lights, slow moving traffic) as the age of the driver increased. Forty percent of 16 year olds reported frustration, while only 30% of 24 year olds did. This study showed that overall there was a decline in the influence of these "emotional/impulse expression" factors contributing to drivers risk-taking behaviour as age increased. These "emotional/expressive" factors were also

found to be related to the frequency of road traffic accidents and convictions for motoring offences. Schuman et al also found that self reports of moderate to heavy drinking peaked between the ages 21-22 years. Personal problems were found to emerge for subjects between the ages 16-18 years and again between 21-22 years. They found that around the ages of 21-22 years, personal problems often emerge, moderate to heavy drinking is often engaged in and the car is often used as an outlet for expressing impulses.

Schuman et al also found that with an increase in age there is a decline in use of the car to express these impulses, but that this is accompanied by a decrease in anxiety about driving; that is, there is an increase in their confidence about their driving ability. They interpreted the decline in reporting of "close-calls" with an increase in age, as an indication of a lessening in awareness of potential hazards in road traffic situations. Older drivers reported being less worried about driving under tension and admitted to taking more chances. As age increased, so did reporting of driving after drinking, indicating an increase in confidence in their ability to handle drink. No clear connection was measured between accidents and measures of driving confidence.

An earlier study by Preston and Harris (1965) is of interest here, because although it does not consider the effects of age, it does examine the effect of accident history upon subjective levels of skill (which may be seen as one measure of driving confidence), as one method of performance feedback to drivers. In 1965, Preston and Harris carried out a study with two groups of drivers, 50 with severe accident histories, and 50 with accident free histories, but matched across relevant variables. Despite the differences in accident histories, there were no differences in how the two groups rated their skill with respect to other drivers. These results would seem to indicate that drivers have difficulties learning from driving experiences, as one would have assumed that the drivers with the accident histories would have tended to have rated themselves as lower in driving skill in relation to other drivers. Similarly, MacMillan (1975) found no association between accident-involvement rate and an anxious attitude towards driving. This supports the argument put forward by Whitlock (1971) that accidents are not taken seriously by drivers and hence they do not learn from them. Whitlock argued that (1) accidents are believed to be events that happen to other people, (2) drivers believe that they are in control of the car and can get out of any difficulty that they meet, and (3) drivers who take chances usually get away with them, as the road is usually a forgiving environment, and so risk-taking is rewarded rather than punished. If drivers

believe themselves to be more skillful than others, they may engage in greater, or more frequent, risk-taking. Also, drivers who believe themselves to be safe, may not pay sufficient attention to road safety information directed to drivers in general, as these drivers consider themselves to be safer and less risky than most other drivers.

The next study, by MacMillan (1975), is reviewed as it employed survey techniques to examine attitudes and reported driving behaviours with a wide age-range of drivers. MacMillan (1975) in his book 'Deviant Drivers' examined the attitudes and reported behaviours of drivers in a study of 638 male and 168 female drivers. The age range of the drivers was between 16-50 years (with the following age bands employed: 16-20, 21-30, 31-40, 41-50 and 51 or over). The findings pertaining to young drivers which have been reported by MacMillan will be highlighted. The study was based on data obtained from a large survey. One section of the questionnaire contained twenty four items which he defined as relating to aggressive approaches to driving. MacMillan defines a high score on this set of twenty-four items as indicating an aggressive approach to driving, but goes further to say that this also defines a driver who takes risks and who has little respect for the rules of the road. Four main areas of results will be considered here: aggressiveness, competitiveness, speed, perceived seriousness of driving offences.

Results from MacMillan's study indicated that male drivers were significantly more 'aggressive' than the women drivers in the sample. Only 14.3% of women compared to 30.1% of men were defined as aggressive. He breaks this 'aggressive' label down into 'willingness to take risks' and 'carefulness', and suggests that the sex differences displayed are of no surprise due to the traditional role expectations of men and women in society. Of particular interest are the findings that amongst men, but not women, an aggressive attitude was significantly related to age and driving experience. When age was accounted for, the differences due to driving experience almost disappear. Age would seem to be an important variable affecting driver attitudes. Results showed that the level of aggressiveness in both men and women declined with age. These findings complement other findings in his study that young drivers are more competitive, as well as the findings of other researchers that young drivers are more impulsive and willing to take more risks (Jonah, 1986; Quimby and Watts, 1981; Schuman et al, 1967).

The study also focused on speed as one aspect of risk-taking. Subjects were asked what the fastest speed was that they would be prepared to drive at on a straight

open road, and on a narrow winding country lane. Results showed that significantly more men than women drove fast on both open and narrow roads. The reported speeds declined in a linear relationship to the drivers age. MacMillan warned for some caution in the interpretation of the results however as he found that subjects were responding with their usual or normal speeds, as opposed to their fastest speeds. Drivers were no doubt affected by the knowledge of speed limits when responding to questions on speed: it may be suggested that their reported speeds reflect a somewhat conservative estimate. The analyses also took into account the effect of exposure: after controlling for exposure there was still a significant age effect on speed levels. The main age differences occurred between those aged between 16 and 40 years and those over 41 years in male drivers. When examining the relationship between accidents/convictions and speed, age was controlled for. Results showed that high speed driving on both open roads or country lanes (over 70mph) is significantly associated with both accident involvement and motoring convictions for all age groups and both sexes. There were no significant differences between the age groups for those who reported driving over 40mph (but less than 70mph) in terms of their relationship to accident involvement or motoring convictions.

Drivers' ratings of the seriousness of driving offences were also examined. Women rated both driving and non-driving offences as more serious than men, with the exception of driving without insurance. In terms of age effects, results indicated that the youngest male drivers were significantly more tolerant of moving motoring offences than other groups. These young males, as noted earlier, were also more aggressive, competitive and faster than other groups.

MacMillan's results would tend to suggest that a combination of youthfulness, inexperience, competitiveness and aggressiveness could be a dangerous combination on the roads. Accident statistics have already shown that young drivers are over-represented in road traffic accidents (Broughton, 1988).

From MacMillan's study the powerful influence of sex and moreover age, are most apparent. Age and sex are more strongly associated with driver attitudes than either accident or motoring conviction history.

The following study by Jessor (1984), which also employs quantitative survey techniques, examines the view that the pattern of driving behaviour of young people can be seen in the context of their behavioural patterns in general.

Jessor (1984) in his 'Problem Behaviour Theory' presents a social-psychological approach to the study of problem driving behaviours of young people. Problem Behaviour Theory considers problem behaviours as functional in the attainment of goals. The explanation of problem driving behaviour rests upon the psychological, social, and behavioural characteristics of the adolescent, relevant dimensions of the social environment, and the attributes of the situation in which the behaviour takes place. Jessor argued that the risk-taking behaviours of young drivers are employed to express opposition to authority, to gain independence and control over one's life, to cope with anxiety, fear of failure and frustration, to project the right image to peers, and to demonstrate 'maturity'. The high offence and accident rate of young drivers reflects one aspect of a general health-risk behavioural syndrome among the young: risky driving is part of a larger syndrome of adolescent problem behaviour.

Jessor (1987) applied his Problem Behaviour Theory to his analysis of data on 1800 high school male and female students in the USA, where he again suggests that risky driving behaviour can be seen as part of a larger pattern of adolescent problem behaviour. In his study he employed a 29-page Health Behaviour Questionnaire which contained some items that related to the social psychology of risky driving among adolescents. Of this total sample of 1800, Jessor reports some specific results on the 150 males and 218 females in the sample who had been driving for 6 months or longer (and who were 16 years and 6 months or older). Jessor does not specify the upper age-range limit of the drivers: however, as all subjects are high school students it may be assumed that the upper age limit is approximately 19 years.

In the data analysis, Jessor used a single general risk-taking item which was designed to examine conscious and intentional risk-taking while driving. Results from the general risk-taking item showed that a large number of respondents, 60% of males and 33% of females, reported engaging in risk-taking while driving 'for fun', at least once or twice during the last 6 months. A greater distinction is made between males and females when considering subjects who had engaged in risk-taking 'three times or more', with a reported 31% of males and only 7% of females. A word of caution is needed here, as the item used in this analysis was a single question taken from a seven-item Risk-Taking Scale, thus the reliability of the item is unknown. A problem with the total sample of 1800 students who participated in this study, was that a large number of respondents were either too young to hold a driving licence, or had not held it for at least 6 months (the time period in question). Thus the sample used in the analyses reported above and below were

restricted to 150 males and 218 females.

Jessor reported a significant correlation between the risky driving item and the total score of the remaining 6 other items in the Risk-Taking Scale (none of which dealt with driving). For males the total item-total score correlation was 0.51 and 0.42 for females (representing a significant amount of shared variance), indicating that risk-taking while driving is part of a larger pattern of behaviour involving deliberate and intentional risk-taking for fun or thrills in other areas of behaviour and in interpersonal relationships.

Considering Jessor's data on 'problem drinking' he found that among the respondents who answered 'never' to the risk-taking while driving item, the percentage was 16 for males and 15 for females. In contrast, those who answered 'more than three times' to the risk-taking while driving item, the percentages for problem drinking were 40 for males and 38 for females.

In summary, from the above results, Jessor suggests that risky driving (as measured by his single item) can be seen as part of a larger pattern of adolescent problem behaviour, and is not limited to the sphere of driving. Jessor states that risk-taking while driving is a reflection of a more general tendency towards thrill-seeking through taking risks in other areas of life. He suggests that young drivers disregard objective risk as they engage in deliberate risk-taking while driving. He argues that prevention/intervention efforts in the area of road safety may be more effective if focused at the level of lifestyle, rather than restricted to the specific behaviour of driving.

Thus, the research findings of MacMillan and Jessor presented above, paints a picture of the young driver as being aggressive, risk-taking, inexperienced, competitive and more likely to be involved in a road traffic accident than their older counterparts. Some differences have been acknowledged between males and females, but age is still shown to be the most important factor even when exposure is accounted for. Explanations by the above researchers for the reported attitudes and adopted driving styles, which relate to a disproportionately high accident rate, have focused on socialisation and cultural influences and the position of young people in society today.

The next six studies to be reviewed have employed reviews of government statistics or survey techniques to assess drivers' attitudes and reported behaviours in relation to drink-driving. The first study to be examined is that by Clayton (reported in two separate papers).

The work by Clayton, McCarthy and Breen (1980) on drink-driving behaviour and its correlates, included an analysis of the attitudinal and perceptual factors that are associated with drink-driving. They surveyed 1,032 male drivers/riders with drink-driving offences in Birmingham during an 18 month period from January 1976. The male subjects were aged between 16 and 59 years (although the total number of subjects under 20 years of age was only 49). Results indicated that 90% percent of offenders were car drivers, while 24% of the offenders were also under 25 years. Furthermore, it was found that the under 20 years and the 20-24 age group had lower BAC's (blood-alcohol concentrations) than those aged thirty years and over. The mean BAC for subjects under 24 years was 153/100ml, compared with 187mg/100ml for the 30-49 year age group.

In 1982, Clayton, McCarthy and Breen examined the drink-driving attitudes and behaviours of 388 male drivers aged between 16-59 years. They found the following series of factors to be related to drink-driving: a disregard for the legal limit; a perception of an ability to exceed the legal limit and still be safe to drive; little social pressure against drink-driving; and a low perception of the seriousness of drink-driving as an offence (compared to how it is treated by law). At least two of these factors relate to similar attitudes reported to be prevalent among young male drivers: firstly, inflated perceptions of their driving skill (Finn and Bragg, 1986), and secondly, the rating of driving offences as less serious than other groups of drivers (Brown and Copeman, 1975). Unfortunately, the above variables relating to the offence and attitudes towards it, were not examined by age and sex, as they related to drink-driving.

In summary, it would appear from Clayton's research that a large minority of drink-driving offenders are under 25 years of age, and that this behaviour is related to perceptions of self-skill and the offence. The next study, while considering the self-reported drink-driving behaviour of young males (under 25 years) in the United Kingdom, also provides some data on the factors associated with the drink-driving offender.

In 1987, Guppy reported interview results with 261 male-only drivers under 25 years (as part of a larger study) with respect to drink-driving attitudes and behaviour. Results showed that 24% of the male drivers under 25 years reported drinking over the legal limit at least once within seven days prior to being interviewed.

Data from the larger study shows that the under 25 year old group are not dissimilar to those between 25 - 29 years with respect to drink-driving, as 24% of subjects

from the 25 - 29 age group also reported to have driven after having consumed enough alcohol to put them over the legal limit. Results for subjects' drink-driving behaviour decline thereafter with age: 30-49 years showed 18%, while those aged fifty-plus showed 6% admitting to drink-driving. Further analyses indicated that drink-driving offenders had a higher mean estimate, than non-offenders, of the amount of alcohol that they perceived they could consume before their driving would be affected. The offenders also had higher mean estimates of the amount of alcohol that would have to be consumed by the 'average driver' to reach the legal limit. Subjects in the 'offender group' were also found to have a lower perceived likelihood of detection on a given drink-driving occasion, and were found to consume more units of alcohol away from home per week, than were those in the non-offender group.

The fourth study in this area to be examined has provided some evidence to suggest that a growing proportion of young female drivers are drink-driving (Popkin, 1991). Statistics show that in America 49% of traffic fatalities involving 15-19 year olds are alcohol related, as are 66% of those of 20-24 year olds (NHTSA, 1987). The review of data for North Carolina by Popkin (1991) suggests that while overall alcohol involvement rates in fatal crashes has been declining in recent years, the problem of drink-driving in women aged 21-24 years has not. There are statistics provided by the United States Fatal Accident Reporting System to support this (Fell, 1987). Popkin's study revealed that between 1976 and 1985 there have been the following increases in drink-driving among young female drivers: for females under 18 years there has been an increase of 29%, while for females aged 18-20 years there has been an increase of 33%. In comparison there have been decreases in drink-driving within the same age-groups of the male driver population. These results tend to suggest, that in parts of America at least, drink-driving is not a 'male-only' problem.

The fifth study into drink-driving attitudes to be reviewed, examines a wider range of attitudes and perceptions associated with the drink-driver offender. Farrow (1987) conducted a questionnaire study of one hundred and fifty-three 16-19 year old drivers. Results indicated a large difference between drink-driving offenders and non-offenders in their attitudes towards driving and drinking behaviour. Results showed that offenders, more than non-offenders, associate alcohol with social events, play drinking games, drive fast to resolve stress, more often drink prior to driving, and are less likely to rely on parents when faced with a situation of having to drive home intoxicated.

A more recent study by Martens, Ross and Mundt (1991) examined young drivers' evaluation of driving impairment due to alcohol. In this study 96 psychology male/female students aged 18-20 years (from part of a larger sample) were divided into three groups - abstainers/light drinkers, moderate drinkers and heavy drinkers. Subjects from each group were asked to rate the importance to safe driving of three driving components (attention, control/manoeuvring, and emergency responses). These young drivers did not consider the three components to differ in importance for safe driving when alcohol was not involved. However, the components were considered to be differentially impaired by alcohol: emergency responses was the component considered to be most effected by alcohol. It was shown that the group of heavy drinkers judged alcohol to be less impairing, except in emergency situations, than the other two groups. The greater perceived impairment of emergency responses, appears consistent with Finn and Bragg's (1986) finding that young drivers view driving situations requiring personal skill and control, to be less risky than those involving elements of surprise (resulting from chance events, or the actions of others, not resulting from one's own skill).

The next study reported here is of particular interest as it focuses on an even lower age range, the pre-driver, and his/her attitudes towards drink-driving.

Diblasio (1988) reported a self-completion questionnaire study in America that focused on attitudes towards drink-driving and riding as a passenger with a drunk-driver, in a sample of 384 respondents, 49% male, aged 15 years or less (he does not report the lower age limit). Results indicated that (a) young people aged 15 years and under, reported experiencing temptation to ride as a passenger with an older drinking motorbike rider, and (b) that teenagers were aware of the dangers involved when a driver drives a car when under the influence of alcohol, but that they often believe that the negative consequences will not happen to them. If these results are held to be true then they may partly explain why advertising and educational campaigns do little to deter such risk-taking behaviour.

Results also indicated that 69% of the pre-driving subjects in his sample admitted to, at some time, having ridden in a car with a drinking driver, and 21% of subjects reported regularly riding as a passenger on a motorbike with a drunk driver. In a previous study in 1986, Diblasio found that 78% of high school students (ages not reported) reported to have ridden as a passenger on a motorbike with a drinking driver at some time, while 36% reported having done so on a regular basis. A methodological point needs to be made here: obviously,

defining this behaviour as 'regular' tells us nothing of the frequency. Within this group of high school students, he found no sex differences on this variable. The older subjects in the sample, reported riding with a drinking driver more frequently than did the younger subjects (no specific details on age groups were provided). These results would tend to suggest that the pre-driving period is a significant time when young people develop the behaviour of riding with a drinking driver, and that as age increases so does the behaviour.

Further, Diblasio stated that he found a positive correlation between the occurrence of young people drink-driving and riding with drink-drivers, and the drink-driving behaviour of the subjects' parents. Hence, this data provides some evidence for the claim that children may learn drink-driving behaviours at an early age from their parents. The results from Diblasio's study are not reported fully enough to check the correctness of these assertions.

From the 1986 and 1988 studies, Diblasio offers the conclusion that older subjects (from a high school population) have more firmly developed normative definitions of drink-driving behaviour than the younger subjects (15 years and below). Diblasio suggests that the effects of positive reinforcement, and modelling of peers and adults, are important in explaining drink-driving and being a passenger of a drunk-rider. In terms of prevention, it might be easier to change these not yet fully developed normative definitions of the younger students, if only because they can be considered a 'captive' audience for school-based educational programmes, as opposed to older peers who are near to leaving school.

Overall, results from the above drink-driving studies have indicated that: drink-driving offenders under 25 years have lower BAC's than those aged thirty years and over (Clayton, 1980,1984); a large proportion of pre-drivers admit to having been a passenger with a drunk driver or rider (Diblasio, 1986,1988); a large minority of male drivers under 25 years reported drinking and driving over the legal limit (Guppy, 1987); that drink-driving in young females is becoming an increasing problem in some parts of America (Popkin, 1991), and that there are a number of identifiable attitudes and perceptions associated with alcohol consumption and drink-driving behaviour (Clayton, 1984; Guppy, 1987; Farrow, 1987; Martens et al, 1991).

From the above review of survey studies, results have indicated that young male drivers are significantly more tolerant of moving motoring offences than other groups (MacMillan, 1975), and that one of the characteristics

associated with the offence of drink-driving is a low perception of the seriousness of the offence (Clayton, 1984). The next study to be reviewed has examined the perceived seriousness of driving offences in more depth.

Brown and Copeman (1975) compared drivers' attitudes towards 31 road traffic offences. Two hundred and twenty-four subjects (including both sexes) across a wide range of ages were employed in this study. Subjects were required to rate the seriousness of offences on a scale of 1 (not serious) to 10 (very serious). The ratings were designed to measure the dangerousness of driving behaviours in terms of their likelihood of having extreme consequences. Seriousness was assessed on the assumption that the offence was committed with intent. Results indicated that there were no sex, age (18-25 years versus 35-55 years), or interaction effects for the overall rank ordering of offences. The three most highly ranked offences were 'failing to stop after injuring another road-user', 'overtaking where visibility is obscured', and 'driving with BAL (blood-alcohol levels) more than 50% over legal limit'. The lowest ranked offence was 'exceeding displayed speed limit by between 10 and 20mph'. However, there were significant age-sex interaction effects on the absolute ratings of seriousness of offences. Young male drivers rated offences as being less serious than did young and older female drivers and older male drivers. Overall, young drivers (of both sexes) rated offences as less serious compared to the older drivers (of both sexes).

These results are in line with those of MacMillan (1975), that young male drivers have a lower perception of the seriousness of driving offences than other groups of drivers.

The above research in the 'survey' studies section presented so far has suggested that a large proportion of young drivers not only engage in dangerous driving practices (MacMillan, 1975; Diblasio, 1988; Guppy, 1986), but also engage in deliberate risk-taking behaviours (Schuman et al, 1967; Jessor, 1987). Some evidence has been presented to suggest that participation in risk-taking behaviours may be linked to the young drivers' perception of their skill (Clayton, 1984). The next series of studies to be presented develops the issue of young drivers' perceptions of their driving skills and their perceived likelihood of accident-involvement, to see if these perceptions can assist in explaining the attitudes and reported behaviours revealed so far.

Svenson (1982) conducted a study to assess whether people have a correct perception of their own skill and risk-taking behaviour, in comparison to others. Svenson

aimed to replicate an earlier study by Naatanen and Summala (1975) (which found that between 70-80% of drivers reported themselves to be safer than the average driver), but to provide subjects with a more well-defined population of drivers whose characteristics, at least partly, were known to subjects. Svenson's study contained 161 student subjects, 81 of whom were American (median age of 22 years) and 80 who were Swedish (median age of 33 years). Half of the sample in Svenson's study were asked to judge their skill in driving, and the other half were asked to judge how safe they were as drivers. Most subjects rated themselves as safer and more skilful drivers than the rest of the group (subjects compared themselves to other subjects in the experiment). Svenson's results suggest that some drivers may have an inflated perception of their own driving skills and how safe they are as drivers when compared to other drivers in general. This mis-perception may very likely play a part in the risk-taking behaviour of many young drivers. However, although results indicated the younger American sample considered themselves to be more skilful and safer than the older Swedish sample did, it is not possible to determine whether this is an age effect, or a cultural difference.

Another limitation of Svenson's study, and one rather critical to this review, is the lack of information on the age range of subjects. The only information given are the median ages (22 and 33 years), which provides no useful information about the age range of the sample. Despite this methodological criticism, the study has been included in this review as useful research in the general field of risk-taking, which may have some applicability to young drivers.

In summary, Svenson suggested from his study that the inaccurate perception which young drivers hold of their driving skill, may be related to the risk-taking behaviour of these young drivers. The hypothesis that risk-taking is somehow linked to confidence in one's driving skills, was considered to some degree by Spolander (1982).

Spolander (1982) found evidence to suggest that younger drivers' perception of their skill increases proportionately faster than that warranted for their experience. Newly licenced drivers perceived their skills to be inferior to that of the average driver, but after three months experience this rating rose to a level where these drivers rated themselves as superior to those of the average driver. Spolander also found that drivers who rated their driving skills higher, also reported engaging in risk-taking behaviour, in terms of faster driving and a higher frequency of overtaking, than other road users.

Groeger and Brown (1989) conducted a study in which they attempted to replicate the findings of Svenson (1981). Groeger and Brown employed 54 subjects, divided into three age groups with mean ages of 24.5 years, 39.6 years and 57.7 years. It should be noted that the sample sizes within each mean age group were small, each containing only 18 subjects (9 males and 9 females). Subjects were asked to rate their skill in relation to others in their target age group, using a percentile scale, on 10 dimensions. Two of these dimensions were the same items used by Svenson, which asked subjects to provide ratings in terms of how skilful they are as drivers, and how safe they are as drivers. Results showed that while there were no age group differences on any of the 10 dimensions, subjects tended to rate themselves overall more positively than members of their own age group. These findings led Groeger and Brown to argue that these 'positive-self' results are artefacts: that is subjects do not respond accurately, but attempt to present themselves in a positive light to the experimenter. Another facet to the same study required subjects to provide ratings for themselves and the 'average driver' on a variable analogue scale. Using this scale subjects were required to place a mark on a line of given length (from 'never' to 'always'), to reflect their perception of themselves and others on a particular dimension. Results showed that some significant differences between the age groups in their ratings of other drivers (e.g., disassociated and timid) disappeared when exposure and/or experience were accounted for. The only differences which could be purely attributed to age, were in terms of the rated indecisiveness of other drivers. When experience was taken into account young drivers rated their driving as less 'smooth' and more reckless than older drivers. While some sex differences were also found, these largely disappeared when driving experience was taken into account. So, from Groeger and Brown's study it can be seen that drivers do rate themselves as safer and more skilful than other drivers, but that many age effects associated with driving attributes disappear when experience and/or exposure is accounted for, when subjects are classified into these specific mean age groups.

McKenna, Stanier and Lewis (1991) also examined drivers' perceptions of skill for 'self' and 'others' in an attempt to address the issue of a 'positive-self' bias, as proposed by Groeger and Brown (1989). McKenna et al conducted a questionnaire survey of 99 male and female subjects, between 18-68 years of age, all of whom were staff or students at Reading University. Results showed that drivers of all ages, and of both sexes, judged their own skills as superior to those of the average driver, across a wide range of skill scenarios. As drivers generally rated 'other drivers' skill as being above

average, but their own skill as even higher, the authors suggest that these results are more consistent with a 'self-enhancement' bias, rather than a 'negative-other' bias. As these results were anonymous, the authors argue that this provides evidence against the 'positive-self' bias explanation offered by Groeger and Brown (1989), that drivers were seeking to represent themselves in a positive light to the experimenter. As the authors point out, if inflated judgements of subjects' own driving abilities do solely reflect a desire to create a positive image, it is not clear how or why these self-ratings should be sensitive to weekly exposure or experience. So, from the studies of both Groeger and Brown (1989) and McKenna et al (1991), it would appear that there is recent evidence that drivers still hold inflated perceptions of their driving skill and safety, but that this may also be related to the number of miles driven per week and the number of years a driving licence has been held.

The question of driver perception of the likelihood of accident-involvement has also been considered by other researchers (Finn and Bragg, 1986; and Sivak et al, 1989) using multi-methodological approaches.

Finn and Bragg (1986) conducted a study in which three different methods of estimating the risk of accident involvement were used to compare risk estimates of young and older male drivers. The methods employed were: a 33-question closed-ended questionnaire designed to evaluate subjects' perceptions of the likelihood of accident-involvement; ratings of the riskiness of 10 specific driving situations as illustrated in 10 still photographs; and ratings of the riskiness of fifteen videotaped driving situations. The first phase of the study which employed survey techniques will be considered in this section, while the second two phases which employed still photographs and videotaped scenes will be considered in the 'laboratory studies' section.

Ninety-three subjects were included in the sample, 45 between the ages of 18-24 years and 48 between the ages of 38-50 years. The main aim of the study was to compare the risk perceptions of young male drivers with those of older male drivers. Finn and Bragg justify excluding female drivers from the study due to the fact that the high accident rate for young drivers is primarily a high accident rate for young male drivers (Hodgdon, Bragg and Finn, 1981).

One of the first tests in the study required subjects to provide an estimate of the total number of drivers involved in road traffic accidents in a given area in the last year. Results showed that young drivers gave higher estimates than did older drivers, indicating that young

drivers see driving as more dangerous than older drivers. Also, it was found that estimates provided by older drivers were more variable than those of younger drivers: this may be partly explained by the fact that the older subjects were less homogeneous in terms of their driving experience than the younger subjects.

Following this, subjects were asked to rate the perceived likelihood of an accident for themselves, for other members of their peer group and for members of an older/younger age group, in the next 12 months. The table of results presented by Finn and Bragg (1986) indicated that both young and older males estimated that young drivers had a higher likelihood of being involved in an accident in the coming year than older drivers. However, young drivers estimated their own chances of being involved in an accident as significantly lower than the chances for the average young male, while older drivers estimated their chances of being involved in an accident to be comparable to those of other older male drivers. These results would seem to indicate that while young drivers recognize that their age and sex is at greater risk of accident-involvement than are older male drivers, they perceived their own risk to be significantly lower than that of their male peers.

Finn and Bragg suggested that the discrepancy between the young driver's low perceived likelihood of an accident and the objective likelihood reflected by accident statistics, was partly due to the over-inflated perception of their own skill in relation to all other drivers. They suggested that young drivers perceived that firstly, they were more skilful than older drivers, and secondly were better able to avoid an accident.

A later study by Sivak, Soler and Trankle (1989) also examined drivers' ratings of skill for themselves and for the 'majority of drivers'. Sivak et al undertook a series of three studies as part of a larger research project into cross-cultural differences in driver risk-taking behaviour. The studies looked at driver self-assessment (measured using a questionnaire), driver risk-perception (measured with the use of colour slides) and driver risk-taking behaviour (measured through a simulation task). The study employing survey techniques will be considered in this section, while the two studies employing slide and simulation techniques will be considered in the 'laboratory studies' section.

All three studies were undertaken across the following countries: United States of America, Spain, West Germany and Brazil. The studies involved drivers in age groups 18/19-21 years, 35-45 years and 65-75 years, and were almost equally divided according to sex. The sample size

employed in the questionnaire study into driver self-assessment was 180.

Results from the study into driver self-assessment indicated that although most subjects viewed themselves positively, subjects in the oldest age group viewed their driving most positively, followed by those in the middle age group, with the younger subjects last. The scales that the subjects rated themselves on were: predictable, safe, relaxed, wise, considerate, responsible and driving skills. Results showed that the biggest difference was between the youngest group of subjects and the two older groups. There was a high correlation between age and experience ($r=0.83$); after the effects of driving experience were controlled for, significant age effects only remained on the 'wise' and 'considerate' scales. However, what may be considered to be a positive self-assessment may vary between subjects according to the subject's age and associated attitudes and values.

Sivak et al also reported that drivers in all countries assessed themselves more positively on their driving skills than they did for the 'majority of drivers': no details were given about the individual age groups. Previous studies (Svenson, 1981; McCormick, Walkey and Green, 1986) have also indicated that drivers tend to rate themselves as more skillful and less risky than the average driver.

Overall, it would appear from the above 'survey' studies research that young drivers are competitive, aggressive and engage in risk-taking behaviours (Schuman et al, 1967; MacMillan, 1975; Jessor, 1987); that a large minority of drink-driving offenders are under 25 years of age (Clayton, 1980); that young drivers perceive a range of driving offences as less serious than other groups (Brown and Copeman, 1975; MacMillan, 1975); that there are a number of identifiable attitudes and perceptions associated with drink-driving behaviour (Clayton, 1984; Guppy, 1987; Farrow, 1987); that young drivers may be involved in more road traffic accidents, partly because of some deliberate risk-taking (Schuman et al, 1967; Jessor, 1987), and partly due to a mis-match between their perceived level of skill and actual level of skill (Svenson, 1981; Spolander, 1982; Finn and Bragg, 1986; Groeger and Brown, 1989; McKenna et al, 1991). The over-optimistic view that young drivers hold of their driving ability may not only increase their risk-taking behaviour, but may also explain why general media propaganda is unsuccessful: these drivers may not identify with those who are in need of instruction.

All of the above studies have employed survey techniques in the process of data collection on driver attitudes and

perceptions. This survey data is valuable in providing some explanations for the objective measures of driving behaviour reviewed earlier. Some of the studies reviewed in this section have employed a multi-methodological approach: the laboratory methods used by these researchers are examined in the next section on 'laboratory studies', and the degree of integration of the survey and laboratory results will be considered.

1.2.4 Laboratory Studies.

Laboratory studies of driving behaviour have often been employed in an attempt to provide data (behavioural and judgmental) on simulated road traffic situations. Methods frequently employed in laboratory studies of driving behaviour include recording subject responses to driving situations depicted in photos, video recordings or computer simulation. Laboratory studies are often employed out of a desire to breakdown aspects of driving behaviour that have been observed in 'natural' road traffic situations, and are often combined with survey techniques which may provide some explanations for these observed behaviours. Laboratory methods provide the potential for a classic experimental design, where the researcher has control over all the variables to be studied. Laboratory methods may also be employed for ethical reasons: there are some behaviours (such as performance under the influence of alcohol, or performance at hazard identification and response tasks) that cannot be safely simulated and evaluated on public roads for the purpose of an experiment. Some of the disadvantages of laboratory studies are that the situation is not a real one, hence questions of validity and generalisability are often raised: how representative are the driving situations or driver tasks to those experienced in the real world? The representativeness of the subjects' behaviour may also be questioned when observed in an artificial and unfamiliar situation. A problem of a lack of familiarity with the testing equipment, may also influence the results.

This section presents the results of some laboratory studies into driving behaviour, highlighting those results which pertain specifically to young drivers, or which may be used in interpreting their high accident-involvement. The first three studies to be examined (Finn and Bragg, 1986; Mathews and Moran, 1986; Sivak et al, 1989) have all employed laboratory techniques in order to extend the research questions posed to address the issue of young drivers and risk-perception. In particular, the laboratory methods employed by Finn and Bragg (1986) were used to address the issue of specific risk-perception, to complement their previous survey study of general risk

perception. This study by Finn and Bragg will be examined first.

The three part study by Finn and Bragg (1986), mentioned earlier in the 'survey' studies section, was conducted to determine whether mis-perception of risk could explain the high rate of accident-involvement of young drivers. The study aimed to investigate whether young drivers perceive driving to be less hazardous than do older drivers. Finn and Bragg employed three methods: a questionnaire designed to evaluate drivers' perceptions of the likelihood of accident-involvement; ratings of the riskiness of specific driving situations as illustrated in 10 still photos; and ratings of the riskiness of 15 videotaped driving situations. The study on drivers' perceptions of the likelihood of accident-involvement employing questionnaires, was reviewed in the previous section on 'survey' studies. The same subjects were used in each of the three phases of the study. As stated previously, 93 male subjects were included in the sample, 45 between the ages 18-24 years, and 48 between the ages 38-50 years.

In the second phase of the study subjects were required to rate the perceived risk associated with 10 specific driving situations, as depicted in 10 still photographs. The ten driving conditions used were: urban driving, rural driving, driving with bald tyres, tailgating, driving slowly, driving at night, driving on wet roads, speeding, driving on snow covered roads and drink-driving. Subjects were asked to provide risk estimates for themselves, for their peers, and for the other age group (young or older drivers). Results showed that over all driving situations, young drivers rated their risk of accident-involvement as significantly lower than those of both similar age (peer) male drivers and older male drivers. However, similar results were found for older drivers who rated themselves at less risk of an accident than younger drivers or similar aged older drivers. In no situation did the young drivers perceive themselves to be at greater risk than their peer group or older drivers. In the two conditions 'driving on wet roads' and 'drink-driving', young drivers saw themselves at less risk than their peer group, and in the five conditions 'tailgating, driving at night, speeding, driving in snow, and drink-driving', they saw themselves at less risk of an accident than older drivers. Young drivers also perceived that other young drivers were significantly less likely to be involved in an accident 'at night' or when 'speeding' than the older drivers.

Overall, young drivers perceive less risk in specific driving situations: young drivers rated their likelihood of accident-involvement lower than that of their peers, and in particular, lower than that of older drivers. In

comparison, older drivers perceived young drivers to be at more risk of an accident than themselves in 8 out of the 10 driving situations. In addition, the older drivers perceived their chances of accident-involvement when 'drink-driving' as higher than that of their peers. The photo-rating data tends to support the questionnaire findings that young drivers see their own accident-likelihood as lower than that of their peers. However, no statistical techniques were employed to examine the relationship between a general measure of the perceived likelihood of accident-involvement and the specific situation measures of perceived risk.

In the third phase of the study subjects were required to rate the risk of an accident for each of 15 situations depicted on videotape. Finn and Bragg do not fully describe the 15 situations. Results showed that on only one out of the 15 sequences did young drivers provide lower risk estimates (on a tailgating sequence) than older drivers, and on one sequence provide higher estimates (a pedestrian sequence), than older drivers. Finn and Bragg interpret these two findings in terms of young drivers' perceptions of skill: the skill of the driver is important in avoiding an accident in the first situation, but less so in the unexpected second situation. The authors argue that young drivers, unlike older drivers, have not yet learned that unexpected events occur quite frequently, usually without an accident occurring. The videotape data tends to support the driving situation specificity found in the photograph rating data. The different ratings of risk across situations in the photograph and video data may be related to the perceived level of skill involved in avoiding an accident in each situation.

The results from the three phases of Finn and Bragg's study provide evidence to suggest that when general measures of risk are employed (as in the survey study), young drivers perceive that their own age group is at greater risk of an accident than older drivers, but that the risk for themselves is lower than for their peer group and similar to older drivers. When specific measures of risk are employed (using laboratory techniques) young drivers tend to see themselves at less risk than those of their own age group or older drivers. It would appear that a downwards shift in young drivers perception of risk (in comparison to older drivers) occurs by providing situation specific stimuli (in this case, in laboratory settings) rather than general survey questions about risk-perception.

In conclusion, results from this study would tend to suggest that the high accident-involvement of young drivers, is at least partly due to a failure to accurately perceive the level of risk associated with hazardous

situations (and hence the need to show caution). This inaccurate hazard perception may lead to an over-inflated perception of their own skill in relation to other drivers. However, as argued by Groeger and Brown (1989), the results produced by Finn and Bragg do not provide conclusive evidence for an age effect on self-assessments, as the data was collected as risk estimates, which confound hazard perception and self-assessments. A study by Mathews and Moran (1986), reviewed below, studied hazard perception and self-assessments separately.

Mathews and Moran (1986) examined drivers' perceived likelihood of accident involvement and confidence in dealing with a hazardous situation in a study involving groups of young (18-24) and older (35-50) drivers. They showed subjects twelve video sequences of various types of driving situations. The different types of driving situation could be broken down into three main categories: vehicle handling skills; fast driving reflexes and accurate driver judgements. Subjects were asked to rate (i) the likelihood of being involved in an accident in situations under each of these three main categories, and (ii) their confidence in dealing with each of the driving situations. They also had to rate the likelihood of an accident, and level of confidence, for other members of their peer group and for members of the older/younger age groups. They found that on the driving reflex items, younger drivers rated themselves as less likely to be involved in an accident than did the older drivers. Younger drivers were also more confident in their reflexes than were the older drivers.

For the vehicle handling items, younger drivers again rated themselves as less likely to have an accident than did older drivers. Young drivers also rated themselves superior to their peers in this respect. They also rated themselves as having an equal chance of having an accident as older drivers, but they did not rate themselves as being more confident than older drivers in dealing with the various vehicle handling situations. Young drivers did believe themselves to be superior to their peers in terms of their competence to deal with the situations.

Results from the items relating to driving judgment showed no difference between older and younger drivers' estimates of the likelihood of an accident. Young drivers did rate themselves less likely to have an accident than their peers, whereas the older drivers did not. With respect to confidence, young drivers rated themselves superior to their peers and equal to the level of confidence that they believed the older drivers to possess. Both groups were equally confident about making safe judgemental decisions across the driving situations presented.

Mathews and Moran performed correlations between subjects' perceived likelihood of an accident and their levels of confidence across situations in the three main categories. Perhaps not surprisingly, they found that across all situations, as the drivers' perceived level of confidence with dealing with a situation increased, the perceived likelihood of an accident decreased. They concluded that these results, along with the accident statistics for young drivers, indicated that young drivers, under certain conditions, have an inflated perception of their own level of skill and furthermore rate themselves superior to their peers and older drivers. They went on to suggest that it is this inflated perception of skill that leads young drivers to be involved in proportionally more accidents than older drivers.

Mathews and Moran argued that objectively younger drivers were less skilful in many respects when compared to their older counterparts. In support of their argument they cited the works of Shinar, McDonald and Treat (1978) and Blaauw (1982). Shinar et al (1978) found that younger drivers were more likely to be involved in an accident due to improper directional control of their vehicle. Blaauw (1982) found that younger drivers showed poorer performance on a speed control and steering task.

Evidence would tend to suggest (Schuman et al, 1967; Evans and Wasielewski, 1983; and others) that young drivers have a higher rate of participation in risky driving, and that this may be partly due to their perceived level of skill (Finn and Bragg, 1986; Mathews and Moran, 1986). Furthermore, the evidence would tend to suggest that there is a mis-match between young drivers' subjective and objective levels of skill, and that this mis-match contributes to their proportionally higher accident rate (Finn and Bragg, 1986; Mathews and Moran, 1986). The above evidence also suggests that younger drivers often unwittingly engage in risky behaviour: as these drivers perceive themselves to have a high level of skill, and consider themselves able to safely handle the situations they encounter on the road, they often do not realise when they are actually involved in risky driving. Despite this, previous research has shown that there is also some evidence to suggest that young drivers *knowingly* engage in risky behaviour more frequently than do older drivers (Schuman et al, 1967; Jessor, 1987).

The following studies by Sivak et al (1989) are of interest, not only because of their focus of interest on risk-taking, but because of the aspects of risk-taking they studied and the methods they employed. The studies considered driver self-assessment, risk perception and risk-taking behaviour by three data collection methods: questionnaires, colour slides and video simulation. The

study on self-assessment employing questionnaires was reviewed in the previous section on 'survey' studies.

The studies involved drivers in age groups 18/19-21 years, 35-45 years and 65-75 years, and were almost equally divided according to sex. The sample size in each of the two studies reported here was 320 (for the colour slide test) and 180 (for the video simulation test). Driver risk-perception was measured using colour slides of traffic scenes (for which subjects had to rate the perceived level of risk involved), while risk-taking behaviour was measured by giving subjects a task to perform (crossing two lanes of traffic) on a simulated intersection crossing on a video display. One obvious problem of comparing subjects responses across the three methods employed is the lack of consistency in the measurement techniques used: would any observed differences be due to a real effect or due to the measurement techniques employed? In fact, Sivak et al in their three papers did not attempt to make a statistical repeated measures, or even descriptive, comparison. The importance of these results for this review, lies not in the cross-cultural differences but in the methodologies employed and age and sex differences; hence these are the only results which are discussed here.

The study on driver differences in risk perception showed that younger drivers tended to report lower perceived risk than did the middle-aged or older drivers. Subjects were shown 100 colour slides depicting various road traffic scenes; each of these scenes were coded on 23 dichotomous characteristics. The two scene characteristics that contributed most to the differences between the age groups were speed and road surface friction. Results showed that the younger and middle-aged subjects were less responsive to speed than the older subjects, but that the older subject group were less responsive than the middle or younger age groups to low road surface friction. In terms of sex differences, none of the characteristics of the scenes contributed to sex differences in risk ratings. The age group findings are in line with previous research, that is that younger drivers generally perceive less risk than their older counterparts (Mathews and Moran, 1986; Finn and Bragg, 1986). Sivak et al suggest in conclusion that this lower perceived risk on the part of younger drivers, might contribute to their over-representation in road accidents.

In the study into driver risk-taking behaviour, Sivak et al asked subjects to perform simulated intersection crossings on a computer display. Subjects had to use the computer keyboard to make their 'car' cross a main road of moving traffic, and get safely to the other side. The data collected for analysis included: Probability of

Attempt (attempts divided by opportunities); Probability of Success (successful crossings divided by attempts: a measure of risk-level of performance); and Minimum Clearance (mean distance of the minimum clearance for all attempted crossings). Results showed that there was a significant effect for age on Probability of Attempt: younger subjects attempted to cross proportionally most often, followed by middle-aged subjects and then the older subjects. There was a significant sex effect with proportionally more attempted crossings made by males than females. There was no age or sex effect on the variable Probability of Success. On the variable Minimum Clearance there was marginally no age effect, but post hoc comparisons indicated that younger subjects had smaller minimum clearance than a combined group of middle aged and older subjects. There was a significant sex effect with males having smaller minimum clearance than females. A worthy word of caution was given by Sivak et al in this study: that it was not clear whether subjects perceived the task given to them as analogous to the real world situation. A validation study would be required of the simulated task in relation to an actual inter-section crossing.

The above results indicate that while young drivers engage in more potentially dangerous behaviours (Probability of Attempt), their behaviours may not be more likely to result in an accident (Probability of Success). Unfortunately, Sivak et al did not analyse for any significant age effects *within* the broad age categories they employed; data which would have been of most use for this review of young drivers and risk-perception.

Overall, the three studies by Sivak and colleagues, indicate that younger drivers perceive less risk, take more risks (in a simulated situation), and view themselves as relatively more skilful compared to other drivers. However, a comparison of the ratings of self-skill by young and older drivers in the earlier survey work of Finn and Bragg (1986), indicated that in comparison to general ratings provided by older drivers, young drivers tend to view their driving ability less positively (young drivers estimated their chances of accident-involvement in the coming year at 21.4%, while older drivers judged their own chances of accident-involvement at only 13%), although when asked about specific driving situations young drivers perceived themselves to be more skilful than older drivers.

The above research studies would tend to suggest that one of the reasons for young drivers' high accident rates may be their inaccurate perceptions of skill. A further problem for the inexperienced driver is that the dangerous situations that s/he is likely to meet, only occur very

rarely (Brown, 1982). Brown (1982) developed this further, by saying that young drivers, especially young male drivers, have more confidence in their ability to recover from dangerous situations or from decision errors, than older drivers. He suggests that because young drivers easily learn the required perceptual motor skills, they become overconfident in their ability to control the car in most situations. Fuller (1988) argues that the difficulty for the inexperienced driver is the lack of a clear relationship between antecedents, behaviour and consequences in the road traffic environment. Frequently a driver will exhibit safe driving and receive no reward, or will exhibit unsafe driving and be rewarded indirectly (by the lack of negative consequences).

From all the research presented so far, it is clear that due to the complexity of factors involved, an examination of risk needs to consider: (1) whether a driver perceives a situation as risky or not, (2) whether a driver perceives a situation as risky, but due to his/her level of confidence in his/her skills, perceives no risk to him/herself, and (3) whether a driver perceives a risky situation and feels at risk but is motivated to accept the risk. Hence, although the risk-taking behaviour would be the same in all three cases, the underlying reasons would be different and as such intervention needs to be different in each case. This underlines the need to distinguish between hazard perception and risk perception. One may perceive a situation as hazardous, but this does not mean that one equates this with one's own perceived level of risk. Risk is defined by the perceived likelihood of an accident (which relates to the perceived level of skill in a given situation), and the evaluation of the likely negative consequences if an accident were to occur.

The next set of laboratory studies to be reviewed are examined for the information they provide on hazard perception, as one aspect of driver risk-perception. There may be factors associated with young drivers' perceptions of road traffic situations that lead them to misperceive the associated risks, and hence give rise to an inflated perception of skill. None of the studies presented below have focused on age of the driver in any comparative sense, but they have focused on perceptual factors as they relate to driving performance. As previous research has indicated that young drivers are over-represented in road traffic accidents (Broughton, 1988), the results from these perception studies may play some role in explaining the poor driving performance of young drivers. The aspects of driver risk-perception which are considered in the studies below are as follows: (1) driving knowledge within which drivers interpret perceptual information, (2) simple reaction time to hazard

perception, (3) perceptual factors that drivers pay attention to, (4) the speed of hazard perception, and (5) the style of response to the perception of a hazard.

Early studies on driver performance have indicated that verbal tests of driving knowledge have appeared to have little relationship with driving record (Crancer et al 1971). This may be seen as indicating that pure driving knowledge, as an arena within which to interpret perceptual information, is not a single major factor in driving performance. However, this area has produced conflicting results, as later studies have indicated that other methods of knowledge assessment (e.g., specific pictorial information tests as opposed to non-pictorial global written tests) have produced higher correlations with driver performance (Veling, 1982). Performance tests such as simple reaction time have also been disappointing (Goldstein, 1961). Currie (1969) also found that pure reaction times did not assist in predicting driver performance. In a study in 1969, Currie assessed subjects' speed in perceiving hazards and responding to hazards, measured by their quickness in braking. Currie compared the results between two groups: accident-repeaters and accident-non-repeaters. Results showed there to be no differences between the groups in terms of pure reaction times, but the non-accident repeaters did perceive danger sooner. From these results it would appear that the speed of hazard perception may be one important factor in predicting driver performance. Spicer (1964) examined the role of perceptual attention in driving performance. In 1964, Spicer conducted a study to examine aspects of perceptual attention in which he showed subjects, aged 15-17 years, a film divided into eleven separate segments, representing a variety of traffic situations. Afterwards subjects were given a checklist from which they were to select items which were of importance to them (items which they would pay particular attention to when driving). Results showed that drivers aged 15-17 years with accidents, were less accurate compared to the non-accident group of drivers, in perceiving essential features of road traffic situations.

From the studies presented so far it would appear that the factors which drivers pay attention to, and how quickly they perceive them to be hazardous, are influencing factors in driving performance (rather than pure driving knowledge or simple reaction times). The next study, by Crancer, Wallace, Delay, Paulsrude and Rodell (1971), also provides some evidence to suggest that an ability to accurately perceive hazards is important in driver performance.

In 1971 Crancer et al conducted a study where subjects watched three 23 minute films of different road traffic

environments on a driving simulator. The study assessed subjects' use of accelerator, brake, signals, steering and speed in relation to responses considered appropriate to specific situations. Results showed that subjects with a poor driving record had a better performance across most variables (faster reaction time, fewer errors in steering, speed and turn signals, and superior knowledge of the right of way laws). Despite this generally better performance, these poor-record drivers also made more situation-missed errors: it appeared that their attention to steering and other control behaviours, impaired their ability to accurately perceive hazards. Crancer et al used this evidence to indicate the importance of accurate hazard perception. The drivers with the good driving record showed a bias towards caution, often braking later (due to the lower speed travelled at). The poor record driver tended to approach situations faster, braking earlier and harder. This study has indicated the importance of accurate and timely hazard perception, along with some indication of the importance of the style of response to hazards. The next study by Pelz and Krupat (1974) consider the role of style of response to hazards in driving performance.

The above studies have suggested that how accurately and quickly drivers perceive hazards, and the style of perceptual response is a better predictor of driving record, than driving knowledge or simple reaction time. The following study by Pelz and Krupat (1974) wanted to measure several dimensions of perceptual style. The study included a sample of 57 male undergraduates aged between 18-21, out of their total sample of 60 subjects. The subjects watched a 5 minute film of road traffic situations as seen from the drivers point of view. Subjects had to record their judgements of danger throughout the film by manipulating a handle in front of them, to indicate a level of danger from 'safe' to 'unsafe'. From their driving record subjects were divided into three groups: those with a safe driving record, those with accidents only, and those with violations or both accidents and violations. The results are briefly discussed below across four areas. Firstly, results on subjects 'baseline caution' showed that during uneventful periods safe drivers had the highest level of caution, followed by the accident-only group, with the violations group having the lowest level of caution. Secondly, results indicated that when 'a hazard appeared' the safest group of drivers responded the fastest, followed by the accident-only group, with the violation group last. Thirdly, results on subject response after the hazard had been recognised, indicated that the violations group responded abruptly, followed by the accident-only group, while the safe group had the most gradual onset slope of response. Fourthly, results on subject response when the

danger had passed, showed that the level of caution for the violations group dropped most sharply, followed by the accident-only group, while the safe group declined most gradually. From these results, the authors concluded that the style of responding to a hazard, its onset and aftermath, were more controlled by the safe record drivers, and most abrupt for the violations group of drivers. These results indicate that the style of perceptual response may be more important than simple perceptual accuracy, reaction times, or driving knowledge.

It can be seen that there is evidence to indicate that accuracy of hazard perception and style of perceptual response to potential hazards, may be better predictors of driving performance (as indicated by driving record) than simple verbal and reaction time tests. These results on perceptual style, although not specific to young people, do provide another area for attention in a consideration of the factors involved in the risk-perception and risk-taking behaviours of young drivers.

In the examination of the concept of risk, the research presented so far has investigated young drivers' perceived level of skill, and some factors associated with hazard perception, but has not placed much emphasis on driver evaluation of the likely negative consequences if an accident were to occur.

Overall, from the evidence presented by the above 'laboratory' studies into risk-perception and risk-taking and young drivers, it would appear: that young drivers have a low perception of the likelihood of accident-involvement for themselves, which may arise from an inflated perception of their own levels of skill (Finn and Bragg, 1986; Mathews and Moran, 1986); that young drivers report lower perceptions of risk across a range of driving situations than their older counterparts (Sivak et al, 1989); and that young drivers engage in more potentially dangerous behaviours on a simulated driving task (Sivak et al, 1989). Evidence from studies on hazard perception have indicated that the accident-involvement of drivers may be related to which factors they pay attention to (Spicer, 1964), how accurately (Crancer et al, 1971) and quickly (Currie, 1969) they perceive hazards, and the style of response to hazard perception (Pelz and Krupat, 1974). The results from these hazard perception studies may partly explain the risk-perceptions, risk-taking behaviour and the accident-involvement of young drivers. These findings on hazard perception may also have implications for driver education and training.

All of the above studies have employed laboratory techniques as a methodology to collect data on driver behaviours (and some have supplemented this with survey

techniques). The advantage of collecting data under laboratory conditions is that they allow for a detailed examination of subject behaviours under controlled conditions, and provide the opportunity to measure other variables, such as age and sex, unlike 'natural' observational studies. The studies in this section have employed a variety of laboratory stimuli ranging from still pictures, video recordings, computer simulation to a driving simulator, in order to measure aspects of driver risk-perception. Certain aspects of driver risk-perception (hazard perception and response) could not have been safely observed easily, using road-side or in-car observational techniques, and hence laboratory methods were applied.

Some of the studies in this section have employed multi-methodological approaches, providing the potential for integration of results across methodologies (Finn and Bragg, 1986; Sivak et al, 1989). However, no attempts were made by the authors of the two multi-methodological studies (Finn and Bragg, 1986; Sivak et al, 1989) to integrate the findings from the different methodologies on a statistical basis. The study by Sivak et al (1989) was reported as three separate research studies: the authors did not attempt to make inferential or descriptive statistical comparisons between the studies (on self-assessment, risk-perception and risk-taking), despite the fact that the issues studied are all conceptually inter-related. The advantage in combining the survey and laboratory data from these studies lies in the explanatory power of measuring driver attitudes using survey techniques, to interpret the observed behaviours demonstrated in the laboratory studies.

Finn and Bragg (1986) did make an attempt to integrate the findings of the three phases of their study, although not by the use of statistical techniques. They compared data produced from general risk-taking situations using survey techniques, with data produced from specific risk-taking situations using laboratory techniques, and found that the results were different. A complication with this particular comparison is that neither the variables measured, nor the techniques employed, were held constant, hence the single effect of either is more difficult to make confident judgments about. Even when the variable to be measured is kept constant, and only the techniques varied, there are still methodological problems. It would appear that the problem associated with comparing results across different methodologies, lies in the interest created by them: the lack of consistency in the measurement techniques used. This lack of consistency in the use of measurement techniques raises the issue of whether any observed differences would be due to a real-effect or due to differences in the measurement

techniques employed.

1.2.5 Summary and Integration of Research Into Young Drivers' Risk-Taking Behaviours.

As can be seen from the above studies, it would appear that young drivers are identified as being over-represented in road traffic accidents and violations, even when exposure has been taken into account. Evidence from studies into the risk-taking behaviours of young drivers, would tend to suggest that young drivers drive in a potentially more dangerous fashion than older drivers, and as a result are over-represented in road traffic accident statistics. Evidence has been presented by Evans and Wasielewski (1983) to suggest that young drivers are more likely to exhibit risk-taking behaviours than other groups (in terms of following distance); Harris (1987) to suggest that young drivers adopt more dangerous overtaking strategies; Quimby and Watts (1981) to indicate that young drivers drive with smaller safety margins; and Quenault et al (1968) to suggest that young drivers were more likely to drive faster and to overtake more frequently. However, there is evidence to suggest that drivers under 25 years (and in particular those under 20 years) are less likely to be impaired due to alcohol than older drivers (Sabey et al, 1988).

Some researchers (e.g., Fuller, 1988) have suggested that the type of driving exposure experienced by young drivers may influence their risk-taking behaviours. In particular Fuller (1988) suggests that young drivers are exposed to more risky driving conditions, such as night-time driving and driving after consuming alcohol. However, as Jonah (1986) in a review of the literature points out "even when one controls for the quantity and quality of exposure to risk, young drivers are still at greatest risk of casualty accident involvement, particularly those aged 16 to 19" (p.257).

Overall, a review of the research literature into young drivers' risk-taking behaviours, would suggest two main explanations: risk utility and risk perception. The first explanation, that of risk utility, proposes that young drivers engage in deliberate risk-taking as they are more likely to experience risk as intrinsically rewarding. There is evidence to suggest that a large proportion of young drivers not only engage in dangerous driving practices, but also engage in deliberate risk-taking behaviours (Schuman et al, 1967; MacMillan, 1975; Jessor, 1987). The explanations put forward by MacMillan (1975) and Jessor (1987) for the deliberate risk-taking behaviours of young drivers, have focused on socialisation and cultural influences. The view that young drivers often knowingly engage in deliberate risk-taking

behaviours, has also been concluded from studies (such as Harrington and McBride, 1970) which have shown young drivers to be over-represented in speeding offences.

Researchers have suggested some different utilities for the risk-taking behaviours of young drivers. Researchers, such as Farley (1984) and Zuckermann (1979) have emphasised a physiological need for increased arousal in explaining the utility of risk-taking behaviours. In contrast, Hodgdon et al (1981) have suggested the following utilities for driver risk-taking behaviours: an outlet for stress, aggression, expression of independence, means of increasing arousal, to impress others, and as a means to an end. Other researchers have studied the psychosocial characteristics of young people, in an attempt to understand what factors influence the perceived utilities of risk-taking behaviour (Harrington, 1971; Mayer and Treat, 1977; Pelz and Schuman, 1973; Quimby and Watts, 1981). The evidence on risk utility as a mediator of risk-taking behaviour is limited as most research in the area has examined high and low accident groups among young drivers, rather than differences in risk utility as a function of age. However, there is research to suggest that risk has greater utility in young drivers in the expression of emotional-motivational factors, the facilitation of peer approval, feeling of power and control, the enhancement of self-esteem and is related to accident-involvement (Pelz and Schuman, 1968; Harrington, 1971; Jonah, 1986).

However, a further examination of the literature on young drivers' over-representation in road traffic accidents would tend to suggest that while this may be partly due to some deliberate risk-taking, it may also be partly due to their inaccurate perceptions of their driving skills (Svenson, 1981; Spolander, 1982; Finn and Bragg, 1986). Further research on the interaction of risk perception, risk utility and driver age may prove useful in trying to understand the risk-taking behaviours of young drivers. The approach by Wilde, which has attempted to integrate risk perception and risk utility will be discussed shortly.

The second explanation put forward to explain young drivers' over-representation in road traffic accidents, is that of risk perception; the view that young drivers' lack of experience of contingencies in the driving situation leads them unintentionally into risky situations. This view suggests that young drivers do not have correct perceptions of their own skill and the risk associated with certain behaviours. There is much research to support this view: compared to experienced drivers, inexperienced drivers are poor at identifying distant hazards (Brown, 1982); are more likely to be driving in

situations where they may come into conflict with other drivers (Jonah, 1986); see less risk in specific driving situations (Finn and Bragg, 1986); underestimate the risk of an accident in video traffic sequences involving vehicle handling and driving reflex skills (Mathews and Moran, 1986); take longer to perceive and respond to simulated potentially dangerous traffic conditions (Quimby and Watts, 1981); give lower ratings of the seriousness of the consequences of their own 'offensive' driving (Brown and Copeman, 1975); and are less likely to be able to stop within the limits of forward visibility (Quimby and Watts, 1981).

The above evidence would tend to suggest that young drivers may unwittingly engage in risk-taking behaviours: if young drivers have an inaccurate perception of their driving skills, and perceive themselves as able to safely handle the situations they encounter on the road, then they may be less likely to realise when they are involved in risk-taking behaviours. The over-optimistic view that young drivers hold of their driving ability may not only increase their risk-taking behaviour, but may also explain why *general* media propaganda is unsuccessful: these drivers may not identify with those who are in need of instruction.

Wilde (1976, 1982) in his 'risk homeostasis theory' made an attempt to integrate these two main explanations for young driver risk-taking: that of risk perception and risk utility (reasons behind intentional risk-taking). The theory states that drivers have a target level of objective risk which they find acceptable and which they try to maintain. Adjustment action behaviours, which are carried out in an attempt to maintain a target level of risk, are mediated by a pattern of expected costs and benefits. There are determining factors in a driver's target level of risk and ensuing decisions. These determining factors include values associated with culture, peer group pressure, gender and age-role identification and personality traits. Hence, perceived rewards for fast driving may raise the target level of risk. These socialization and cultural determinants are similar to those proposed by both Macmillan (1975) and Jessor (1987) in their explanations of intentional risk-taking behaviours. While Jessor states that prevention/intervention efforts in the area of road safety may be more effective if focused at the level of lifestyle, rather than restricted to the specific behaviour of driving, Wilde suggests that the route to reducing risky driving is to reduce the target level of risk by providing incentives for cautious behaviour and disincentives for risky behaviours, altering the utility of risk. The implication of the theory of risk homeostasis is that if external measures (such as changes

in vehicle or road design) are taken to increase road safety, drivers will perceive a decline in the level of risk to a point below their target level, and will compensate by taking greater risks in order to restore the homeostatic balance.

While Wilde's theory on risk homeostasis has been subject to criticism (e.g. McKenna, 1982; Haight, 1986), it does have important consequences for accident reduction techniques and has been useful in prompting further theoretical debate. One of the issues to arise out of the debate on risk homeostasis theory is the concept of 'risk compensation'. This concept suggests that rather than precise homeostatic control over risk, drivers are more likely to exhibit behaviours compensating for varying levels of risk in the road traffic environment.

Although Wilde (1981) has cited evidence in support of his concept of a target level of risk maintained by drivers, there is evidence to refute this hypothesis (e.g. Huddart and Dean, 1981; Slovic and Fischhoff, 1982). There is also evidence to suggest that conventional safety measures do reduce accident rates, thus contradicting risk homeostasis theory (Hakkert et al, 1981; Rutherford et al, 1985). Road modifications and seat-belt usage are two specific areas of intervention highlighted by McKenna (1982) and Broughton and Stark (1986) in which reductions have been documented in the frequency and severity of accidents.

While risk homeostasis theory appears plausible in that following the introduction of a safety measure drivers can modify their behaviour, it appears less plausible in the assertion that people *always* modify their behaviour, that their behaviour modification is *always* compensatory and that compensation *always* completely offsets the benefits of a safety measure (McKenna, 1982). While there is some evidence to suggest that people do exhibit compensatory behaviours under some conditions (Rumar et al, 1976), this evidence is not totally consistent with risk homeostasis theory because the compensation was not complete. Research has also shown that under some conditions there is no evidence that people compensate at all (Lund and Zador, 1984). Huguenin (1984) provides a strong criticism of risk compensation, stating that "the predictions of driver behaviour based on risk compensation theories is at best vague and at worst impossible, as definitions are unclear. In most cases the models cannot be falsified in Popper's (1966) sense; far more precise versions are necessary" (p.558). A similar criticism of risk homeostasis theories has been levelled by Haight (1986) who stated that, "there is some question as to whether the theory is meaningless (since incapable of testing... because it does not and cannot specify stable measures of

compensation), or simply false. Evans' (1986) conclusion that "there is no convincing evidence supporting it and much evidence refuting it" is if anything generous. In my view a sufficient argument against the validity of risk homeostasis is provided by the incoherence of its 'theoretical' formulation" (p.364). Perhaps a more constructive approach for further work, as suggested by Haight (1986), would be to identify the circumstances in which risk compensation exists, and the extent of such compensation.

While Mathews and Moran (1986) do not refer to a 'target level of risk' they do argue, similarly to Wilde, that the decision making process associated with risk-taking behaviours is jointly influenced by both risk perception and utility. While on the one hand risk utility (and the associated needs and motivations) may influence the perceptual evaluation of information, the perception of risk associated with a given action may also influence the evaluation of risk utility.

In conclusion, research would tend to suggest that the high accident-involvement of young drivers, is partly due to a failure to accurately perceive the level of risk associated with hazardous situations and an inaccurate perception of driving skills (risk perception), and partly due to motivational factors that increase young drivers propensity to engage in deliberate risk-taking behaviours (risk utility). The extent to which young drivers can accurately gauge the level of risk in a situation that they have intentionally become involved in, and their frequency of such risk-taking activities, may also be dependent on their ability to perceive risk accurately. Hence, although a young driver may know that s/he is engaging in a risk-taking behaviour, s/he may not accurately perceive the level of risk that they are exposing themselves to.

The next section reviews remedial actions for reducing road traffic accident rates. Special attention will be given to education and training methods as these have often been directed solely at the young driver population.

1.2.6 Remedial Actions: Introduction

There are three main forms of remedial action for the reduction of road traffic accidents: (1) education and training of pre-drivers and drivers; (2) enforcement of traffic regulations; and (3) engineering schemes to modify either the vehicle and/or the road environment (Dean, 1981). A brief example of each type of remedial action is given below, prior to a detailed review of driver

education and training evaluation studies.

The action of enforcement in reducing road traffic accidents covers not only road user behaviour, but also vehicle design, operating standards, driver training and highway requirements. Road traffic laws generally come into effect along with educational and media campaigns, but also are the last resort when other persuasive measures have failed (Ross, 1973). In 1967 in the United Kingdom, an absolute blood-alcohol limit of 80mg/100ml was introduced, with compulsory body-fluid tests for all drivers suspected of drinking and driving. Results showed an immediate drop in the number of total fatalities (Sabey and Codling, 1974), but the effects of this new legislation began to soon decline rapidly (Ross, 1973; Sabey and Staughton, 1980). These results provide evidence to suggest that the perceived level of detection and perceived severity of the sanction (Ross, 1982) must be appropriate if deterrence is to be achieved. Some enforcement policies have had a measurable effect on road traffic accidents. In 1972, the introduction of the law which prohibited 16 year olds from riding motorcycles of over 50cc was believed to have lead to a reduction of 1200 fatal and serious injuries (Dean, 1981). The compulsory wearing of crash helmets, introduced in 1973, was thought to have led to a reduction of 200 fatal and serious casualties among motorcyclists (Dean, 1981). Enforcement policies have often been implemented to increase the impact of engineering measures, as in the example of the compulsory introduction of crash helmets for motor cyclists.

Improvements in road safety can also be made by engineering measures on their own, related either to the vehicle or the road environment. Many accidents occur at junctions, and the introduction of mini-roundabouts over recent years has been a successful attempt to reduce these junction related accidents (Dean, 1981) by reducing much of the decision-making that drivers have to make. In terms of vehicle design, the compulsory installation of seat-belts, combined with legislation to enforce drivers to wear them, has had an effect on the number of fatal accidents (Broughton and Stark, 1986). It can be seen, however, from the above examples of engineering and enforcement measures, that these are mostly aimed at the general population of drivers, and not tailored to the specific needs and problems of the young driver sub-population. Two main exceptions have been the licensing and drinking laws, and nighttime curfews in the United States and Canada, aimed at young drivers, which have been thought to have a temporary reduction in the involvement of young drivers in road traffic accidents (Williams, Karpf and Zador, 1983a; Williams, Preusser and Lund, 1985; Preusser et al, 1984; Simpson et al, 1985;

Vingilis and De Genova, 1984). In contrast, another type of countermeasure, driver and pre-driver education and training, has been aimed almost exclusively at young drivers.

The third type of countermeasure to reduce road traffic accidents can be divided into two types: driver education and driver training. A more detailed distinction between the use of these two terms will be drawn later on, but for the present, driver education can be seen as education for road safety through structured educational programmes (i.e., in schools), or media campaigns aimed at specific road safety issues; while driver training can be viewed as structured instructional programmes aimed at teaching the necessary skills to drive a car (formally through school programmes or commercial company driving courses). In practice, many school-based programmes have combined both driver/pre-driver education and training, as will be noted in particular from the American school-based initiatives. There has been much research, particularly in America, on driver training schemes and the young driver, as is discussed in the next section (1.3).

Most media propaganda campaigns have been aimed at drink-driving, motor-cycle accident prevention, speeding and child road safety (Dean, 1981). The evaluation of educational media campaigns, in terms of a change in behaviour (which has a direct influence on road traffic accidents), is very difficult to measure due to the lack of experimental control. It is difficult to determine the relative contribution of road safety campaigns in the causation of behaviour changes, in any group of drivers, due to the possible influences of extraneous variables.

Attitudes begin developing very early, and young people not yet old enough to drive a car or motorbike are exposed to the road environment and the use of cars through many channels, including personal experience, parents, peers and the media. One example in the United Kingdom where educational measures are thought to have had some impact, was the introduction of the Green Cross Code in 1971. Within three months of launching the campaign, child pedestrian casualties were 11% below the expected level (Dean, 1981). However, there is no data to assist in the evaluation of the relative contribution of other, unstated, factors in this change in child pedestrian casualties. Road safety education in schools in the United Kingdom, unlike many European countries and states within America, is not compulsory. In the United Kingdom, various local and national road safety schemes have been put into practice over the years, but very few pre-driving or pre-riding courses are available in schools for young people under 16 years. The situation has always historically been different in America, where many states

have set up state school driver education and training courses, and where there have been strong links between these courses and the rate of licensing of new drivers. This issue of school-based programmes is discussed in more detail in the following section on driver education and training for young people (1.3).

School-based driver education and training programmes may be viewed as the primary countermeasure in reducing the road traffic accident rate of young drivers for two main reasons. Firstly, school-based training and education programmes are the only countermeasures that have been designed to specifically alter the behaviour and attitudes of young drivers: in contrast engineering and enforcement measures are generally aimed at the total population of drivers. Secondly, a large amount of research has been devoted to evaluating school-based driver and pre-driver educational programmes, particularly in the United States where educational methods have been seen as one of the main tools for attempting to reduce the road traffic accident rate of young drivers. School-based driver and pre-driver educational programmes are more amenable to direct evaluation than most other countermeasures, as the sample under study is clearly defined and permits easy repeated access for information collection. The section below introduces the area of driver/pre-driver education and training, and then discusses the merits and weaknesses of some programmes and evaluation studies.

1.3 DRIVER/PRE-DRIVER EDUCATION AND TRAINING

1.3.1 Introduction.

This section on young driver and pre-driver education and training will review some specific evaluation studies, before proceeding to examine some major methodological problems and some further studies which have attempted to overcome these problems.

The high involvement of teenagers in road traffic accidents has long been recognised as a major 'health' problem, and as such prompted many states in America to fund high school driver education programmes. The rationale behind these programmes has been that they may be able to change the 'deviant' attitudes and behaviours of young people (MacMillan, 1975; Jessor, 1987) when these attitudes are most amenable to external influence (Bishop, 1973). The drawback of most countermeasures is that they often only have a short-term effect (Ross, 1973). However, this may be effective enough if the short-term benefit of educational measures can span the time period

when most young people are vulnerable to being involved in road traffic accidents.

Driver education was under scrutiny in the 1970s in the USA, when states were debating whether or not to continue public funding of high school driver education, unsure of its merits: it has been these doubts that have prompted many studies into driver education and training programmes. Generally, studies of driver education have focused on firstly, the extent to which driver education affects the proportion of teenagers licensed and the amount they drive, and secondly, the extent to which driver education improves the road safety of teenagers who have completed driver education courses. Improvements in safety have generally been measured in terms of reduced fatalities and reduced citations for violations. An exception to this has been school-based programmes for the prevention of drink-driving, which have also focused largely on knowledge gains and attitude changes.

An examination of many state laws in the USA would tend to suggest that they are based upon an assumption that formal driver education, often within high schools, helps to increase the road safety of young drivers, and hence justifies public financial support. In the USA in 1982-3, 25 states provided special financial funding to support driver education in high schools. In addition, 23 states allowed young people to obtain their driving licenses at a younger age if they completed driver education (National Safety Council, 1984). New York and Pennsylvania allowed young people who had undergone driver education to be exempt from the night-time curfews that applied to newly licensed drivers. Some vehicle insurance companies in the United States have offered lower insurance premiums to young people who have attended driver education courses. It can be seen from the above evidence that in America there have been many incentives for young people to attend formal driver education and/or training courses, often run by their own schools. This view of driver education in America has probably had some impact on the type of experimental design that has been possible in driver education/training evaluation studies.

An important distinction in the way the terms 'driver education' and 'driver training' have been used in America has been made by Goldstein (1971). Driver education has usually been taken to mean classroom instruction, simulator instruction, car driving practice off of the road, observation of another student driving, and driving practice on the road. The term driver training has generally been taken to emphasise manipulation of the driving experience in a car or simulator. Driver education programmes in commercial company driving schools, have generally fallen within the definition of

driver training, while driver education courses provided by schools, have tended to go beyond the pure skills of controlling a car, focusing on attitudes, to produce safe and responsible driving attitudes in their students.

The role of high school driver education in increasing road safety and reducing the road traffic accident rate for young drivers has been the subject of much debate. While there is some evidence which at first glance would appear to support driver education (Allgaier, 1964), there is also much evidence to the contrary (Lund et al, 1986). Some research has suggested that completion of a driver education course is associated with better accident and violation records per licensed driver (Allgaier, 1964). Other research has suggested that this recorded improvement in accident and violation occurrence per licensed driver, is not the result of the driver education courses in themselves, but rather indicative of certain characteristics of the young people who choose to attend these courses (e.g., drivers with lower exposure). Research by Conger et al (1966) and McGuire and Kersh (1969), amongst others, has shown that when such 'other' factors are controlled for (e.g., exposure and socio-economic status among others), any differences in accident rates between driver education students and non-driver education students are greatly reduced or disappear entirely. Furthermore, when the effect of driver education is measured for young drivers as a group, rather than per licensed driver, it has been shown that it has the effect of producing more young drivers with full licenses and also a higher number of young people involved in road accidents (Robertson, 1980; Robertson and Zador, 1978). Obviously, the higher the number of young people there are with driving licences, the higher the potential number of them on the road at risk of an accident.

Section 1.3.2 below considers the many studies which have compared driver education students with non-driver education students, and claimed to have shown that the former have fewer accidents. There are many problems with these comparative studies in that the groups being compared are often not strictly comparable as they differ in many respects. To assess the effectiveness of driver education programmes, subjects need to be assigned at random into experimental (formal driver education) and control (no formal driver education) groups, before evaluation occurs, in order to avoid a volunteering bias. Such randomization requires equivalence on all relevant variables, including the quality and quantity of driving exposure. For obvious reasons, it is often not practical to assign students to random groups, particularly in America where driver education is often seen to be 'a good thing' and where it has often been a pre-cursor to early licensing. If driver education is perceived to have

advantages attached to it, people will want the freedom to choose, as opposed to random assignment. The problem would not be so great in the United Kingdom where driver education in schools has generally not been tied into legislation, and where it has not been so prevalent. In many ways it is more practical to make comparisons between different driver education programmes.

The section below presents a review of some of the main evaluative studies of driver education/training programmes that have been conducted. Studies which have focused primarily on knowledge gains and attitude changes (usually in the field of drink-driving) will be reviewed first, followed by studies of more general driver education programmes, which have focused primarily on behavioural changes measured by changes in accident and/or violation rates. After a review of these evaluative studies, the following section will discuss some of the main methodological problems.

1.3.2 Evaluation Studies Of Driver Education and Training Programmes.

In the last fifteen years many school-based programmes aimed at the prevention of drink-driving have been developed. Two of the main approaches to school-based programmes are the informational (where the provision of information is thought to lead to changes in attitudes and behaviour) and affect-based (where affective processes are employed as a link to behaviour change) models. Both of these measure success in terms of changes in attitudes and knowledge, as these are presumed to be critical links to behaviour (Malfetti et al., 1975). However, research has indicated that changes in attitudes and knowledge have not always been related to behavioural and road safety measures (Mann et al, 1983). A third main approach, that of behavioural models assess behavioural measures of impact. There are problems with this model though as firstly, accurate assessments cannot be made immediately after programme completion, and secondly, the most common method of data collection on drink-driving behaviour, the self-report method, is open to questions of validity. Traffic safety statistics are another method of assessment, but again follow-up studies over a period of time are required. This section will begin by examining each of these approaches briefly as they have been applied to the sphere of drink-driving in the following school-based studies presented below.

In 1970, Jenkins examined the effects of an informational based programme upon knowledge gains in the area of drink-driving. While the study did find an increase in knowledge about various aspects of drink-driving, some

caution is needed in the interpretation of these results due to the methodological design employed. The sample size was small (18 subjects in each condition), and the data was not presented in a way amenable to pre- and post-test evaluations. In light of the design problems with this study, some doubt must be cast over the reliability and validity of these findings. Another study of a drink-driving education course by Turnauer (1973) compared the results from an informational-based and an affective-based approach. The results indicated that the affective-based approach had a significant positive impact on drink-driving attitudes in an immediate post-test and in another test three weeks later. However, there are also problems in the interpretation of these results, partly due to a lack of information about the educational programmes employed in the study, and partly due to the method of non-random assignment of subjects to experimental groups.

A later study by Malfetti, McGrath and DeMeo (1975) reported significant improvements in both attitudes and knowledge after an informational and affective-based programme. However, there was no control group in the design, and evaluation was a pre- and immediately post-test design. A further study by Malfetti, Simon and Homer (1977) evaluated another informational and affective-based programme, where evaluation took place immediately prior to the programme, immediately after it and again eight weeks later. The results of the study showed an immediate positive effect on knowledge and attitudes, but not behaviours. However, the follow-up study eight weeks later showed a positive effect on knowledge, but not on attitudes or behaviours. These results would suggest that while a joint informational and affective-based programme has (at least) short-term effects upon drink-driving knowledge, it has a very limited effect upon drink-driving attitudes, and no effect upon drink-driving behaviour.

The above studies have all been poorly designed and so were all reviewed briefly. If any tentative conclusions can be drawn from these studies, they are that while informational, or informational and affective-based programmes may produce some knowledge changes, they only have a short-lived impact upon attitudes and have not been shown to have any impact on behaviours. The studies presented below, by McKnight, Preusser, Psotka, Katz and Edwards (1979), and Masten (1979), also indicate that while educational programmes may produce some knowledge gains, but no changes in attitudes, there is also a risk of negative changes in behaviour (Masten, 1979).

In 1979 McKnight et al evaluated the National Highway and Traffic Safety Administration Alcohol Safety Programme. A

very brief review will be made of this study as the design was quasi-experimental, with no pre-test behavioural measures, and no specification of time intervals between evaluations. The results indicated a knowledge gain, but no attitude improvement. The results on behavioural changes indicated an improvement in attitudes towards the drink-driving behaviour of others: the experimental group were more likely to intervene in the drink-driving behaviour of other individuals. There would appear to be some contradiction here between the results on attitude and behavioural changes: these contradictions may be due to the design methodology employed. Masten (1979) in a similar study, found knowledge gains, but no improvement in attitudes or behaviours. Other studies (Donovan, Hagen, Homer, Kenell and Malfetti, 1982; Albert and Simpson, 1985; and McKnight and McPherson, 1986) have reported either small gains in knowledge or attitudes, but also some negative effects on drinking-driving behaviour.

All of the above studies reported have some design flaw, and hence the results must be treated cautiously. Evaluations of alcohol and drug programmes have indicated some positive results (Botvin et al, 1984), some which apparently have no impact (Morgan and Hayward, 1976) and some which appear to have deleterious effects (Stuart, 1974). In their review, Mann, Vingilis, Leigh, Anglin and Blefgen (1986) suggest that positive effects are more likely to be found where procedures and designs are rigorously controlled. In a similar vein, studies of more general driver education suggest varying levels of success (Schuman and McConochie, 1971). Some studies of more general driver and pre-driver education, which have focused on the success of education and training programmes in terms of resultant changes in young driver accident and violation rates, will be examined next.

Harrington (1971) conducted an extensive 4 year follow-up study in California of young newly licensed drivers. He found that 27% of those who had taken the high school driver training course (including behind the wheel driving experience) failed the driving part of the licensing test on their first attempt. Results also indicated that those students taking the driver training course had better accident records during their first year of driving than the non-training course students, but that this effect was only short-lived: no significant differences (in terms of accident record) were found between the two groups in the subsequent two years of driving. While the differences in accident record between the training and non-training male students were not significant after the first year, they were in the opposite direction in years two and three: results indicated that males who had undertaken driver training had higher accident means than the non-driver training males in the second and third years of driving.

Results also showed that there appeared to be a positive effect of the training course on the number of violations for males during the first 4 years, and for females during the first three years of driving. However, as in other studies, there were also shown to be variable differences between the training course and non-training course students, which may be a reflection of selection and volunteering biases. Harrington (1971) reported the results of a related one year follow-up study by Asher and Dodson (1969). This study found no difference between trained and untrained males, but found a statistically significant correlation (-0.05) for females, indicating that females with driver training had worse accident records than the untrained.

In 1975 Shaoul conducted a large-scale experimental-control study in the United Kingdom of a driver education course given to sixth form students (16-17 year olds). The study was a non-random control group design, as the author pointed out, which may have led to a volunteer bias. Results from the study indicated that there were fewer accidents per driver for the driver education subjects, but that this effect disappeared when the number of self-reported miles driven were taken into account. Those who had attended the full driver training course drove significantly less miles than those who had not attended the course. The author concluded that the study did not provide evidence that the driver education courses were successful in reducing the accident rate per mile driven. The study also showed that more students in the driver education group obtained their licenses than the non-education group, and that the same group had a higher rate of accident involvement per person than the non-education group. From this study it would seem that the driver education course increased the number of licensed drivers without decreasing the accident-involvement per driver. The author concluded that driver education can only be regarded as an effective measure in reducing accidents, if the reduction in accidents is offset by any increase in accidents due to an increase in the number of licensed drivers. Shaoul suggested that the difference between the two groups in terms of exposure (miles driven) was an effect of the course, but this difference is more likely to be the result of a selection bias in the sample.

Advocates of driver education who attempted to consider the effects of driver education courses upon accident involvement, have tended to suggest that these courses did have some positive effect, as drivers who attended these courses had lower accident rates than the non-attenders (Robertson and Zador, 1978). An example of this would be to cite the results of Shaoul's work without taking exposure (reported mileage) into account. However,

studies have found that there are a range of other factors involved accounting for the group differences in the accident rates (Conger, Miller and Rainey, 1966; McGuire and Kersh, 1969). There tended to be differences such as measured I.Q, intellectual interests, less aggressive or impulsive personalities and annual mileage, between those who attended the driver education courses and those who did not, which had not initially been taken into account in explaining the between group differences in their accident rates. Other between-group differences (academic ability and knowledge, socio-economic status, and intelligence) have been found by Asher (1968). These between-group variables have also been shown to be related to accident-involvement citations for violations (Conger et al, 1966).

Another study into driver education was undertaken in the United States in 1978 by Robertson and Zador. The study included data from 27 states over the years 1967-8, 1970-1, and 1973. Data was examined for 16-19 year olds. This study showed that driver education resulted in an increase in the number of 16-17 year olds obtaining their licenses, without any reductions in the fatal accident rate per driver of these ages. The study also indicated that most young people who received high school driver education would not have obtained their licenses until the ages 18-19 if the driver education had not been available. Additionally, the fatal accident rate per 10,000 licensed drivers among the 18-19 year olds, was not affected by the driver education. A third major finding was that by delaying licensing from the ages 16-17 years to 18-19 years, had no effect of the fatal accident involvement rate per 10,000 18-19 year old licensed drivers. Other data provided by the study showed that in 1975, approximately 4,000 drivers aged under 18 years were involved in fatal accidents; it was estimated that in about 50% of those accidents only one vehicle was involved. Thus the authors suggest that by removing all drivers aged under 18 years from the roads, the accident-fatality rate would have been reduced by 2,000. Further reports have indicated that driver training through commercial schools of driving (Jones, 1973) and driver training through multiple range driving courses (Council, Roper and Sadof, 1975), produce fatal accident rates similar to those from driver education courses.

All of the above studies have focused on, and provided conclusions about, fatal accidents. It may be safe to infer that as accidents which involve serious injury are similar in many respects to those which involve fatalities, that conclusions from studies of fatalities may apply to these less serious accidents also (Robertson and Zador, 1978). The more minor accidents involving only damage to property, or minor injuries, tend to have very

different characteristics (Robertson and Zador, 1978), and hence it would not be wise to assume that the above results apply to these types of accidents too.

After reactions from the driver education community to Robertson and Zador's work, which included some strong criticisms of driver education, a re-analysis of their data was conducted by Nichols, Seaver, Voas and Carlson (1979). Criticism was raised at the suspected unreliability of their data (the figures for young people enrolled on courses, and numbers of licensed drivers by age group populations for each state-year, were often estimates), and the attribution of cause and effect relationships to correlational data. The results of the re-analysis suggested that (a) a significant positive relationship existed between driver education and the rate of driver licensing; (b) other factors such as mobility and socioeconomic status may affect this relationship; and (c) the cause and effect interpretation was not well supported.

Many publicity campaigns have adopted the 'fear appeal' approach, as termed by Hovland, Janis and Kelly (1953). Rogers (1975) proposed that the three important components of fear appeal are: (i) magnitude of noxiousness of a threatened event, (ii) the probability the event would occur, and (iii) the success likelihood of a coping response in averting danger. Road safety campaigns and driver education often attempt to modify attitudes on these three components (that personal injury can be severe, that any driver can be involved in an accident, and that the best way to avoid accidents is to drive safely and lawfully). Further investigation of driver education is needed to see whether these three components are being modified effectively (into terms that the subjects can relate to), or whether they are playing a role in changing driver attitudes, and in what direction.

A study by Griffeth and Rogers (1976) was designed to examine the effects of the components of fear arousal upon road safety attitudes and behaviour. Their study was comprised of 144 high school students, all of whom were enrolled in driver education courses from three schools. All subjects were unlicensed with a mean age of 15.9 years. Subjects were shown either a high or low noxiousness film, written essays containing information designed to either persuade subjects that their likelihood of being involved in an accident was either very high or very low, and written essays to persuade subjects that the success likelihood of safe driving practices in preventing accidents, was either very high or very low. Subject driving behaviours and performance were measured using a driving simulator. Simulators have become popular for economic and safety reasons; they are cheaper than

instruction using a dual control car, and allow the learner to experiment in a safe and controlled environment.

Using the simulator to measure performance after exposure to the experimental conditions, results indicated that the conditions representing the three components of fear appeal did have some effect upon attitudes towards safety and performance on the simulator. Results indicated that subjects who saw the high noxiousness film were more fearful of the outcomes of not driving safely, and were persuaded that accidents can cause much personal injury. The essay information persuaded subjects of the positive effects of safe driving practices upon avoiding accidents. They found that the arousal of fear, was effective in reducing the number of steering, braking and speeding errors on the simulator. Overall, the authors concluded that by manipulation of fear-appealing information presented to subjects prior to simulator assessment, a positive effect could be detected in both attitudes and behaviour. Two obvious points of caution are needed here. Firstly, there is still not a great deal of evidence to indicate that performance on a simulator is a good representation of that on the road, and secondly, attitudes and behaviours were being manipulated in a 'social' vacuum, without the pressures of peers, social situations and real life constraints. The next study reviewed considers the effects of legislation on driver education.

A study by Seaver, Nichols, Carlson and Voas (1979) indicated that there may be some positive effects of a combination of legislation and driver education. Seaver et al (1979) examined the relationship between driver education enrollment, state laws requiring driver education in order to obtain a license before the age 18 years, and the rate of licensing 16 and 17 year olds. They developed a cross-sectional longitudinal data set, which included data across several variables by areas within the District of Columbia for the years from 1965 to 1975. Some of the variables included in the analysis were: laws requiring driver education for licensing prior to 18 years of age; driver education enrollment; the number of 16 and 17 year olds licensed; and the population of 16 and 17 year olds. They found that driver education was significantly positively related to the rate of licensing of 16 and 17 year olds. They also found that the introduction of state driver education legislature had a significant negative relationship with the licensing of young drivers, while it had a significant positive relationship with the enrollment of young people on driver education courses. In most states where driver education was introduced as a licensing requirement for people under 18 years, licensing at the ages 16-17 years had previously

been allowed without this requirement. In this way, driver education may have become a barrier to early licensing. From their results they suggest that overall, driver education probably has some positive effect on the licensing rate of young drivers. A large experimental study of 16,000 high school students by Lund, Williams and Zador (1986) suggests that the type of driver education provided may influence the subsequent accident and violation rates of young drivers. Students were randomly assigned to an enhanced driver education programme, a minimal driver education programme, or to no driver education programme at all. Results showed that students enrolled on a minimal training programme were more likely than the non-programmed students to obtain licenses, but were not more likely to be involved in accidents or traffic violations. On the other hand, students enrolled on an enhanced driver programme were more likely to obtain their licenses, to be involved in accidents and to have traffic violations than the non-programmed students. They found that the students on the minimal course were more likely to take longer in completing the course than those on the enhanced course, and noted this as one possible cause in exposure differences between these two groups. Hence, the type of driver education programme available would seem to be the crucial variable from this study (probably due to its effects of licensing).

Lund et al (1986) conclude that driver education courses do not decrease the number of accidents and violations among teenagers as a group, rather that the availability of driver education increases interest in obtaining one's license earlier, resulting in more young people on the road, and hence more accidents and violations per capita. So although the accident rate per licensed driver may decrease (the probability of an accident per driver), the actual number of accidents per capita (for a given population) is increased, through the increased number of young drivers on the road. These findings are in line with those of Robertson (1980) that when driver education is dropped from high school curriculums, licensing and accident rates among teenagers decrease also.

Policies that have been suggested to reduce the number of young driver road traffic accidents include the elimination of high school driver education programmes, combined with a restriction upon the hours during which newly licensed drivers may drive. Some researchers have suggested that high school driver education increased the number of 16-17 year olds licensed, without reducing the number of accidents. (Robertson and Zador, 1979; Shaoul, 1975). Purely by obtaining their licences earlier, and hence being on the roads earlier, these young drivers have increased their risk of road traffic accident involvement.

Robertson (1980) reported that when driver education in schools in Connecticut was eliminated from some high school districts, there was a substantial reduction in the number of 16-17 year olds obtaining their licences, and an associated reduction in the number of road traffic accidents within this age group. Research by Preusser, Williams, Zador and Bloomberg (1984) compared accident rates for young drivers across states in America, some which had curfew laws and some which didn't. Some states imposed night-time driving curfews for beginning drivers, aimed at keeping these newly licensed drivers off the road during night-time, when many accidents occur. This forces young people to gain experience primarily during the hours of daylight, when increased visibility makes less demands upon the inexperienced driver. They found that there were less accidents in states during the imposed curfew time than with drivers of similar ages at the same time in another state where a curfew did not exist.

In summary there has been much more research into driver education and training programmes in America than in the United Kingdom, due to their greater proliferation and links with legislation, than in the United Kingdom. Studies have tended to suggest that when exposure and between group differences have been accounted for, there is minimal difference in accident rates between formally trained and non-formally trained students (Conger et al, 1966; McGuire and Kersh, 1969). Studies which have focused on accident rates per driver, have often produced opposite findings (Allgaier, 1964); these studies have not taken into account the fact that driver education often tend to increase the number of young people with licences (as these students obtain their licenses earlier)(Shaoul, 1975; Robertson and Zador, 1978), thus putting more young people on the road at risk of a road traffic accident, increasing the total number of accident-involved young people (Shaoul, 1975; Robertson and Zador, 1978). Many studies have also been criticised for their lack of random sampling or statistical controls for differences between driver and non-driver education students.

The next section will consider in some depth, some of the methodological problems associated with evaluation studies of driver education/training courses. Where there are studies which have attempted to overcome these design issues, these will be presented.

1.3.2.1 Methodological Problems with Evaluation Studies.

For many years proponents of driver education have claimed its many safety benefits. There were many non-random control group studies conducted around the 1940s and 1950s (American Automobile Association, 1945; National Education

Association, 1957), which appeared to confirm the suggested benefits of driver education, in terms of reduced accident rates and reduced citations for violations. However, many researchers have questioned the validity of the early studies, and their suggested results that driver education is an effective safety measure (Haddon, Suchman and Klein, 1964). These earlier studies have been criticised in particular, for their lack of random selection or statistical controls for differences between groups of driver education and non-driver education students. Studies have shown that driver education students do differ from non-driver education students in many important respects (Conger et al, 1966), and have placed emphasis on the fact that these variables could account for the differences between the two main groups of subjects. Conger et al (1966) found that when they attempted to control for the selection bias, they found smaller differences in accident and violation rate between the two groups of young drivers.

Klein and Waller (1970) outlined five major criticisms of studies of driver education programmes. The first criticism is in the selection of subjects into driver education and non-driver education groups (or formal and non-formal driver education groups) as mentioned above. In most cases, there has been no random assignment of subjects to groups; evaluation has been primarily of pre-established groups. There is evidence (as presented earlier) to suggest that there may be many differences between those who elect to take courses and those who do not: these differences represent the many uncontrolled variables in most evaluation studies. Some brief examples are given below of some studies which have found differences between driver and non-driver education subjects. Rainey, Conger and Walsmith (1961) found personality trait differences between driver and non-driver education students; Conger, Miller and Rainey (1966) found differences in intelligence and socio-economic status between driver and non-driver education students; while Asher (1968) found inter-group differences in terms of academic interests, educational aspirations, dating patterns, socio-economic levels and intelligence quotients. The above evidence does indicate between-group differences which highlight the importance of random sampling (where possible) or at least a recognition of these extraneous variables.

The second criticism levelled at evaluation studies, is the problem of controlling for the quantity and quality of exposure between formally and 'informally' trained drivers. Conger et al (1966) found that exposure is higher among informally trained drivers than in those who have attended formal driver training courses. The role of exposure has not always been taken into account when

evaluating the effect of driver education courses, thus casting doubt upon the validity of the findings.

A third criticism raised has been linked to the fact that many driver education students are only assessed by their driving records, over a very short period. It leaves open the possibility that the effect of driver education may be positive for a short period only, and may in fact turn negative over time (Harrington, 1971). The other associated problem is that with the passage of time, other influences on the driver may counter-balance any influences acquired from a formal driver training course.

A fourth criticism is that the differences in the background between the drivers with formal driver education and/or training and those without, may lead to differences in the levels of reported accidents and violations (McGuire 1973; Klein and Waller 1970).

A fifth problem associated with these studies is the lack of generalizability. There are many differences between different driver education and training courses, and so it is not safe to generalise from specific research on a small number of courses, to other driver education courses in general.

Studies have been undertaken which have attempted to overcome some of these methodological difficulties. A study by Conger et al (1966) is one of these. They found in their study that when the potential effects of extraneous variables, such as exposure, socio-economic status and intelligence were controlled for through a matching technique, previously significant differences in violations between formal and informal trained students, disappeared. Although, significant differences were still found in the number of responsible accidents in the first four years of driving, with formally trained drivers having fewer accidents. So it appears from this study that when exposure and other extraneous variables are accounted for, there is a positive effect of the course on accident-involvement.

McGuire and Kersh (1969) conducted a similar matched group comparative study. They found that when these other variables had been accounted for (age, sex, mileage, father's education and occupation) the number of accidents between those who had received classroom instruction only, compared to those who had received classroom instruction and behind the wheel training, did not differ significantly. This would tend to suggest that the additional instructional skills training (behind the wheel), did not have any positive effect (or negative) on the rate of accident-involvement.

In both Conger et al and McGuire and Kersh's studies, the sample size of the matched groups were small (40 and 36 respectively). Also the matching procedure cannot be sure to cover all extraneous variables, particularly the self-selecting variable (differences between those who elect to take driver training courses and those who don't). In contrast to these two studies, the next study by Dreyer and Janke (1979) employs a random design, and large sample sizes.

In 1979 Dreyer and Janke conducted a study with a sample of 2,057 high school students from five California high schools. Students were randomly assigned to one of two groups (experimental and control). Nine hundred and eighteen subjects were assigned to a traditional driver training program (involving practice in a normal road traffic environment) and 1,139 subjects were assigned to an experimental programme using a driving range (test track). The only difference found between the two groups was in terms of the number of accidents: range students had fewer total accidents than the non-range students in the year immediately after training. No differences were found on a driving knowledge test, simulator test, or overall course grade (focusing on driving skills). Also, there were no differences in terms of how long it took students to become licensed. They did not state in their study whether the two groups differed in terms of exposure and whether this was accounted for when considering the accident rate. Evaluation was over a relatively short time period (1-year), but over this period it would appear that training on the road was associated with a higher accident rate.

1.3.3 Summary.

In summary there have been many non-random control group evaluation studies of driver education programmes, the results of which must be treated with caution. Of the few studies that have attempted to overcome some of the methodological problems of their counterparts, results have still been contradictory: some have found training and education to have a positive effect (Conger et al, 1966), some have found no measurable effects (McGuire and Kersh, 1969) while some have found negative effects (Dreyer and Janke, 1979).

The above research into young driver/pre-driver education and training programmes would tend to suggest that these initiatives have not been very successful in reducing road traffic accident and violation rates when exposure and other extraneous variables are taken into account. This may be partly due to the research design of these studies, but may also be to (1) the information contained within

these courses, (2) the method of information presentation and instruction, (3) the age at which young people are first exposed to driving/road safety educational programmes, and (4) the short-term nature of these courses. The first and third points may be particularly important, as many driving/road safety programmes are aimed at young people at an age when they may already have well defined (and possible 'deviant') attitudes towards driving, and often when they already have some first hand driving experience.

If road safety researchers and practitioners wish to improve driver/pre-driver education and training programmes, then detailed research is required to provide information on the attitudes, perceptions and behaviours of both drivers and pre-drivers, as they develop from an early age. Such research would provide much needed information on what driving-related information to target at young people of different ages. Such information would provide practitioners with a better foundation for moulding positive road safety attitudes early on, and to assist in changing the 'deviant' attitudes of young drivers (MacMillan, 1975; Jessor, 1987), by targetting the appropriate attitudes, perceptions and behaviours on the basis of sound research.

1.4 RATIONALE AND AIMS OF THIS STUDY.

The research into young peoples' driving behaviour and attitudes has suggested that they often see driving as a means for emotion-expression (Pelz and Schuman, 1971; MacMillan, 1975; Jessor, 1987), often engage in deliberate risk-taking behaviours (Quenault et al, 1968; Schuman et al, 1967; Jessor, 1987), but also hold inaccurate perceptions of their driving skills (Sivak et al, 1981; Finn and Bragg, 1986; Mathews and Moran, 1986), and are not competent at hazard perception and evaluation (Quimby and Watts, 1981; Brown, 1982). These results provide some information on what areas need to be included in driver/pre-driver training courses, but does not provide information on the ages at which young people first begin to develop attitudes towards the different facets of road user behaviour, and how these change with age and first hand driving experience. Research is needed that allows one to determine what information needs to be targetted at young people of different age groups, including before they start to drive. In addition to this, research into methods of information presentation may yield results that enable one to determine if certain aspects of the task of driving are better presented to young people by one method as opposed to another.

The fact that many driver/pre-driver education programmes have been short-term initiatives, may have an influence on the length of their impact upon young peoples' attitudes and behaviour. The development of a curriculum course which is aimed at the needs of each age group throughout secondary education, and which continues throughout their educational career, may have a more positive and lasting impact, particularly if the right level of information is targetted at the right problem attitudes and perceptions at the appropriate developmental stages.

In the light of the above research findings on young drivers, this present study will concentrate on the development of attitudes, perceptions and behaviours of young people in relation to general road usage, offences and risk-taking. The design of this study will be cross-sectional, sampling four age-groups (11-12, 13-14, 15-16, 17-18) within a non-driving population, and three age-groups (17, 18, 19 years) within a driving population. During these age ranges, young people represent a particularly interesting group of subjects for this research, because the personal and social significance of driving may be hypothesized to develop rapidly. The attitudinal and perceptual dimensions that young people develop during these formative years may have an important bearing on how they drive when they become drivers.

This study will attempt to discover how knowledge about driving, rules of the road, risk-perceptions and attitudes towards risk-taking change with age (from 11 to 19 years of age) and with first hand experience of driving. It will also attempt to uncover some of the ways in which these attitudes and perceptions of young drivers differ from their younger non-driving counterparts.

In terms of practical contribution, the study will help to provide a knowledge of the range of attitudinal and perceptual dimensions, (as they relate to the different age-ranges) which inform driver decision-making and define which attitudes to risk, driving offences and general road usage may be applied to the problem of identifying points where interventions are most needed and most likely to be effective.

In terms of a theoretical contribution, the study will provide evidence on the theory of risk perception, in an attempt to test the applicability of this theory to perceptions of risk with young and pre-drivers. By defining the age-related attitudinal dimensions to risk-taking behaviours, the study will also attempt to provide some insight into the issue of risk utility with a sample of young drivers and pre-drivers.

The methods used in this study involve established questionnaire methods, and the relatively innovative technique of interactive video. The use of interactive video to present simulated driver decision situations is a novel methodology. It is high in realism, it presents subjects with the need to make decisions in real time, and it provides the researcher with a facility for demonstrating the immediate consequences of particular driver decisions. The application of both survey and interactive video methods within this study will allow the researcher to: (1) provide some conclusions about these methods in terms of how they highlight perceptual and/or behavioural differences between young people of different ages, and (2) examine any differences between attitudes/perceptions and behaviours, particularly within the non-driving sample.

The main objectives of this study are summarised below.

- 1) To assess the developmental changes that occur between the ages 11 and 19 years in terms of attitudes, perceptions and behaviour in relation to general road usage, driving offences and risk-taking. An investigation of which dimensions discriminate between the sexes will be conducted, but only as a secondary objective.
- 2) To investigate how these attitudes, perceptions and behaviours differ between pre-driving and driving subjects.
- 3) To evaluate interactive video technology as a method for assessment, in comparison to the more traditional survey methods.
- 4) To help to identify those points where interventions are most needed and most likely to be effective. By building up a knowledge of the range of attitudes, perceptions and judgments which inform driver decision-making and which define attitudes to risk-taking and general road usage, these may then be applied to the problem of identifying effective points of intervention.

CHAPTER TWO.

METHODOLOGY.

CHAPTER 2.

METHODOLOGY.

2.0 OVERVIEW.

This first section provides an overview of the methodology as presented in this chapter. The methodology describes the study of road safety attitudes, perceptions and behaviours of young people aged 11-19 years. The study has two main phases, each employing a distinct methodology. The first phase employs the use of self-completion questionnaires (Non-Driver and Driver Questionnaires) to assess attitudes, perceptions and reported behaviours, while the second phase employs the use of interactive video technology to assess subjects in a series of simulated road traffic situations.

The methodology section contains details on the research objectives and research design, the sampling strategies, the assessment instruments, the administration of the survey instruments and Interactive Video Driving Programme (I.V.D.P.), and treatment of data.

a) Research Objectives and Design.

The first section of the methodology (2.1) describes the four main research objectives of this study, covering group differences, countermeasures, comparison of methodologies and theoretical concerns. Following this there is a short section (2.1.1) identifying six main issues for inter-group comparison. In light of these research objectives, section 2.1.2 summarises the implications for the research design and states the methodologies employed.

b) The Non-Driver and Driver Questionnaire Studies.

i) The Sampling Strategy.

Section 2.2 describes the Non-Driver and Driver Questionnaire studies in detail, starting with the sampling strategy. The issue of sampling strategy covered the areas of sample size in relation to projected analyses, the method of subject selection, and a description of the population from which the sample was drawn.

ii) Development, Administration and Analysis of the Survey Instruments.

Sections 2.2.2 to 2.2.2.2 detail the development of the survey instruments considering firstly, the method and results from the in-depth interviews and how these, combined with previous research findings, contributed to the generation of questionnaire items. This is then followed-up in more detail in later sections (2.3.1 to 2.3.4). Section 2.2.3 describes the pilot questionnaire, sample size and pilot results. Section 2.3 and its sub-sections, presents an initial overview of the Non-Driver and Driver Questionnaires, followed by details of the content of the questionnaires, broken down by each questionnaire section. Information is provided as to why two Non-Driver and two Driver Questionnaires were used, which items are contained within the questionnaire sections, the similarities between the questionnaires, the measurement and scaling of questionnaire items, and the relation of items to previous research.

Section 2.4 details the administration of both of the Non-Driver and Driver Questionnaires. This section provides details on when the questionnaires were administered, the sample of schools and organisations involved, and the procedure employed for the administration of the questionnaires. The problem of obtaining a representative sample from a population who are not in further education on a full-time basis is also discussed.

The implications of comparing the results between the Non-Driver and Driver Questionnaires are considered in section 2.5, in light of the fact that they contained different items and were administered to two distinctly different samples.

c) The Interactive Video Study.

The interactive video study, and specifically the use of interactive video as a methodology to study attitudes, judgements and behaviours in road safety, is introduced in section 2.6.1. The use of interactive video to present simulated driver decision situations is discussed and the advantages of interactive video outlined. Section 2.6 continues to describe the equipment used in the interactive video study, including the video material employed for use with the laserdisc system.

i) The Sampling Strategy.

The sampling strategy used in this phase of the project is described in section 2.6.3. The sample for this phase of the study was taken from the original sample of respondents who completed the Non-Driver and Driver questionnaires, to provide continuity of data, and hence allow a general comparison of the results between the questionnaire data sets and the interactive video data set.

ii) The Development, Administration and Analysis of the Interactive Video Driving Programme.

The development of the Interactive Video Driving Programme (I.V.D.P.) is considered in section 2.6.4. with specific reference to the theoretical issues which were addressed. Section 2.6.5 describes the I.V.D.P. in terms of instructions given to subjects, and the three practice scenes that subjects were shown. This section then goes on to provide details of the format and order of scenes in the I.V.D.P. The I.V.D.P. begins with 'verbal commentary scenes' where subjects watched four scenes and had to provide a verbal commentary on requested issues. Following this subjects were shown 14 'interactive video scenes' where they were required to interact with the system by providing answers to decision situations and to progress through the programme. This section provides detailed information on each scene presented to subjects.

Section 2.6.7. describes the administration of the I.V.D.P., focusing on time-scales, equipment set-up and the procedure.

Section 2.6.8. examines relevant issues for consideration in the comparison of the I.V.D.P. data and the questionnaire data.

The methodology chapter finishes with section 2.7 which provides an outline of the treatment of the data, in terms of the univariate and multivariate procedures employed.

2.1 OBJECTIVES OF THE RESEARCH.

This section details the four main research objectives as described at the end of the introduction. Following these main objectives, there is a summary of six particular issues for investigation.

The four main research objectives are as follows:

- (1) To assess the developmental changes that occur between the ages 11 and 19 years in attitude, perception and behavioural dimensions in relation to road safety. An investigation of which dimensions discriminate between the sexes was conducted, but only as a secondary objective.
- (2) To investigate what differences exist between drivers and non-drivers in terms of certain attitudes, perceptions and behaviours.
- (3) To make a descriptive comparison of the results yielded from assessment with interactive video technology with those from questionnaires, to shed some light on any differences between the methodologies. By making a comparison between the two methodologies according to the developmental stage of the subjects, it may be possible to determine where (on a developmental scale) the results highlight differences. An attempt will also be made to determine whether differences between the methodologies only exist where particular types of judgments are required.
- (4) To attempt to identify those points where interventions are most needed and most likely to be effective. By building up a knowledge of the range of attitudes, motivations and judgments which inform driver decision-making and which define attitudes to risk-taking and general road usage, these may then be applied to the problem of identifying effective points of intervention.

As can be seen from the above research objectives, this study focuses primarily on the age of drivers and pre-drivers in the analysis of the data: an investigation of what attitudinal dimensions the sexes could be discriminated on was performed, but only as a secondary objective.

Existing research would tend to suggest that young drivers have significantly higher accident and offence rates when compared to older age groups (Pelz and Schuman, 1971; Goldstein, 1972; Johnson, 1972; Jonah, 1986; Broughton, 1988). The main aim of the current study was to examine what developmental changes occur between the ages 11 and 19 years in attitudes, perceptions and behaviour in relation to road safety, in an attempt to identify those points where interventions are most needed and are most likely to be effective, in order to reduce the accident and offence rate of young drivers. One important route for countermeasure development aimed at young pre-drivers and drivers, lies within road safety education in schools. The findings from this study will have implications for educational and training measures designed to influence the behaviours and attitudes of both young drivers and pre-drivers. One aim is to identify effective points for intervention, through educational measures, based upon the age-ranges of young people. When considering the implementation of school-based driver education programmes, it would be difficult to justify in socio-political terms, research towards the development of different education programmes for males and females. Thus the detailed examination of differences in attitudes, perceptions and behaviour between the sexes is seen as of secondary importance in the current study.

2.1.1 Particular Issues For Investigation.

The particular issues for investigation with pre-drivers and with young drivers are summarized below.

1) Attitudes towards driving offences.

Previous research with *drivers* has indicated that young drivers and male drivers have a lower perception of the seriousness of road traffic offences than other groups (Brown and Copeman, 1975; MacMillan, 1975). This issue of the perceived seriousness of driving offences will be investigated in this study as part of an attempt to construct a developmental pattern of young peoples' attitudes to road traffic offences. The study aims to extend the research on driving offences by examining the perceptions held by a much younger sample of young people than previously considered: that of pre-drivers ranging between the ages 11-18 years and young drivers between 17-19 years. This issue of offence seriousness will be investigated by the survey techniques employed in this study.

2) Perception of accidents: likelihood, severity and associated factors.

This issue will be investigated in this study by applying both interactive video and survey techniques. The aim will be to examine whether: (a) there are any differences between subjects' ratings of the perceived likelihood of an accident for themselves and their evaluation of how serious such an accident would be, and (b) whether there are any differences in the subjects' perceptions of the likelihood of an accident for themselves and for other drivers. These issues will be examined with both pre-drivers and young drivers to examine for any developmental (defined by age and direct driving experience) effects. Previous research has considered the perceived likelihood of an accident for self and 'other drivers' with younger and older drivers using survey and laboratory techniques (e.g., Finn and Bragg, 1986; Mathews and Moran, 1986): results have tended to indicate that younger drivers have lower perceptions of the likelihood of accident-involvement for themselves than do other groups. The research by Brown and Copeman (1975) which examined the perceived seriousness of offences with a wide age-range of drivers, was also partly based upon the concept of the negative outcome of such driving offence behaviours: thus results from their study may also indicate that the younger drivers perceive the potential negative outcomes resulting from such offence behaviours, as less serious than their older counterparts. This issue of the seriousness of negative outcomes of driving behaviours will be examined not only with a sample of young drivers, but also a sample of pre-drivers employing both interactive video and survey techniques. In addition, this study will extend the issue further by attempting to combine the perceptions of the perceived likelihood of an accident with the perceived seriousness of a negative outcome.

3) Driving behaviours: reported, simulated and predicted.

Research by Schuman et al (1967), MacMillan (1975), Evans and Wasielewski (1983), and Sivak et al (1989) and others, has examined the reported and observed driving behaviours of young drivers. Results have tended to suggest that young drivers, and particularly young male drivers, drive in a potentially more dangerous manner than other groups of drivers. The issue of driving behaviours in this study was extended to examine the following two main issues. Firstly, the driving behaviours of young people before they start to drive by (a) their simulated driving behaviours observed with interactive video techniques, and (b) their predictions of their future driving styles from

the questionnaire data. Secondly, to examine the reported driving behaviours of a sample of young drivers from the questionnaire data, and the simulated driving behaviours of these subjects from the interactive video data. The combination of these two methodologies may help to present a more comprehensive account of the driving behaviours and associated attitudes of young people ranging from pre-drivers through to young drivers.

4) Risk-taking: attitudes and perceptions.

The issue of young drivers' risk-taking behaviour and the associated attitudes and perceptions have been considered by a number of researchers (e.g., Quimby and Watts, 1981; Svenson, 1981; Finn and Bragg, 1986; Mathews and Moran, 1986; Sivak et al, 1989). The use of single research methods has not allowed researchers to examine the issue of intentionality in risk-taking. In addition, the issue of drivers' evaluation of the likely negative consequences of accidents resulting from risk-taking behaviours has not been studied in-depth. This study aims to extend research knowledge in this area by assessing the perceptions and attitudes towards risk-taking with pre-drivers as well as young drivers, to examine for developmental effects before and after they start to drive. The attitudes and perceptions of young people will be examined using survey methods and interactive video techniques to assess, in particular, their attitudes towards risk-taking, their perceived level of skill and their perceptions associated with risk-taking behaviours (hazard identification, response and evaluation).

5) Social influences and general attitudes towards driving.

This issue will be examined mainly with the pre-drivers to determine the possible early influence of social factors on their perceptions of driving. Earlier research with young drivers has indicated that they see driving as a means for emotion-expression (Schuman et al, 1967) and that young drivers often exhibit aggressive and competitive behaviour on the roads (MacMillan, 1975). Similar issues to these will be examined in an attempt to analyse for any age differences, from 11-18 years, in order to identify at what ages potentially negative attitudes being to develop, and in order to highlight points for remedial intervention.

6) Attitudes towards drink-driving.

Much research has been conducted on young drivers' attitudes towards drink-driving (Clayton, 1980, 1984; Guppy, 1984/1987 and others), but less have examined this issue with pre-drivers (Diblasio, 1986, 1988). This study aims to extend this area of research by starting with a much younger age group (to assess developmental effects) and to examine critical beliefs towards the offence. The attitudes towards drink-driving will be assessed using survey techniques.

2.1.2 Implications For Research Design.

In order to allow reliable multivariate statistical analysis to be performed, reasonable-to-large sample sizes are required. Due to these sample requirements, interviewing pupils individually would have been impractical because of the inherent time-consuming nature of the process, and so a questionnaire approach was employed instead. Prior to the use of questionnaires it was necessary to conduct in-depth interviews with a relatively large sample of young people to assist in the development of questionnaire items. These in-depth interviews were particularly important due to the relative lack of previous research on the driving-related attitudes and perceptions of subjects as young as 11 years old.

Self-completion questionnaires were employed to obtain data from both drivers and non-drivers: separate questionnaires were designed for these two classes of young people to allow for greater focus on reported driving behaviours with the driving sample. The questionnaires were both structured and designed for self-completion to reduce the amount of time required to administer them. Structured questionnaires were employed as part of the study methodology as they are a relatively quick, efficient, and cheap method of data collection. In addition to this, structured questionnaires allow the collection of large-scale quantitative data which is required for multivariate statistical analysis. Multivariate statistics would need to be employed to meet the research objectives: the objectives require the analysis of multiple variables across subject groups.

From the above section on research objectives, it can be seen that one of the subsidiary aims is the make a comparison between two methodologies: the method of structured questionnaires, and the more novel methodology

of interactive video technology. To meet this objective an Interactive Video Driving Programme was developed, thus allowing assessment of subjects' driving-related judgments and behaviours within an interactive environment. The use of interactive video to present simulated driver decision situations, allows the assessment of judgments and behaviours in a less abstract environment (by providing subjects with visual representations) than that permitted by questionnaire data collection. The data produced by the Interactive Video Driving Programme was quantitative allowing multivariate analyses to be performed.

2.2 THE NON-DRIVER AND DRIVER QUESTIONNAIRE STUDIES.

2.2.1 The Sampling Strategy.

Subjects were obtained from 17 state schools/colleges, one college of further education and three companies in the North West of England. As the data collection was undertaken from the University of Manchester, the sample was drawn from schools in the surrounding counties in order to permit ease of access to these schools and to elicit co-operation from schools in the surrounding community.

The non-driving subjects were selected from 17 state schools and colleges: a total of 1,036 non-driving subjects participated in the study. The respondents ranged from 11-18 years of age, included both sexes and were from mixed ability classes. Full details on subject numbers by age and sex are presented in the results section.

The driving subjects were selected from the sixth forms of 7 schools/colleges, day-release courses at a college of further education, and from three local employers: a total of 139 driving subjects participated in the study. The respondents ranged from 17-19 years of age and included both sexes. Full details on subject numbers by age and sex are presented in the results section.

The participation of all respondents was on a voluntary basis. Where subjects were drawn from a particular school or college an attempt was made to obtain a random sample across abilities. Due to school time-table restrictions this was usually achieved by selecting whole classes of mixed ability pupils in order to cause the least disruption.

The total number of subjects who participated in the questionnaire phase of the study were reduced for analysis purposes due to problems of missing data. This problem is discussed below.

As the type of analyses to be employed would require the division of the total sample into sub-groups (e.g., four non-driver age groups within a discriminant function analysis), it was important to ensure that relatively large sample sizes were obtained within expected groups. Group sample size is particularly important in discriminant function analyses. Tabachnik and Fidell (1989) state that the sample size of the smallest group should notably exceed the number of predictor variables in order to avoid overfitting (producing results so close to the sample they do not generalize to other samples). As it was expected that 17 or more variables might be included in a discriminant function analysis, an attempt was made to obtain group sample sizes to exceed these minimum requirements. An attempt was made to obtain group sample sizes larger than would be necessary for analysis to allow for a potential loss of subjects between the different project phases (questionnaires I, questionnaires II, and the interactive video assessment), although this was more difficult within the driving population as only relatively small numbers of drivers within each age group could be obtained from schools.

2.2.2 Development of The Survey Instruments.

2.2.2.1 In-depth Interviews.

The Sample and Procedure.

In-depth interviews were conducted with 55 non-drivers in order to gain qualitative information for the development of the Non-Driver Questionnaires. Subjects were selected from 5 schools in the counties surrounding Manchester. The in-depth interviews were conducted during January and February 1989. All interviews were conducted by the author on a one-to-one basis with subjects and lasted an average of 45 minutes. Subjects were selected by the schools, who were asked to provide a mix of pupils in terms of sex, ability, background and gregariousness. Selection by gregariousness was included to avoid a possible sampling bias introduced by teacher selection of the most outgoing pupils (i.e., the pupils who they

believed would be the most 'talkative' in the interview). The age range of the subjects was from 11 to 17 years. The breakdown according to subject ages is: 11-12 years = 15, 13-14 years = 15, 15-16 years = 15, and 17 years = 10. Thirty males and twenty-five females voluntarily participated in the in-depth interviews.

In-Depth Interview Objectives.

The aims of the in-depth interviews were to assess the level of knowledge and interest that subjects had about driving. This was undertaken with particular focus on the younger age levels, and specifically to address the following issues:

- (1) To assess the degree to which these young people had developed opinions about drivers in general, about learning to drive and its desirability, about parental and peer influences, and about the types of car that they would like to drive.
- (2) To measure awareness of alcohol, its physiological effects, the desirability of drinking, attitudes towards drink-driving, awareness of (and attitudes towards) the legal drink-driving limit and penalties for transgression, and reported levels of alcohol consumption.
- (3) To assess knowledge of, and attitudes towards, different driving behaviours and their relation to driving offences and penalties. The main driving behaviours discussed were drink-driving, speeding, and driving through red traffic lights. Some questions were asked about the perceived likelihood of detection for these offences. Respondents were also asked how they felt in general about the police.
- (4) To investigate respondent's perceptions of different groups of drivers on the road (young, old, male, female), and to discuss what sort of driver they thought they would become.

The above information was required in determining the level at which to pitch the specific driving-related questions when developing items for the Non-Driver Questionnaires.

In-depth Interview Results.

The results of the in-depth interviews are discussed briefly below.

Most subjects expressed an interest in driving (although males more so than females), were keen to learn to drive when they were old enough, and were frequent passengers in parents', siblings' or friends' cars. Only about two-thirds of subjects had ideas about the types of cars that they would like to drive: the older subjects had more developed ideas than the younger ones. Approximately 30% of males aspired to driving what they considered to be fast, sporty cars, while very few females did, generally preferring the smaller, 'standard' cars. In terms of the ability to identify cars from pictures, in general the male and older subjects were more accurate.

Subjects' awareness of alcohol, its uses and their own reported consumption increased with age (the increase tended to be larger with males than females, particularly in terms of consumption). The younger subjects (under 15 years) were not accurately aware of the legal drink-driving limit, as opposed to some older subjects who were more informed, but in general all subjects expressed a socially responsible attitude towards drink-driving. As with other driving offences, subjects tended to believe that there was a 'high' likelihood of detection for drink-driving. A very low percentage of subjects (less than 10%) were aware of the possible penalties for drink-driving.

Most subjects had positive attitudes towards the police. Their knowledge of driving offences and sanctions improved with age, as would be expected. Most subjects were aware that there were speed limits, that the law attempted to prevent drunk drivers from driving, and that it was an offence to drive through red traffic lights. In general, subjects thought that there was a 'high' likelihood of detection for transgression of road laws.

Nearly all of those interviewed had formed some beliefs about different groups of drivers. Virtually all subjects said that most men drove faster than most women. Approximately 30% of both males and females said that females were the safest drivers, another 30% from each sex thought there was no difference, while the remaining 40%, from both sexes, said that men were the safest drivers. Most subjects also said that older drivers (but not elderly) were safer than younger drivers, because they drove slower and were more experienced. Most subjects said that they thought they would become safe drivers, but with a large minority (20%) saying that they would be fast

drivers.

Overall, results from the in-depth interviews indicated that young people, even as young as 11 years old, do have a detailed knowledge about driving (albeit to varying degrees), have developed attitudes towards the task of driving and about different groups of drivers, and have some awareness of offences and penalties. These results were drawn upon heavily when developing items for the Non-Driver and Driver Questionnaires, as described in sections 2.2.2.2 to 2.3.3.

2.2.2.2 Generation Of Questionnaire Items.

Some items in the Non-Driver and Driver Questionnaires were replicated from previous questionnaires (Harris. D, 1987; Guppy. A, 1984; MacMillan.J, 1975), and some were edited versions (Guppy.A, Wilson. P, and Perry. J, 1990), but most were generated from the informal interviews with an early sample of subjects, and issues highlighted by previous research, in order to address the objectives in question. The similarities of previous research in relation to specific items used in this study, are considered in more detail in Sections 2.3.1 and 2.3.4.

The interview results had indicated that all subjects could reason about questions concerning the perceived likelihood of detection for certain offences: the subjects held beliefs about the varying degrees of likelihood of detection for the offences they were questioned about. As subjects in the interviews could answer these questions it was decided that similar items would not present a problem if put into the questionnaires. The perceived likelihood of detection items for drink-driving were taken from Guppy (1984), but a 5-point subjective probability scale was employed as opposed to a logarithmic one. Subjective probability scales were used to keep the answer format as simple as possible due to the young ages of some subjects employed in the study.

Subjects in the interviews demonstrated that they held views about various groups of drivers, and were able to make predictions about their own future driving styles and skills (particularly in terms of speed and safety). Subjects as young as 11 years had developed views on these and related issues, and so these results provided the basis for developing similar questionnaire items, most of which were answered employing a 5-point scale.

The interview results, that all subjects had an awareness of different driving offences and an awareness that penalties existed, allowed the inclusion of similar and

related items (such as rating the seriousness of various driving offences) in the final questionnaires.

Items were developed for the questionnaires that pertained to what types of cars the respondents would like to own, and what factors would be important to them when buying a car: these questions were asked as it became apparent during the in-depth interviews that the very developed nature of young people's attitudes towards driving had lead to these issues holding importance for them (and a subject which some liked to talk about at length).

The relationship between questionnaire items and previous research is considered further in sections 2.3.1 to 2.3.4.

2.2.3 The Pilot Questionnaire.

Both the Non-Driver and Driver Questionnaires were divided into two sub-questionnaires (as opposed to one large one) in order to reduce completion time and to fit in with school/college lessons. This approach did lead to some missing data: some subjects were present for the first questionnaire, but absent for the second.

The Non-Driver and Driver Questionnaires were piloted on 50 non-drivers and 25 drivers at a local school with an attached sixth form college. Results were very good, with a 100% response rate for both the first Non-Driver and Driver Questionnaires, but due to some subjects being absent from school for the administration of the second questionnaires, this was reduced to 84% for the Non-Driver Questionnaire (eight subjects were 'lost') and 88% for the Driver Questionnaire (three subjects were 'lost'). Results indicated a full questionnaire completion rate, with no items presenting any significant problems. As such, the pilot questionnaires were retained and used for the main study, and the pilot data used as the start of the main data collection process. In the pilot study the Non-Driver Questionnaires took approximately 20 minutes each to complete, while the Driver Questionnaires took 25 minutes each to complete.

2.3 Overview Of The Questionnaires.

The Non-Driver Questionnaires consisted of 211 items (93 items in Questionnaire I, and 118 items in Questionnaire II). The Driver Questionnaires consisted of 217 items (105 items in Questionnaire I, and 112 items in Questionnaire II). Both the Driver and Non-Driver Questionnaires were intended to cast a wide net over a large number of variables concerning young people's

attitudes, judgments and behaviours in relation to the task of driving. There was a deliberate overlap in items between the two types of questionnaires to allow comparisons between drivers and non-drivers to be made. In order to make the Driver Questionnaire relevant to the experiences of drivers, there inevitably had to be some differences to the total pool of items presented in the Non-Driver Questionnaire. In the Driver Questionnaire a large proportion of items focused on specific experiences of driving, and drew upon subjects' detailed knowledge of driving, while most of the more 'simplistic' non-driver items were dropped.

The questionnaires covered a range of items from the following areas: alcohol and driving; parental and peer influences; perceptions of other drivers; aspects of personality and social skills; risk-taking; perceptions of young people's driving; perceptions/expectations of their own driving; functions of a car/driving; the police, offences and sanctions. Full details of the items can be found in copies of the questionnaires in Appendix A.

Within the Driver Questionnaires there were items on experience, exposure and accident history. These items were included more as a standard procedure to allow for possible further developments of the study at a later date (for example, collection of data from an older sample of drivers), than as a specific objective of the present study.

The first Non-Driver Questionnaire was broken down into five sections, while the second Non-Driver Questionnaire was broken down into four sections. The first Driver Questionnaire was broken down into four sections, while the second Driver Questionnaire was broken down into two sections. Different attitude scales were used in the questionnaires, although most were measured on 5-point Likert scales, from 'strongly disagree' to 'strongly agree'. A scale with an odd number of points was used to give respondents the opportunity to make a neutral response, rather than being forced to decide the direction of their attitudes. The reason for using different scales was two-fold. Firstly, particular attitude scales were more appropriate to elicit answers to some questions than to others. Secondly, variety in the format of the questionnaire was intended to aid the concentration of the respondents and to avoid boredom. The questionnaire was divided up into sections (with different colour pages) again to aid concentration, and to highlight the beginning and end of sections containing different types of questions (and in particular, questions with different types of answer formats).

The content of questions within each section of the

Non-Driver and Driver Questionnaires are summarised, with examples, below.

2.3.1 NON-DRIVER QUESTIONNAIRE I.

Section A.

This section contained biographical details about the subject, followed by items referring to the subject's experience of driving and peer and parental influences. Some examples of questions within this section are: "When you are older do you intend learning to drive (i) a car (ii) a motorbike?; How much do you think your parents will help you with the financial costs of having a car?; When you have passed your driving test do you think your parents will let you use their car?; How many of your friends drive cars?; and How many of your friends ride motorbikes?" The questions focusing on parental influences relate particularly to issues raised by Preusser et al (1985) whose study indicated that parents play an influencing role in the licensing of their sons or daughters, particularly with respect to how early licensing occurs. Most variables in this section were categorical or dichotomous. Overall, there were only ten questions in Section A.

Section B.

Section B contained items relating to attitudes towards deliberate risk-taking, competitive driving, the police, power and thrill seeking, drink-driving, views on different groups of drivers, personality variables, and beliefs about the type of driver the respondent believes they will become. Many questions in this section were developed to address the issues of risk-taking and youthfulness highlighted by Pelz and Schuman (1968) amongst others. Pelz and Schuman (1968) found that there was a decline in the influence of 'emotional/impulse expression' factors contributing to drivers' risk-taking behaviour (and the associated frequency of accidents and offences), as age increased. The items in this section of the questionnaire allow the examination of the attitudes of young non-drivers to these issues.

The in-depth interview results indicated that even the youngest subjects (11 years old) had some knowledge of the offence of drink-driving, and held views about different groups of drivers, along with what sort of driver they thought they would become. In the light of these results, items covering these issues were included in the Non-Driver

Questionnaire in this section, with the knowledge that these questions would be within the ability range of the non-driving sample.

All questions in this section were designed as attitude statements which subjects were required to answer on five point Likert scales ranging from 'strongly disagree' through to 'strongly agree'. The list of attitude statements included items such as: "The police do a good job; People who drive fast are the most skilful drivers; Young drivers are safer drivers than older drivers; I often feel superior to others; Speed limits on most roads are too slow; I think I will be a fast driver; Overtaking other cars will be exciting"; and "It is O.K. to drive by yourself without having passed your test". Overall there were 34 attitude statements in Section B.

Section C.

This section contained items that referred to reasons for learning to drive, beliefs about the uses of a car, factors considered important in a car, and what type of car one would like to have. These questionnaire items were developed primarily out of the in-depth interviews conducted with a sample of 55 non-drivers. The in-depth interview results indicated that subjects often had strong reasons for wanting to learn to drive, and attitudes about what type of car they would like and what features were important to them in a car. The following questions are examples of ones contained in this section. Subjects were asked to rate the importance of the following six possible reasons for wanting to drive a car: "I will be able to get about easier; My friends will be learning to drive; People treat you more like an adult when you have a car; It will be fun to drive a car; It will help my social activities"; and "My parents want me to (learn to drive)".

The next question asked subjects to rate the importance of the following ten different qualities in a car, in terms of how much they would influence their decision in deciding which car they would like to have: "how fast it is; whether it looks good; whether it is a good make; how economical it is; safety features; whether their parents have one; whether a friend has one; whether it handles well; the size of it; and whether it is reliable". Subjects had to rate each of the above attributes on five point Likert scales, ranging from 'not very important' to 'extremely important'.

The third and last question in this section asked subjects to rate a list of five different types of car in order to indicate how much they would like to have them. Subjects used a five point scale again, ranging from 1 to indicate

a very low preference to 5 to indicate a very high preference. The following categories of cars were presented to the subjects: a small hatchback (e.g. a Metro or a Fiesta); a medium hatchback (e.g. an Escort or an Astra); a sports coupe (e.g. an Audi Coupe or Capri 2.8i); a fast hatchback (e.g. a Golf GTi or a Peugeot 205GTi); and a saloon car (e.g. a Sierra or a Montego). Overall, there were three main questions in Section C, divided into six, ten and five components respectively.

Section D.

Section D contained a list of 5-point scale attitude items referring to the level of interest in cars, driving offences, risk-taking, drink-driving, and personality variables. The particular areas of interest here, and some of the items, were developed from the previous research of MacMillan (1975) and Jessor (1987). MacMillan's study (1975) indicated that as age increases an aggressive and competitive attitude towards driving decreases. In addition to this, actual driving behaviours (reported driving speeds) were found to decrease as age increased. In terms of driving offences, young males were found to be more tolerant than other groups. The items in this section of the questionnaire will provide data on similar issues, but with a much younger non-driving group of subjects, to assist in assessing the development of these attitudes.

The list of attitude statements in this section included items such as: "I find cars boring; I am interested in motor sports; It is O.K. for skilful drivers to ignore speed limits; Driving fast on country lanes will be exciting; When I drive I will probably take some risks; My parents disapprove of drinking and driving; I am an independent sort of person; It is safe to drink over the legal limit and drive"; and "Driving will be a way of expressing my personality". Subjects rated each attitude statement on a five point scale from 'strongly disagree' to 'strongly agree'. Overall, there were twenty-eight attitude statements in Section D.

Section E.

This section contained a list of 5-point Likert scale attitude items referring to the dangerousness of a variety of driving situations and manoeuvres. As results from the in-depth interviews indicated that non-driving subjects had knowledge of a range of driving offences, and held attitudes towards them, it was felt that they would be able to comprehend the list of dangerous behaviours in this section, as they relate closely to actual driving offences. Subjects were required to rate each item from

'not very dangerous' (1) to 'very dangerous' (5). Section E included the following items: Not stopping at a pedestrian crossing when someone is trying to cross; Being over-cautious at roundabouts; Going too fast on roundabouts; Parking on double yellow lines; Braking too quickly in wet weather; Parking on the pavement; Not indicating when turning right; Driving too slowly in town; Jumping the queue in traffic jams by driving down the bus lane; Failing to give way to other drivers at junctions; Driving through red traffic lights just after they have turned red; Following the car in front too closely; Overtaking a car when approaching a bend; Driving above the speed limit in town; Driving above the speed limit on motorways; Turning in a road where U-turns are not allowed; Driving a car alone without a full driving licence; and Driving when having drunk slightly over the legal limit. Overall, Section E contained eighteen items.

2.3.2 NON-DRIVER QUESTIONNAIRE II.

Section A.

Section A contained biographical items, along with items referring to educational aspirations, driving experience, awareness of road safety adverts, and difficulty of learning certain driving skills. The reason for the duplication of some biographical items, was to serve as a double-checking mechanism in the process of combining Questionnaires I and II, for each subject, during data preparation. This duplication of biographical items as a 'double-checking mechanism' was in addition to the matching of subject numbers from the first and second questionnaires, and was undertaken by the researcher by hand.

The questions contained in this section included the following: "Do you plan to: (i) Finish education after the 5th year (ii) Finish education after the 6th form (iii) Go on to University, Polytechnic or College?; At what age do you think people should first be allowed to get a driving licence?; Have you ever tried to drive a car, even for a very short distance?; Have you ever tried to ride a motorbike, even for a very short distance?; Have you seen any adverts on T.V. advising people not to drink and drive"?; and "How difficult do you think it will be to master the following skills as a driver: Being aware of traffic and pedestrians, Judging when it is safe to overtake, Being aware of dangerous situations, Spotting hazards, Keeping a safe distance behind the car in front, and Coping in situations where a lot is happening at once". Most of the items in this section were developed out of the in-depth interviews, which highlighted that

even the youngest subjects had views on these aspects of driving behaviour. The variables in Section A were measured mostly on dichotomous and Likert scales. Overall, there were fifteen questions in Section A.

Section B.

This section contained a list of 5-point attitude scale items referring to risk-taking, offences and competitive driving. Each item was rated from (1) 'strongly disagree' to (5) 'strongly agree'. The attitude statements in this section included: "There should be stricter penalties for those who drink and drive; Racing other drivers away from traffic lights will be fun; Young drivers are more likely than other drivers to have an accident; It is safe to drive 10mph above the speed limit"; and "For me, driving will be a way of escaping the problems of everyday life". The items in this section relating to risk-taking and emotion-expression were designed to examine issues similar to those considered by Schuman et al (1968). Results from the in-depth interviews indicated that young non-drivers did hold beliefs about particular groups of drivers, about what sort of drivers they thought they would become, and about driving offences, hence items on these issues were included in this section. Overall, Section B contained eleven attitude statements.

Section C.

Section C commenced with a series of questions relating to alcohol and driving. The following questions are examples of some of these: "Do you drink alcohol with friends?; How often do you drink alcohol?; How much alcohol do you think the average man could drink without it affecting his driving?; What is the largest amount of alcohol the average man could drink without exceeding the legal drinking and driving limit"? These drink-driving items were included to consider issues and attitudes towards the offence highlighted in the works of Guppy (1984) and Jessor (1987). Jessor's 1987 study indicated that risky driving behaviour can be seen as part of a larger pattern of adolescent problem behaviour, including problem drinking, and so some of the items in this section were designed to examine the attitudes towards, and reported experience of, alcohol with a young non-driving sample. The items examining subjects' perceptions of the legal drink-driving limit were replicated from Guppy (1984). The results from Guppy's study showed that drink-driving offenders had a higher mean estimate of the amount of alcohol that would have to be consumed by the 'average driver' to reach the legal limit. From these results it can be seen that an accurate perception of the legal limit is related to one's driving behaviour: the

items in this section allow an examination of the awareness of this issue with a range of non-driving subjects. In addition to the above research, results from the in-depth interviews indicated that even subjects as young as 11 years old, do hold attitudes towards the offence of drink-driving.

This was then followed by a list of 5-point scale attitude items referring to how sorry subjects feel for someone when they get caught by the police for committing certain driving offences. Some examples of these questions are: "How sorry do you feel for people when you hear that they have been prosecuted for the following offences: - driving at 40mph on a 30mph road, driving at 80mph on a 60 mph road, driving through red traffic lights just after they have turned red, driving fast because one is late for a meeting, drinking over the legal limit and then driving a car, parking on double yellow lines, and racing with other cars on public roads". The results from these items will be used in comparison with the findings of MacMillan (1975) that young males are more tolerant of driving offences than other groups.

The last part of Section C is made up of a short series of questions asking subjects to rate (on a 5-point scale) how dangerous certain road conditions are. The following items are those contained in this part of Section C: "How dangerous are the following daytime road conditions when someone is driving: heavy rain, thick fog, icy conditions, dazzle by sun or headlights, snow, and wet roads"?

Overall there are twenty-nine items in Section C.

Section D.

This section began by asking subjects how often they thought a variety of factors were involved in causing accidents. Subjects were asked to rate each of the following fourteen factors on a five point scale ranging from (1) 'not very often' to (5) 'very often': weather conditions; road conditions; the driver's driving ability; other drivers on the road; mechanical problems; pedestrians and cyclists; bad luck; alcohol; lack of attention; inexperience; bad road layout; age; poor driving attitudes; and speed.

The second set of items asked subjects to rate how difficult they thought it would be to master certain driving skills. Subjects were asked to rate each of the following five factors on a scale from (1) 'not very difficult' to (5) 'very difficult': changing gear; correct use of mirrors; steering and road position; judging stopping distances; controlling speed; and co-ordinating

the above skills.

The next set of items required subjects to rate the seriousness of a set of offences on a five point scale from (1) 'not very serious' to (5) 'very serious'. The offences were as follows: not stopping at a pedestrian crossing when someone is trying to cross; going too fast on roundabouts; parking on double yellow lines; parking on the pavement; not indicating when turning right; failing to give way to other drivers at junctions; driving through traffic lights just after they have turned red; following the car in front too closely; overtaking a car when approaching a bend; driving above the speed limit in town; driving above the speed limit on motorways; turning in a road where U-turns are not allowed; driving a car alone without a full driving licence; driving when having drunk slightly over the legal limit; and driving when having drunk a lot over the legal limit. This set of items on the perceived seriousness of driving offences relate directly to MacMillan's 1975 study. In his study MacMillan also asked subjects to rate the seriousness of driving offences (although not an identical set of offences); results showed that women rated all offences more seriously than did men, with the young males showing the most tolerance of all groups. Another study by Brown and Copeman (1975) also examined the perceived seriousness of driving offences by age and sex. Brown and Copeman also found that young drivers rated offences as less serious than older drivers, with young males providing the lowest ratings of all the groups. The set of 31 driving offences employed by Brown and Copeman are similar, but again not identical in item wording, to those employed in this study. This set of questions in Section D enables one to examine what attitudes towards driving offences young people hold even before they start to drive, and how these attitudes may change with age.

The fourth set of questions asked subjects to rate the perceived likelihood of detection for certain offences using a five point scale ranging from (1) 'low' to (5) 'high'. The offences were as follows: drinking and driving; speeding in town; speeding on the motorway; driving dangerously; driving without insurance; driving while on drugs; parking on yellow lines; overtaking other cars dangerously; not wearing a seat-belt in the front seat of a car; driving through red traffic lights just after they have turned red; driving without a full driving licence; and racing with other cars on public roads.

Lastly, subjects were presented with 5-point attitude scale items referring to drink-driving, offences, risk-taking and other drivers. The following attitude statements are examples of some of those contained within this part of Section D: "It will be important to me that

my friends think I can hold my drink when driving; As long as no-one gets hurt it is O.K. to break road traffic laws; It will be important to me that my friends think I am a fast driver; It would be frightening to dart in and out of slower cars in heavy traffic; Young drivers are the most dangerous drivers because they are inexperienced"; and "Young people take more chances when driving with friends in the car".

Items in Section D were developed partly from the results of the initial in-depth interviews and partly from issues raised by previous research, specifically that by Brown and Copeman (1975) and MacMillan (1975). Overall, there were fifty-eight items contained within Section D.

2.3.3 DRIVER QUESTIONNAIRE I.

The type of questions within each section of the Driver Questionnaires are summarised, with examples, below.

Section A.

Section A included biographical details about the subject, followed by items referring to the subject's experience of driving, accidents (including near-misses), type of car driven, and details on education and employment. The following questions are a few examples of those contained within this section: "On which sort of roads do you drive on most: (i) rural roads (ii) urban roads (iii) motorways?; Approximately how many near-miss accidents have you been involved in while driving during the last three months?; Please supply the following information about the vehicle that you drive most often: (i) make of the vehicle (ii) model of the vehicle (iii) engine capacity (iv) approximate age of the vehicle."

Overall, fifteen questions are contained in this first section.

Section B.

This section contained items referring to the perceived seriousness of various accident situations, reported speeding and associated related risk. Some items described scenarios to subjects and asked them to provide ratings on the likelihood of an accident, the seriousness of such an accident, and their level of confidence in avoiding such an accident. All such scenarios were measured on five-point scales. This combination allows for

comparative analysis of these factors. The risk-related issues considered in this section relate to the earlier research studies such as that of MacMillan (1975), Wasielewski (1984), Finn and Bragg (1986) and Sivak et al (1989).

Some of the items requiring subjects to report their driving behaviours in terms of speed driven, are very similar to those employed by MacMillan (1975). The following items were replicated from MacMillan's study: 'how fast would you be prepared to drive on a straight open road' and 'how fast would you be prepared to drive on a narrow winding country lane'. In his study MacMillan found that more men than women reported driving fast on both open and narrow roads; that reported driving speeds declined with age; and that high speed was significantly associated with both accident-involvement and conviction for driving offences. Research by Wasielewski (1984) also considered the relationship between driving speeds and age: he found that speed, as a measure of risk, was best predicted by driver age. The following question is an example of some of the speed-related questions in this section: "How often do you break the following speed limits : 30mph, 40mph, 50mph, 60mph, 70mph?"

A further example of a speed-related question in this section is as follows: subjects were asked to rate the speed of their driving as compared to other drivers, on a five point scale from (1) 'much slower' to (5) 'a lot faster', when driving in heavy traffic, in light traffic, at night, in rain, on country lanes, on dual carriage-ways, on motorways, around town, on single lane A roads, on unfamiliar roads, and in general.

Section B also contained items which asked subjects to rate their perceived likelihood of accident-involvement in a variety of driving situations. An example of one of these items from this section is as follows: "Imagine you are driving at 45mph along a road which has a 30mph speed limit. How likely are you to have an accident at this speed?" Further items then followed to elicit from the subject perceptions in terms of dangerousness, seriousness and confidence in avoiding accident-involvement for each item.

This issue of the perceived likelihood of accident-involvement has been considered by Finn and Bragg (1986), who asked subjects to provide ratings for themselves and for other drivers across certain driving situations. Their results showed that, for specific driving situations, young drivers thought that they were less likely to be involved in an accident than other groups of drivers, leading Finn and Bragg to suggest that young drivers have an over-inflated perception of their

own driving skills. In a further study by Mathews and Moran (1986) subjects were asked to rate (a) their likelihood of being involved in an accident and (b) their confidence in dealing with each of these situations. Their results indicated that as a driver's perceived level of confidence increases, the perceived likelihood of accident-involvement decreases. In Section B of the Driver Questionnaire I, both the issues of the perceived likelihood of accident-involvement, and perceived confidence in dealing with a driving situation, have been examined. In addition to this there are related items on the perceived dangerousness and seriousness of each of the driving situations presented. Related to the above issues is the work of Sivak et al (1989) which found that young drivers tend to perceive less risk than older drivers, when presented with specific driving situations.

Section C.

This section contained similar items to those employed by Guppy (1984) on reported drinking behaviour, reported drink-driving behaviour, and the perceived likelihood of detection and accident-involvement after drinking over the legal limit. The items examining subjects' perceptions of the legal drink-driving limit were replicated from Guppy (1984). The results from Guppy's study showed that drink-driving offenders had a higher mean estimate of the amount of alcohol that would have to be consumed by the 'average driver' to reach the legal limit. From these results it can be seen that an accurate perception of the legal limit is related to one's driving behaviour: the items in this section allow an examination of the awareness of this issue with a sample of very young drivers aged 17-19 years.

The following questions are some examples of those contained in Section C: "Compared to this time last year, how likely are you to drink over the legal limit and drive?; Generally speaking, about how much would you drink on any single occasion if you were intending to drive?; To what extent are you on the lookout for police cars when driving after a few drinks?; Which do you think would be worse: to have an accident (without the police being involved) while over the drink-driving limit, or to be caught by the police when drink-driving?; Imagine you are driving in town between 10pm and 12am on a Friday night. What do you think your chances are of (i) being breathalysed by the police (ii) having an accident when (a) you have not drunk any alcohol and (b) when you have drunk over the legal limit?"

Section D.

Section D contained some further items on drink-driving, and subjects' reported overtaking and car-following behaviours. The drink-driving items contained in this section are identical to those in the Non-Driver Questionnaire II, Section C (questions 4 and 5). In addition, the items on drinking and driving in the Driver Behaviour Questionnaire also include 'self evaluations'.

The following questions are some examples of those contained in Section D: "You are following a car which you want to overtake, but you think that you would have to cut in front of it closely if an oncoming car was to appear - (a) how likely are you to overtake the car in front of you (b) how dangerous do you think it is to do this (c) how likely are you to have an accident when doing this (d) how serious do you think an accident would be when doing this (e) how confident are you that you could avoid a potential accident when doing this?" In Section D there was a total of three questions containing five, three and five items respectively. Two of the three questions used interval scales while the third required subjects to give their answers in quantities of alcohol.

2.3.4 DRIVER QUESTIONNAIRE II.

Section A.

This section contained items referring to subjects' perceived likelihood of detection for certain driving offences, their overtaking behaviour, and attitudes towards drink-driving and the police. The drink-driving items contained in this section are identical to those in the Non-Driver Questionnaire II, Section C (questions 2 and 3). In addition, the items on drinking and driving in the Driver Behaviour Questionnaire also include 'self evaluations'.

The items in this section on the perceived likelihood of detection for certain driving offences are identical to those in the Non-Driver Questionnaire II, Section D (question 12). In addition, the items on perceived likelihood of detection in the Non-Driver Behaviour Questionnaire also include the offence of 'drinking and driving' (this is covered as a separate item elsewhere in the Driver Behaviour Questionnaire).

Below are examples of questions contained within this section. Example one: "What do you think your chances are of being caught by the police while doing each of the following things? : speeding in town, speeding on the

motorway, driving dangerously, driving without insurance, driving while on drugs, parking on yellow lines, overtaking other cars dangerously, not wearing a seat belt in the front seat of a car, driving through traffic lights just after they have turned red, driving without a full driving licence, and racing other cars on public roads". Subjects were required to rate their answer on a five point scale from (1) 'low' to (5) 'high'. Example two: "Please indicate the extent to which you agree or disagree with each of the following statements: I like the police, there should be more traffic police, the police always pick on young drivers, the police do a good job, and the police should do random breath testing".

There were seven questions in Section A, amounting to a total of twenty-seven items.

Section B.

Section B contained items relating to pressures and frustrations while driving, subjects' reported driving style, their attitudes on what they consider to be a dangerous driving style, reported overtaking behaviours, subjects' ratings of their skill and that of other drivers, and the perceived seriousness of certain driving offences. These issues have been highlighted as important factors in road traffic accident rates, and driving behaviours by other researchers including Svenson (1981), Naatanen and Summala (1975), MacMillan (1975), Brown and Copeman (1975) and Guppy, Wilson and Perry (1990).

The items on the perceived seriousness of certain driving offences in this section are identical (but in a different order) to those in the Non-Driver Questionnaire II, Section D (question 11). Below, some examples are provided of other questions contained within Section B.

Example one: (a) "When you are feeling frustrated due to following a slower moving vehicle, how likely are you to take a bit of a risk in order to overtake it? (b) When following another vehicle, how likely are you to overtake that vehicle because you feel under pressure from another vehicle following you? (c) When following a slow moving vehicle, how often do you find yourself closing up the gap between your car and the one in front in order to encourage the other driver to drive faster"? Subjects were asked to rate their answers to these and other questions on five point scales.

Example two: "Using the scales below, circle a number to show the point on the scale which you feel best describes your driving style : defensive - non-defensive, anticipating - non-anticipating, attentive - inattentive,

careful - careless, courteous - discourteous, decisive - indecisive, experienced - inexperienced, forceful - yielding, patient - impatient, cautious - risky, responsible - irresponsible, fast - slow, skilful - unskilful, aggressive - non-aggressive, and confident - nervous". Subjects had to rate their position between the two extremes using a five point scale. This question was similar to the driver self-rating scale employed by Guppy, Wilson and Perry (1990). Further on in the same section subjects were asked to describe what they considered to be dangerous driving styles using the same range of attributes.

Example three: This sub-section contained items to assess subjects' perceived driving skills (across four factors) in relation to that of the average driver. The items were: "Please rate (a) your driving ability and (b) the driving ability of other drivers in general on each of these factors: (i) perceiving potential hazards (ii) avoiding potential hazards (iii) judging safe gaps in the traffic to make manoeuvres (iv) judging when it is safe to overtake". Subjects rated their answers to these items on five point scales ranging from (1) 'poor' to (5) 'excellent'. This issue of perceived driving skill has been considered previously by Naatanen and Summala (1975) and Svenson (1981).

In 1975 Naatanen and Summala found that drivers tend to believe that they are safer drivers than the average driver, while a study by Svenson in 1981, found that some drivers have an inflated perception of how skillful they are and how safe they are as drivers when compared to other groups.

The following set of items relate to MacMillan's findings of aggressive and competitive driving in young male drivers. Example four: subjects were presented with a series of attitude statements and asked to rate their agreement or disagreement on a five point scale. The following statements are examples of some of those presented to subjects: "it annoys me to be overtaken; it is fun to race with other drivers; the only way to get through busy traffic is to be aggressive; I would rather accelerate than brake to get out of a difficult situation; I am less likely to have an accident than other drivers; I feel sorry for people who get 'done' by the police when they were just over the limit; and my driving is superior to that of most other drivers". Several of these items were taken, and adapted from, the research of MacMillan (1975), which found that as age increases a competitive and aggressive attitude decreases.

Overall, Section B contained sixteen questions amounting to a total of eighty-three items.

Both the Non-Driver and Driver Questionnaires were very simple to complete, with most items requiring respondents to tick boxes to indicate their views. The instructions on the questionnaires told respondents to read each question carefully, to answer the questions as best as they could, that there were no right or wrong answers and that all answers would be completely confidential. A copy of the instructions is held with each of the questionnaires in Appendix A.

See Appendix A for copies of both the Non-Driver and Driver questionnaires.

2.4 ADMINISTRATION OF THE QUESTIONNAIRES.

2.4.1 The Non-Driver Questionnaires.

The Non-Driver Questionnaires were administered to 1,036 pupils and students in a total of 17 schools/colleges between April and July 1989. All respondents completed the questionnaires during school time, under the supervision of the researcher or teachers. The overall response rate was reduced by approximately 10% as some subjects who completed the first questionnaire were not present at school for the second questionnaire. The high response rate will provide data which is high in representativeness of the population sampled. The large-scale administration required respondents to complete the questionnaires themselves, as opposed to the employment of a semi-structured interview schedule. Before completing the questionnaire, respondents were explained the purpose of the exercise, were assured of the anonymity of their responses and were informed that participation was voluntary.

2.4.2 The Driver Questionnaires.

The Driver Questionnaires were administered to students in a total of 7 schools/colleges, one college of further education and 3 local employers between April and July 1989. Those in full-time education, completed the questionnaires during college time, under the supervision of the researcher or lecturers. One hundred and thirty-nine Driver Questionnaires were administered to students in the 7 schools/colleges. Of these 139 respondents, the response rate was reduced by 10% (total n=125) as some subjects who completed the first questionnaire were not present at school/college for the

administration of the second questionnaire. The large-scale administration required respondents to complete the questionnaires themselves, as opposed to the employment of a semi-structured interview schedule. The researcher or lecturers were present at the administration of the questionnaires and so were available to explain anything more clearly to the respondents. Before completing the questionnaire, respondents were explained the purpose of the exercise, were assured of the anonymity of their responses and were informed that participation was voluntary.

For those respondents in full-time employment, a total of 35, the questionnaires were posted to the place of their work to be completed unsupervised in their own time. These respondents were posted one large Driver Questionnaire (a combined version of the Driver Questionnaires I and II), hence there were no loss of subjects between Questionnaires I and II as there were for the school/college respondents. These respondents accounted for only 7 of the total driver sample (this was a 20% response rate). Thirty more questionnaires were given to day-release students at a local further education college, all of whom were in full-time employment. These respondents also completed the questionnaire unsupervised in their own time. A 50% response rate was achieved from these day release students (n=15). The low response rate (20% and 50%) obviously has detrimental consequences for the representativeness of the sample of drivers from the chosen population, and so these subjects were not included in the final analysis of the Driver Questionnaire data.

2.5 Comparison of items between the Non-Driver and Driver Questionnaires.

There are differences between the Non-Driver and Driver Questionnaires in terms of the items contained within each. These differences are due to the suitability of the nature of certain questions, depending on whether the recipients would be younger non-driving subjects or older driving subjects, drivers or non-drivers. It was felt necessary to include certain items in the Driver Questionnaire that could not be included in the Non-Driver Questionnaire, in order to gain information on certain judgmental issues which require driving experience. As respondents filled in separate questionnaires tailored to their driving experiences, their data comprises two separate data files. This does mean that comparison between the questionnaires is more difficult. A comparative discussion of the results from the two Questionnaires are undertaken using variable means for comparison between drivers and non-drivers. Univariate

and multivariate analyses will be employed to examine for differences between respondents between ages 11 and 18 (non-drivers) and between respondents between the ages 17 and 19 (drivers) years. The same analysis problem exists between the two sets of questionnaire data and the interactive video data. A descriptive comparison will be made between these two types of methodologies. A summary of comparisons between the questionnaire and interactive video data is presented in Section 2.6.8.

2.6 THE INTERACTIVE VIDEO STUDY.

2.6.1 Interactive Video As A Methodology To Study Attitudes, Judgments And Behaviours In Road Safety.

Interactive video technology involves transferring video images to laser disc and controlling the presentation of the images via computer. The presentation of these images can be controlled so as to manipulate certain features. With the use of interactive video it should be possible to present subjects with a more realistic setting in which to make their judgments and decisions about the driving process.

Interactive video technology enhances the assessment process due to the high degree of motivation inherent in the medium, as well as its individualised, interactive nature. Interactive driving programmes provide innovative procedures for assessment as a result of the integration of the interactive nature of the microcomputer and the realistic imagery and audio of the videodisc. Assessment by interactive video is active as opposed to the passive assessment that takes place with questionnaires.

A variety of road user behaviour scenarios can be presented to subjects in context, providing both audio and visual stimuli. The facility enabling one to demonstrate and standardize a variety of road traffic scenarios from a car drivers' perspective permits the individual to experience simulated road traffic situations in a safe environment.

Interactive video has been found to be highly effective as a classroom presentation system for the delivery of instruction (Schlieve, 1990). Recent advances in presentation capabilities of multi-media technology, has reduced the cost and programming expertise to develop such presentation systems. The interactive video programme described in this thesis was developed as a presentation

system for assessment purposes.

There are six main advantages of interactive video technology over traditional methods (such as still pictures and video recordings) of information presentation of driving scenarios in road user behaviour research.

1)Interactive video has traditionally provided superior colour imaging.

2)Interactive video provides the capability for motion (unlike still pictures).

3)Interactive video provides high quality audio capabilities.

4)Interactive video can allow the interaction of the user and the programme at a user-defined pace.

5)Interactive video allows immediate selection of image-frames via interactive software combined with a laser disc player. Video scenes can be copied onto a laser disc, and from this a particular set of scenes can be later recalled in any required order via computer software, as defined by their frame numbers. This means that the information can be presented to subjects rapidly without any delay in selecting the required scenes.

6)Interactive video may assist in developing a coherent cognitive flow between thought and action, by providing models, concrete materials and real events (Schlieve, 1990).

By using an appropriate medium such as interactive video, it is possible to present all subjects with the same mental frame of reference.

An additional benefit of interactive video is that it allows one to standardize the information and choices presented to subjects, and by dealing with the question of subject choice and values placed upon standardised outcomes, it provides the research framework for learning how to help future drivers and pre-drivers understand the elements of any situation and their choices and to make better decisions.

Data collection can also be simplified using interactive video: the same computer system that is employed to run the interactive video computer programme, can also be employed to automatically save subjects' performance and response data into a data file, ready for later analysis.

Interactive video was used in this study to present simulated driver decision situations to a sample of drivers and non-drivers aged between 11-18 years. Research on driver decision-making (e.g. Ebbesen et al., 1977) has suggested that laboratory simulation techniques have in the past tended to yield rather different results from direct observation. The use of interactive video may be an effective means of bridging this gap. It is high in realism, it presents subjects with the need to make decisions in real-time, and it provides researchers with the facility of demonstrating the immediate consequences of particular decisions. Further advantages of this technique are found in the capability to link chains of contingent decisions, thus simulating the complexity of the decision environment encountered by drivers in reality. Interactive video has further advantages in that as graphics can be integrated into the programme, it is possible to obtain additional data about a subject's decision immediately after it had been made, i.e. to elicit the subject's explanations for each decision, evaluations of each outcome, and assessments of responsibility.

In this study a variety of road user behaviour scenarios were presented to the subjects in context providing both visual and audio stimuli.

The assessment environment using interactive video technology is interactive: the system receives information from the user (user decisions) so that the programme is able to respond differently to different users, in terms of how far a line of questioning may progress. An example of this is whether or not subjects hit the 'return' key to indicate that they would brake as they have seen something hazardous: if they hit the 'return' key they would be questioned about the hazard, what it was, how hazardous it was and how confident they felt in avoiding an accident situation. If subjects did not hit the 'return' key no questions would be asked, and they would receive feedback that the scene had ended and that they would be presented with a new scene. The Interactive Video Driving Programme (I.V.D.P) is an active assessment mode as opposed to the passive assessment that takes place with questionnaires.

The use of interactive video makes it possible to demonstrate and standardize a variety of road traffic scenarios from a car-driver's perspective, thereby permitting the individual to experience a simple form of simulated road traffic situations in a safe environment.

The I.V.D.P has several unique features. Firstly, it has several educational and research implications based upon the innovation of interactive video as a methodological tool for assessment and instruction. Secondly, it is the

first actual application of interactive video with subjects as young as eleven years in the assessment of attitudes, judgments and behaviours in relation to driving behaviour. Thirdly, it allows a combination of state of the art video technology with a sound theoretical basis. Fourthly, it provides an effective means of gathering data on young people's decision-making processes at different ages. Fifthly, it offers a unique opportunity for research in the methods of assessment and instructional training in the field of road user behaviour, particularly with pre-drivers: it provides the ability to present a higher degree of realism to an area yet to be investigated by many young people. Sixthly, it allows automated assessment and storage of data on subjects judgments and attitudes.

2.6.2 The Equipment.

The interactive video system involved the combining of a computer and a laser disc player, and the selecting and editing of relevant extracts from specifically selected databases on laserdisc, to represent typical road traffic scenes. The video images are stored in digital form on a laser disc. These images are read by laser and are converted into analogue signals that are shown on a colour monitor. As the images are stored digitally they can be accessed very quickly and accurately via computer: furthermore, text can be easily woven into the video images, allowing one to interrogate subjects about video sequences they are seeing or have just seen. Finally, what the subject sees, can be made contingent upon his or her responses to earlier questions. Interactive video is a relatively simple and inexpensive way of simulating the driving tasks and is more flexible than ordinary video.

The equipment used was: (1) a Philips colour CM8833 monitor, (2) a Sony Lasermix videodisc player (LDP-1500P), (3) a Zenith IBM compatible computer.

The video images that were copied onto the laser disc came from video tapes made by the Department of Transport Road Research Laboratory and were made available to the researcher by Alex Irving. These tapes were made by fixing a video camera to the dashboard on the passenger's side of a left-hand-drive vehicle. This provides a view that approximates what one would see from the driver's seat of a right-hand-drive car. The tapes contain both rural and urban traffic scenes.

The design (including all editing, design of graphics and questions) and programming of the interactive video system were undertaken by the author of this thesis. Some

assistance in the programming (automatic creation of data files) was provided by Mr M.Conway of the Computer Centre at the University of Manchester.

2.6.3 The Sampling Strategy.

A total of 236 subjects participated in this phase of the study. These 236 subjects were randomly selected from the original set of full-time school and college respondents who participated in the Non-Driver and Driver Questionnaire phases of the study. Due to time constraints and practical limitations school/college leavers were not included in this part of the study (whereas small numbers of the school/college students could be assessed with the I.V.D.P. at their schools/colleges, this would not have been possible with those in full or part-time employment, and would have necessitated the time-consuming process of these subjects visiting the University individually).

The 236 interactive video subjects were drawn from 11 out of the original 17 state schools/colleges in the North West of England that participated in the questionnaire phases of the study. Six schools/colleges declined to take part in the interactive video study, primarily due to time-table restrictions. The interactive video sample was randomly selected from the remaining subset of 11 schools to allow continuity of data between the questionnaire and interactive video phases of the study, and hence comparison of results. Subjects were randomly selected from an alphabetically ordered list of names of students who completed both questionnaires (either both the Non-Driver Questionnaires, or both the Driver Questionnaires).

The subjects ranged from 11-18 years of age, included both sexes and were from mixed ability classes. Forty-three of the 17-18 year olds in this sample were drivers. Full details on subject numbers by age, sex and driving status are presented in the results section.

2.6.4 Development and Design of The Interactive Video Driving Programme.

It was intended to use the Interactive Video Driving Programme (I.V.D.P.) to cover several categories of information included in the questionnaire surveys. However, only certain areas of road safety relevant perceptions were able to be measured using this methodology. Thus in the development of the I.V.D.P.

specific theoretical issues were emphasised for examination. A summary of the theoretical issues relating to road user behaviour that were encompassed by the I.V.D.P. are presented here. Details of the content and format of the I.V.D.P. are given in Section 2.6.5.4.

The main issues addressed are listed below.

- 1) Hazard perception and response.
- 2) Hazard evaluation.
- 3) Risk perception:
 - a) perceived likelihood of an accident;
 - b) perceived seriousness of a negative outcome.
- 4) Risk-taking in terms of:
 - a) speed;
 - b) overtaking behaviour;
 - i) types of overtaking manoeuvre;
 - ii) frequency of overtaking.

The section below gives examples of how these issues were addressed and the types of variables that were employed.

1) Hazard Perception and Response.

The I.V.D.P. addressed the issue of hazard perception and subject response to hazardous situations by showing subjects a scene and asking them to indicate (by hitting the 'return' key) if they saw something that they considered dangerous. Their response was considered, initially, in terms of whether they identified the hazardous situation before an impact occurred. Later, subjects' evaluation of the situation was elicited. This issue of hazard perception and evaluation has been examined by other researchers with older subjects including Quimby and Watts (1981).

2) Hazard Evaluation.

The I.V.D.P. addressed the issue of hazard evaluation by showing subjects a hazardous scene and then asking them to evaluate how dangerous they thought it was. An example was where the 'subjects' car was entering a mini-roundabout and a car from the left pulled out in front. The video would stop and ask subjects how dangerous they thought it was. Another example was where subjects saw 'their' car driving along an A road, approaching a pedestrian

crossing; then suddenly a woman holding a baby ran out onto the crossing in front of the subject's car. The subjects had to evaluate how dangerous the situations were.

3) Risk perception:

a) Perceived likelihood of an accident.

Subjects' risk perception in terms of the perceived likelihood of an accident was addressed by presenting them with dangerous scenes and then questioning them, using subjective probability scales. An example was where the subjects car approached a parked lorry, and begun to overtake it in the face of oncoming traffic: the video automatically stopped and asked subjects how likely they thought they would be to have an accident if they overtook the parked lorry at that moment in time. Another example was where a cyclist pulls out from a side road in front of the 'subject's' car: if the subject braked for the cyclist, the subject was then asked to rate the perceived likelihood of an accident for the average driver, and then for themselves. A comparison of the later two items would give an indication of the subject's perceived level of skill compared to the 'average' driver. This area of subject perception has been raised with a wider, but older range of subjects, by Finn and Bragg (1986) and Mathews and Moran (1986).

b) Perceived seriousness of negative outcome.

The perceived seriousness of the negative outcomes of an accident was addressed by asking the subjects follow-up questions from the scenes depicting potential accident situations. An example of one of the items used to measure perceived seriousness, was a follow-up question to the 'overtaking the parked lorry scene'. The subjects were asked how serious an accident would be if one occurred while overtaking the parked lorry in the face of oncoming traffic. 'Seriousness', was not defined in terms of money, damage to property or persons, but was left open, in order to gain an overall impression.

4) Risk-taking.

a) Speed

Subjects' objective risk-taking in terms of speeds that they were happy to drive at, was measured using the I.V.D.P. This issue of objective risk-taking in terms of driver speed has been highlighted as an important issue by

various researchers including MacMillan (1975), Spolander (1982), Wasielewski (1984), and Wilson (1987). The issue of intentionality, in terms of risk-taking was not addressed, purely the subjects' observable behaviour while 'controlling' the speed of 'their' car on the I.V.D.P. Subjects watched 'their' car drive along a variety of roads, the I.V.D.P. would stop and ask them what speed they would choose to travel at. An example of one of the risk-taking speeding variables was where subjects were driving along a country lane and passed a de-restricted sign: they were then asked at what speed they would travel. The tape continued and the subject's car drove past a 30mph speed limit sign. The tape stopped again and subjects were asked again at what speed they would choose to drive. Overall, subjects were asked at four different points in the program, on four different road situations to indicate the speed at which they would choose to drive.

b) Overtaking.

Subjects' objective risk-taking in terms of dangerous overtaking behaviours, was measured using the I.V.D.P. Previous research has noted some cause for concern in the overtaking strategies employed by young drivers (Jeffcoate et al, 1973; Harris, 1987). The issue of intentionality, in terms of risk-taking was not addressed, purely their observable behaviour while overtaking.

i) Types of overtaking manoeuvre.

Subjects were presented with three different scenes where they could select to overtake if they wished. Throughout these scenes there were a number of unsafe overtaking opportunities, such as approaching the brow of a hill, approaching a bend, in the face of oncoming traffic, on a double or single white line, at a junction or approaching a roundabout. These definitions of 'unsafe overtaking manoeuvres' were taken from the Highway Code. There was only one section of road on one of three overtaking scenes presented to subjects that was designated by the researcher as a safe overtaking place (a long, straight stretch of road, with no white lines, hills, junctions or oncoming traffic). Subjects' behaviour in each situation (overtook/did not overtake) was recorded.

ii) Frequency of overtaking

Previous research has considered the frequency of overtaking manoeuvres as one aspect of risk-taking (Jeffcoate et al, 1973; Spolander, 1982; Harris, 1987). The frequency of subjects' overtaking manoeuvres was measured at each of the three overtaking scenes presented to

subjects. There was no attempt in collecting this frequency data to distinguish between the frequency of safe or unsafe manoeuvres, although this was coded and analysed separately to examine levels of risk-taking.

2.6.5 The Interactive Video Driving Programme.

Subjects watched the video scenes and questions presented on the colour monitor placed in front of them. They used the keyboard to control the system and to input their answers. The keys that the subjects used are as follows: (1) the 'delete' key to delete input and typing errors, (2) the 'return' key to end their input after answering a question, or to stop the video at a particular point, (3) the 'space-bar' to re-start the video at selected points, and to use when typing in their answers, (4) the numerical keys at the top of the keyboard when typing in their answers, and (5) the letter keys in order to type in their answers in word or sentence form when required.

2.6.5.1 Instructions Given To Subjects.

Subjects were introduced to the researcher and asked to sit down in front of the interactive video system. It was explained to the subjects that the researcher worked at the University of Manchester on a project investigating road safety and was particularly interested in what young people thought about the task of driving and road safety in general.

The subject's attention was drawn to the interactive video system and were told that they would be shown how to use it shortly. They were told that they would see videos on the screen, that questions would appear on the screen and that they would be using the keyboard to type in their answers. Subjects were told that it would not be too difficult, there were no right or wrong answers and hence they were not being tested, and that it should be fun.

After initial introductions to the research programme and the interactive video system, subjects were prepared for their first three practice scenes.

2.6.5.2. The Practice Scenes.

Subjects were told that they would be shown three scenes (the system was now running and they were watching the beginning of the first scene), but that they would not be required to do anything and would not be asked any

questions. The aim of these practice scenes was to allow subjects to become familiar with what they would be seeing shortly and to provide them with the opportunity to ask any questions.

As the first practice scene began playing, subjects saw a view from the driver's position of the car being driven along an 'A' road. It was explained to the subjects that the car that 'we' were travelling in was a Ford Granada, a fairly large car, and that when this was filmed the camera was put on the right-hand side where the driver normally sits - so that we were seeing what a driver would normally see out of the front window when driving along. The researcher told the subjects that as they watched all of the video scenes she would like them to pretend, to imagine, that they were driving the car. Subjects were asked if they thought they could do that (to which every subject replied yes).

First of all, the researcher asked the subjects if they could see the screen clearly. All subjects replied 'yes'. As they were watching the first practice scene they were told that the types of questions they would be asked later on would be, for example, to say how fast they would choose to drive this car down a particular road, "not how fast this person is driving the car, but how fast you would choose to drive this car". "All the questions you will be asked will relate to what you think you would be doing and thinking if you were really driving this car. You may also be asked to say when you would choose to brake, or perhaps when you would choose to overtake another car. There will be other questions very similar to these. There are no right or wrong answers: I'm interested in what you would do if you were driving this car. Any questions that you are asked you will be able to answer using the information presented in front of you, so you will not be disadvantaged because you can't see out of the rear or side windows. As we go along, if you have any questions, queries or problems, just ask, and I'll explain it more clearly".

The three practice scenes that were shown to the subjects are described below.

Practice Scene 1.

The car drives along an 'A' road and drives rather fast around a small mini-roundabout. There are parked cars on both sides of the road. It is a residential area with a few shops, pedestrians and side roads around. 'We' pass a parked car on the left with its right-hand door open. We drive through some pedestrian traffic lights, and pass a

small junction box for cars turning right from both directions. 'Our' car continues and we drive over a bridge with oncoming traffic. Over the bridge there are 'SLOW' signs painted on the road as 'we' approach another box junction with a car waiting to pull out and turn right. The car continues along the road, passing through some more traffic lights and past some more parked cars. The scene then comes to an end.

Practice Scene 2.

'We' are driving along a fast, wide country 'A' road. 'We' pass some oncoming traffic, and later on are overtaken by a Volkswagen Golf. 'We' drive up and over a hill. The scene comes to an end.

Practice Scene 3.

'We' drive along a similar fast country 'A' road. There are oncoming cars and cars in front of 'us'. As 'we' follow the car in front 'we' enter a residential area with side roads. The car in front slows down, then indicates and turns left into a side road. 'We' speed up again and continue driving along this road. The scene ends.

2.6.5.3 The Order of Scenes Contained In The Interactive Video Driving Programme.

After the three practice scenes, subjects were asked if they had any questions or problems, and whether they were ready to start. All subjects indicated that they were ready and happy to continue. The first stage of the program involved subjects seeing four separate scenes which they were asked to watch and give a running verbal commentary all the way through. Subjects were asked to "watch the video closely and imagine that you are the driver. Whenever you come across anything you think a good driver would take note of and have to pay attention to - please tell me!" Full details of these four scenes are held in full in Appendix A3, but summaries are given below.

Verbal Commentary Scenes

Scene 1.

The car drives along a dual-carriageway in the right hand lane approaching a roundabout. There are cars queuing in the left hand lane as 'our' car enters the roundabout and leaves at the third exit.

Scene 2.

The car drives down a slip road and joins the motorway, remaining in the first lane for a very short while before pulling out into the second lane to overtake a slow lorry.

Scene 3.

The car drives through a one-way system in the centre of a small town. The car drives past a police car, parked cars, a car reversing out into the path of our car, a pedestrian crossing, with road signs up above and pedestrians on the pavements. As the road splits, 'our' car takes the right fork, following a Fiesta which stops sharply to park.

Scene 4.

The car drives through a residential area with parked cars, shops, a mini-roundabout and side roads. 'Our' car continues over a small bridge with a box junction at the bottom for turning right: 'our' car continues on the major road.

Interactive Video Scenes.

After subjects had been shown the four 'verbal commentary scenes', they were then shown the 'interactive video scenes' (a full description of which is given in Appendix A3). A short summary of the main 'interactive video scenes' and questions contained in the program is given below.

Scene 1.

A car pulls out in front of 'our' car as 'we' enter a mini-roundabout. The tape stops and the subject is asked how dangerous it was for the other car to pull out. Subjects answer using a three-point scale ranging from 'not very dangerous' to 'very dangerous'. Subjects typed their answer in.

Scene 2.

As the car drives along a country A road and approached a signed-posted right-hand bend, the tape stops and subjects are asked what is the fastest speed that they would drive around the bend. They typed their answer in (as for all subsequent questions).

Scene 3.

The car drives along an A road approaching a parked lorry; the car slows as it approaches, but then begins to pull out to overtake the lorry, in the face of oncoming traffic. The tape stops and asks subjects how likely they would be to overtake the lorry at that point, and then how likely they would be to have an accident while doing so. Subjects were then asked to rate how serious such an accident would be. Each question was answered using a five-point scale.

Scene 4.

Subjects saw the car drive along a fast A road which had no safe overtaking opportunities. Subjects were told they could overtake up to five times if they wished (they indicated this each time by hitting the 'return' key).

Scene 5.

The car drove along a different A road, up a hill, at the top of which a woman with a dog, ran out in front of 'our' car. As subjects watched the scene they had to hit the 'return' key if they saw anything that would make them want to brake.

Scene 6.

The car drove along a 30mph limit B road with shops on either side, with both oncoming cars and cars in front. The tape stopped and subjects were asked to state how fast they would choose to drive along the road.

Scene 7.

The tape started up again and subjects were told that they would continue to drive along at their chosen speed and to 'brake' if they felt they needed to. A bike pulls out from a side road straight in front of the car. If subjects 'braked' the tape stopped and asked them why they braked and how likely this situation would be to cause the average driver to have an accident, and then how confident were they that they could have avoided an accident from the point that they chose to begin braking. These questions were only presented to subjects if they chose to brake.

Scenes 8 and 9.

These two scenes were overtaking scenes similar to those presented before: again subjects were given the option of overtaking up to five times on each scene. There were no safe overtaking opportunities in Scene 8, and only a brief

safe overtaking section in Scene 9. Safe and unsafe overtaking situations were defined with reference to the Highway Code: examples of unsafe overtaking situations were overtaking on double-white lines, solid single white lines, approaching a blind bend or brow of a hill or in the face of oncoming traffic.

Scenes 10, 11 and 12.

Subjects saw three consecutive scenes where they were told to brake, by hitting the 'return' key, if they saw anything that may require them to brake. The scenes were: (1) while driving through a built-up area a car makes a U-turn, pulling out in front of 'our' car, followed by another which begins to reverse out into our path; (2) driving along the same road a woman with a baby begins to run out onto a zebra crossing in front of 'our' car; (3) driving along a dual-carriageway a car in the lane beside us begins to pull over into our lane 'cutting us up'. At each point that subjects braked they were asked to type in why they braked and to rate how dangerous the situation had been.

Scene 13.

The car drives along a country lane passing a de-restricted speed limit sign on a straight stretch of road, and then later passing signs indicating sharp bends ahead. Subjects are asked at what is the fastest speed they would travel a) immediately after passing the de-restricted sign, and then again b) after passing the 'sharp bend' signs.

Scene 14.

The car continues along this country lane and approaches a right-hand bend but with a side road on the left. An oncoming motorbike turns right, across the path of our car. The tape stops and subjects were asked how dangerous that situation was.

At the end of Scene 14 the I.V.D.P ends and subjects were thanked for their time.

2.6.6 The Use Of Verbal Protocols.

As detailed earlier, subjects were introduced to the I.V.D.P and saw three practice scenes in order to familiarise themselves with the system. After the practice scenes, subjects were shown four different scenes (described earlier) on which they were asked to provide

verbal commentaries. The researcher took hand-written notes as subjects talked, which were coded and categorised later on.

The advantage of including the verbal commentary scenes was that it provided a means of collecting rich data. By this method it was possible to collect data on subjects' awareness of other road users, their behaviours and potential dangerous situations, which cannot be done so effectively by the use of questioning and prompting (due to the very nature of bias that it introduces).

There are many complex tasks in which the outcome of thinking does not result in an observable action. Verbal protocols, the task of getting subjects to 'think aloud' while they are doing the task, is one method of getting at this non-observable information. The term 'verbal protocol' is usually applied to a problem-solving situation in order to obtain information that will allow one to infer knowledge about the subjects' problem-solving cognitive processes. It is argued by Bainbridge (1990) that as yet there is no simple, brief method of collecting and analysing verbal protocols, and it is likely to remain a research technique. As the 'verbal commentary' data collected during the I.V.D.P. stage of the present study may be considered similar to verbal protocol analysis in some respects, some of the potential methodological limitations of verbal protocol analysis will be considered.

One of the problems with the verbal protocol method is that it may actually interfere with performance. The classic demonstration is for a driver to attend to all the actions involved in driving a car. If one consciously monitors such variables as engine revs, current gear, speed, visibility, steering wheel position and so forth, the performance of driving invariably gets worse. Such skill is shown to be at its best when performed automatically (Shadbolt and Burton, 1990). The verbal commentary task presented to the subjects in the present study was considered to differ from verbal protocols in two ways. Firstly, the aim of the task was to identify subjects' awareness of important factors in the road traffic environment, and not to identify knowledge about a task that would provide information on their underlying cognitive processes. Nisbett and Wilson (1977) suggest that knowledge elicitation techniques which concentrate on the content of thinking are more likely to be valid than reports which claim to be observations of the processes underlying thinking. Secondly, subjects were not required to actively solve a problem (e.g., in this case, to drive a real car on the road, or to drive a simulator), rather they watched a video of someone else driving a car (they viewed this from the driver's seat), and were effectively

'passengers' in the task. Subjects had no other task to undertake other than to provide a verbal commentary to the researcher. This is very different from a situation where drivers' are required to provide a verbal commentary as they actually drive the car; this type of task would obviously allow the potential for the subjects' primary task (that of driving the car) to be interrupted by the secondary task (providing the verbal protocol).

A further methodological problem with verbal protocols is that it involves self-presentation in a social situation and so can be influenced by social biases. People can select what they think is appropriate to say. A subject who is experienced in the task area will be more likely to talk freely and fully if they think the listener will understand what they are talking about (Bainbridge, 1990). On the other hand they may not report points which they think are obvious. They may not mention information which they collect while reporting other activities, which may lead to unexplained behaviour later on. Most people can think faster than they can talk, so only a small sample of all of their cognitive activity can be reported: hence there are limitations of verbal protocols as evidence of thought processes. The present study did not attempt to analyze subjects' thought processes, but rather to obtain factual information on what content of the road traffic environment subjects were paying attention to: thus it may be suggested that the validity of the performance measures collected may be higher than expected in more complex verbal protocol analyses (Nisbett and Wilson, 1977). Subjects may give data on the outcomes, but not the processes, of skill. It will only be possible to infer some additional information that was employed in the task, if it was not mentioned explicitly, indirectly from the fact that the subject would not be able to act in a certain way if they did not have particular knowledge. This underlines the general point that verbal protocol evidence may give a limited sample of the total knowledge available to the person being studied, and thus raises issues of the validity of the performance measured. A limitation of the verbal commentary method employed in the present study is that the verbal reports can provide good evidence of what people have noticed, though not necessarily of what they have not noticed (Landauer, 1988).

Another issue of the validity of protocol analysis is raised due to the problems inherent in asking people to provide reports while performing a task: such a procedure may change the nature of the cognitive processes that are under study. However, the extent of any disruption of ongoing cognitive processes depends on the kinds of information that subjects are asked to provide: probably the most crucial factor is whether or not the information

required in verbal protocols is accessible without changing the focus of attention. i.e, disruption should be less where subjects are asked to think aloud, as opposed to where subjects are asked to provide complex interpretations concerning information which would not normally be the focus of attention (Ericsson and Simon, 1980). Some critics have suggested that talking about a task whilst trying to do it can cause difficulties: such problems can be partly overcome by getting subjects to work with another person (Miyake, 1986), or by videotaping the procedure and then getting subjects to talk through the resulting tape (Schumacher et al., 1984). Effectively both of these techniques were employed in the present study: subjects were required to talk to the researcher and tell her things that they thought 'a good driver would pay attention to' while watching a video of a car driving through selected road traffic scenes. By using this approach where subjects were interacting with the researcher in the performance of the task (although verbal feedback was not provided by the researcher), this may have produced a more natural environment in which to elicit subject responses.

It has been recommended that subjects should be provided with some element of training before requiring them to provide a verbal protocol while undertaking a problem-solving task (Shadbolt and Burton, 1990). One of the conditions for effective protocol analysis is that the subjects should not feel embarrassed about describing their 'expertise' in detail. It is preferable for them to have experience in thinking aloud (Shadbolt and Burton, 1990). A short training session would familiarize subjects with the task of talking about their problem solving. A training task should help to overcome some of the problems of individual differences in performance of talking aloud while completing a task. However, as the present study did not require subjects to actively solve a problem, or to engage in any task, other than to provide a verbal commentary, a training session was not provided. In addition, where previous researchers have advocated training sessions before extracting verbal protocols, this has been advised not only to provide experience of undertaking a primary and secondary task simultaneously as mentioned above (which is not relevant to the present study), but also to reduce any embarrassment experienced by the subjects in 'thinking aloud'. The present study did not require subjects to think aloud, but rather presented them with a more natural task of telling the researcher 'what a good driver would pay attention to'. All subjects had met the researcher on two previous occasions before they were presented with the I.V.D.P., and were presented with 3 practice scenes (showing them what type of information they would be later asked to view), before engaging in the verbal commentary task.

In summary, many of the problems associated with verbal protocol analysis do not apply to the verbal commentary task in the I.V.D.P. study. Firstly, subjects were not asked to provide a verbal commentary while simultaneously engaging in another task. Secondly, the purpose of the verbal commentary task was to obtain factual information and not to identify some underlying cognitive process. However, the verbal commentary task does suffer the limitation that it may be good evidence of what subjects have noticed, but not necessarily of what they have not noticed.

There are two further disadvantages of this method though, one being is that it is a time-consuming process in terms of both data collection and collation, and another is the potential loss of information through data compression (during transcription and categorisation).

2.6.7 Administration of the Interactive Video Driving Programme.

The development of the I.V.D.P begun in May 1989 and the subject assessment was undertaken between September and December 1989.

The I.V.D.P was conducted with pupils and students in a total of 11 schools/colleges. All respondents completed the I.V.D.P at their own school during school time, under the supervision of the researcher. The I.V.D.P. was administered with subjects on an individual basis, with only the subject and the researcher present, usually in a small office or empty classroom. The equipment was set up on a table, and the subject was sat in front of it, ensuring that s/he was seated comfortably, within easy reach of the keyboard, and with the computer screen at eye-level. The researcher sat beside the subject and explained the purpose of the task (relating it to the questionnaires that the subject had completed a few months earlier). Subjects were introduced to the computer system, provided with instructions (as explained in section 2.6.5.1), shown three practice scenes (as described in section 2.6.5.2), assured of the anonymity of their responses and were informed that participation was voluntary, before commencing the programme. Once subjects had started the I.V.D.P., the researcher moved her seating position further to the left of the subject (and away from the computer system) to minimize any pressure felt by the subject. The I.V.D.P took, on average, 45 minutes to complete with each subject.

2.6.8. Comparison Between Interactive Video And Questionnaire Data.

The I.V.D.P was designed to include particular scenes and variables that addressed the same *issues* as those covered in the questionnaires. An attempt will be made to provide a descriptive comparison between data collected from questionnaires and that collected from the I.V.D.P.

A combination of the two methodologies will provide the opportunity to: (1) examine for particular aspects of the task of driving that produce differential responses from subjects between the two methodologies, and (2) to examine whether these discrepancies are consistent across the age ranges, and between the drivers and non-drivers.

The use of the I.V.D.P, where subjects are asked (1) to provide a verbal commentary while watching particular scenes, and where they are asked (2) to make quantitative judgments on scenes and (3) to interact with the system by making decisions based on the available information, allows for further comparisons between the different methods of data collection. Thus by using the Interactive Video Driving Programme, a comparison can be made between subject's performance on particular variables produced from the verbal protocols and subject responses on other variables produced through the interaction stages and quantitative judgments made using the system. One of the issues considered in this study was whether developmental group differences could be produced using the simple strategy of presenting subjects with a video image of a car being driven along different roads (like that offered by standard video technology), or whether developmental group differences could only be produced through interaction with the system (allowing subjects to partly determine the sequence of events).

Another issue for consideration are the possible differences that may be found between the interactive video data and the data produced from the questionnaires.

There has been a relative lack of research in the field of road user behaviour which has systematically compared data on the attitudes, perceptions and judgments of young people across a variety of issues in diverse road traffic situations *before they start to drive* (from the ages 11-18 years). Additionally, these issues have not been examined before using the combined methodologies of questionnaires and interactive video. The employment of interactive video as a testing technique to study road safety with subjects so young is a relatively novel concept.

2.7 TREATMENT OF DATA.

The information contained in the Non-Driver and Driver Questionnaires was coded and entered into a VAX 11/750 for analysis using the Statistical Package for Social Science. Data from the I.V.D.P was coded and entered into a data file on an IBM Compatible PC for analysis using SPSSPC Version 3 (the Statistical Package for Social Science on a Personal Computer). A number of univariate and multivariate procedures were employed in the statistical analysis as outlined below.

2.7.1 Univariate Procedures.

Two-Way Analysis Of Variance.

Two-way analysis of variance techniques are used to estimate the effect of two independent variables or factors on a dependent variable. Difference between the means of groups of scores are tested by calculating the statistic F which compares the variability between group means with the variability between individual scores within the group.

Reliability Analyses (Cronbachs' Alpha)

Reliability analyses can be used to provide reliability coefficients for multiple-item scales. The reliability module in SPSSX computes Cronbach's Alpha and standardised Alpha (Cronbach, 1951).

2.7.2 Multivariate Procedures.

Principal Component Analysis (PCA).

Principal Component Analysis is a technique which assesses the inter-correlations among variables in a single set as a means of identifying sub-groups of variables accounting for significant proportions of the overall variance. PCA may be used to reduce a large number of variables down to a smaller number of metavariates for input into other analytical procedures.

Discriminant Function Analysis.

One of the objectives of this study was to determine what driving related attitude and behavioural *dimensions* could be employed to discriminate between young people aged 11-18 years. The appropriate method for this

investigation is discriminant function analysis, a technique which allows the prediction of group membership from a range of predictor variables. Discriminant function analysis indicates which combinations of variables can be used to maximize the differences between groups. It works on the principle of maximising the difference between the two most dissimilar groups, by use of a weighted linear combination of variables. With the remaining non-accounted for variance it then attempts to produce another weighted linear combination of variables to maximise the difference between the next two most dissimilar groups, and so on.

There were specific reasons for firstly, employing discriminant function analysis techniques (as opposed to manova) in this study, and secondly for employing non-factorial discriminant function analysis designs: both of these reasons relate directly to the objectives of the study.

Firstly, the results that can be produced from discriminant function analyses were desirable as they have practical implications in the field of driver education, because they allow one to determine between which age ranges developmental differences in attitude dimensions occur. In the design of material and organisation of school-based classes for driver education programmes, one needs to know (1) what material to focus on with each age-group, and (2) across which age-groups can the same material be employed and (3) which age groups require attention to be focused on different material. The need for information on age-groups according to the attitude and behavioural dimensions along which they differ, can be clearly seen.

Discriminant function analysis differs from manova in two important ways. Apart from the process of classification, another important difference involves the interpretation of differences among predictors. "In manova there is frequently an effort to decide which predictors are associated with group differences, but rarely an attempt to interpret the pattern of differences among the predictors as a whole" (Tabachnick and Fidell, 1989, P.506). In discriminant function analysis there is often an attempt to interpret the pattern of differences among the predictors as a whole, in an attempt to *understand the dimensions along which groups differ*: it is this utility which is of most importance in meeting the objectives laid out in this study. In discriminant function analysis however, the attempt to understand the dimensions along which groups differ does become more complex when there are more than two groups, as there may be more than one significant dimension (function) along which groups differ. However, the first discriminant function provides

the best separation among groups: usually, only the first one or two discriminant functions reliably discriminate among groups, while the remaining functions provide no additional information about group membership.

The emphasis in this study is not primarily on a decision rule for classifying cases, but rather on the ability to interpret the results of the discriminant function analyses in terms of the *combination of predictors* (discriminant functions) that separates various groups from each other.

Secondly, as the main focus in this study was on age groups, and not sex, the groups employed in the discriminant function analyses were not formed on the basis of more than one attribute. It would have been possible to have predicted age-sex group membership from a set of attitudinal independent variables through factorial discriminant function analysis (this same problem could have been addressed in a different way by a factorial manova). However, neither a factorial discriminant function analysis or factorial manova were performed as the main objective of this study was to determine along which attitude and behavioural *dimensions* the different age groups could be discriminated. It is also interesting to note that statistical programs designed for discriminant function analysis do not readily extend to a factorial arrangement of groups. In addition to this, as the results of the Non-Driver Questionnaire in Chapter 3 will indicate, the results from this study did confirm that the set of attitudinal predictors employed, could reliably discriminate between the age groups (when a broad age-range from 11-18 years was used), but rarely between the sexes, with very few age-sex interactions.

2.7.3 Statistical Techniques For Meta-variable Construction.

The methods of principal components analysis and reliability analysis were both employed in the creation of meta-variables. In general, principal components analysis was used as an exploratory technique in order to reduce a large number of variables down to a smaller number of meta-variables for input into other analytical procedures.

An example of where PCA was used in the Non-Driver Survey Study, was in the creation of 6 factors from a set of 19 variables relating to 'reasons for driving'. While it was desirable to reduce this large number of variables down to

a smaller sub-set for use in later analyses, there was no prior reason (e.g., previous research, or clear meaning-based logical structures) for dividing these variables into particular groups: hence, principal components analysis was applied.

Reliability analysis, in this case a measure of internal consistency, was employed as a confirmatory procedure in producing a meta-variable scale from a set of variables, when there was some prior reason for dividing variables into particular groups. Usually this analysis was conducted on sets of variables that had clear meaning-based structures (for example, three sets of variables concerning the perceived dangerousness, seriousness and likelihood of detection for certain driving offences).

Another example where reliability analyses were employed, instead of principal components analysis, was in the creation of the two meta-variables measuring 'the perceived difficulty of mastering manual driving skills' and 'the perceived difficulty of mastering cognitive driving skills'. The original variables were divided into 'cognitive' and 'manual' on the basis of meaning, and then their internal consistency as a scale verified using Cronbach's alpha (a statistical index of internal consistency).

In some instances, principal component analyses had been conducted on a set of variables, but had resulted in a number of factors, not all of which were easy to interpret. In these cases, the factor structures were examined for sets of high loading variables that could also be meaningfully grouped together to form a meta-variable: these high loading variables were then submitted to a reliability analysis, prior to meta-variable creation. This procedure was employed in the creation of the meta-variable 'Offender Sympathy'. A principal components analysis produced a three factor solution in which 11 out of 12 variables had high factor scores across all three factors, while the factors themselves were not easy to interpret on the basis of meaning. As such, a reliability analysis was conducted on the 11 high loading variables in order to produce the meta-variable 'Offender Sympathy' with an alpha coefficient of 0.9128. In this way, principal components analysis was used as an exploratory technique with a large set of variables, from which the highest loading variables were then logically grouped together, and their internal consistency as a scale confirmed through a reliability analysis procedure.

In summary, the main objective of employing principal components analysis or reliability analysis was to produce

meta-variables that could be meaningfully applied in later analyses, and as such the choice of test was made on an exploratory (where no meaningful structures were obviously apparent) or confirmatory basis (where clear meaning-based structures were apparent). However, while the use of reliability analyses may score high on meaningfulness and interpretability of meta-variables, it does not provide information on shared variance between scales (although, a correlation matrix of meta-variable scales, such as that produced in a discriminant function analysis, would provide this information).

CHAPTER 3.

NON-DRIVER
QUESTIONNAIRE RESULTS.

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NON-DRIVER QUESTIONNAIRE RESULTS.

3.0 INTRODUCTION.

The Non-Driver Results Chapter has been divided up into three main sections: (1) details of sample characteristics, (2) creation of driving behaviour, accident and offence-related meta-variables through reliability and principal components analyses, and (3) examination of group differences across driving behaviour, accident and offence-related meta-variables through employment of discriminant function analysis tests.

In all analyses on the Non-Driver Questionnaire data subjects have been divided into the following age groups: Group 1 = 11-12 years old, Group 2 = 13-14 years old, Group 3 = 15-16 years old, and Group 4 = 17-18 years old. All subjects in these groups were non-drivers (i.e., none of them had begun to officially learn to drive, and none of them held provisional or full British driving licences).

3.1 OVERVIEW.

SECTION 1: Sample Characteristics.

Section 1 contains a breakdown of the non-driver sample by age and sex, and is presented in a summary table.

SECTION 2: Creation of Driving Behaviour, Accident and Offence-Related Meta-Variables.

This section contains information on the creation of 28 meta-variables from the results of reliability analyses and principal component analyses. The meta-variables are detailed in Section 2 within their respective areas of road user behaviour, as indicated below.

1) Driving Offences.

Reliability analyses were conducted on 63 offence-related variables to produce five driving offence meta-variables, which were used in subsequent analyses.

2) Driving Skills.

Reliability analyses were conducted on two sets of variables relating to driving skills, to produce two meta-variables, which were employed in later analyses.

3) Reasons For Driving.

A principal components analysis was conducted on a set of 19 variables relating to 'reasons for wanting to drive', and produced six factors which were used in later analyses.

4) Accidents: Causation Factors.

Three reliability analyses were conducted to produce three accident causation scales for use in later analyses.

5) Self-perception Factors.

A principal components analysis was conducted on a set of 7 variables and produced two 'self-perception' factors, which were employed in later analyses.

6) Emotion Expression.

One reliability analysis was carried out on a set of variables to produce a scale relating to 'emotion expression and driving'. This scale was used in a subsequent analysis.

7) Attitudes Towards The Police.

A reliability analysis was conducted on a set of variables to produce the meta-variable 'attitudes towards the police'. This meta-variable was employed in a later analysis.

8) Perceptions of Driving Styles.

Reliability analyses were conducted on two sets of variables to produce the meta-variables 'predictions of future driving style' and 'perceptions of young peoples' driving styles', which were later used in an analysis.

SECTION 3. Examination of Group Differences Across Driving Behaviour, Accident and Offence-Related Meta-variables.

Discriminant function analyses were undertaken on the following five driving behaviour, accident and offence-related areas by age and sex.

1) Driving Offences.

A discriminant function analysis was conducted on a set of five meta-variables relating to attitudes towards driving offences.

2) Reasons For Driving.

A discriminant function analysis was conducted on a set of five meta-variables relating to subjects reasons for wanting to learn to drive.

3) Accident Causation Factors.

A discriminant function analysis was conducted on a set of three meta-variables relating to subjects' perceptions of accident causation factors.

4) General Attitudes Towards Driving.

A discriminant function analysis was conducted on a set of eight meta-variables relating to general attitudes towards driving.

5) Attitudes Towards Drink-Driving.

A discriminant function analysis was conducted on a set of 17 variables measuring subjects' attitudes towards drink-driving.

3.2 NON-DRIVER RESULTS SECTION 1:
 SAMPLE CHARACTERISTICS.

The Non-Driver Sample.

The table below presents some descriptive statistics on the sample of non-drivers who were included in the analysis of data from the Non-Driver Questionnaire phase of the study.

A total of 948 non-drivers were included in the analysis of results. As can be seen from the table below, this total sample size of 948 included 4 subjects whose sex but not age was known, and 5 subjects whose age but not sex was known. Eighty-eight subjects, out of the original sample of 1,036, were excluded from the analyses for failure to complete the second Non-Driver Questionnaire.

Table 1. Breakdown Of The Non-Driver Sample By Age and Sex.

SEX	AGE GROUPS				Not	Total
	11-12	13-14	15-16	17-18	Defined	
MALE	135	166	112	75	3	491
FEMALE	114	130	121	86	1	452
Not Defined	1	2	2	0	0	5
Total	250	298	235	161	4	948

3.3 NON-DRIVER RESULTS SECTION 2.

THE CREATION OF DRIVING BEHAVIOUR, ACCIDENT AND OFFENCE-RELATED META-VARIABLES.

Twenty eight meta-variables were created. These meta-variables were formed from the results of principal component analyses and reliability analyses. The results below are divided into the following areas of road user behaviour: Driving Offences, Driving Skills, Reasons For Driving, Accident Causation Factors, Self-Perception Factors, Emotion-Expression, Attitudes Towards The Police, and Perceptions Of Driving Styles. The meta-variables that have been produced are described within each relevant area, and their origins from reliability or principal components analyses examined. Full details of the variables and results from the analyses are held in Appendices B1 and B2.

1) DRIVING OFFENCES.

Five meta-variables relating to driving offences were produced. Each meta-variable label and its meaning are given below, followed by a summary of the reliability analyses. A comprehensive list of the component variables within each meta-variable, their measurement and meanings are presented in Appendix B2.

OFFENDER SYMPATHY - This meta-variable is comprised of 12 variables concerning how sorry subjects felt for drivers who were convicted for various driving offences. The variables covered such offences as speeding, parking, racing, not wearing a seat-belt and drink-driving. All variables were measured on a five-point scale.

PERCEIVED DANGEROUSNESS - This meta-variable is comprised of 18 variables concerning subjects' ratings of how dangerous certain driving behaviours are. The behaviours included areas such as failure to give way, speeding, drink-driving and driving without a licence. All variables were measured on a five-point scale.

PERCEIVED SERIOUSNESS OF OFFENCES - This meta-variable is made up of 14 variables concerning the perceived seriousness of different driving offences. The variables included offences such as drink-driving, speeding, dangerous overtaking and driving without a licence. All variables were measured on a five-point scale.

PERCEIVED LIKELIHOOD OF DETECTION - This meta-variable is comprised of 11 variables concerning the perceived likelihood of detection for a variety of offences. The variables include such offences as speeding, illegal parking, drink-driving and racing on public roads. All variables were measured on a five-point scale.

OFFENCE-ACCEPTABILITY - This meta-variable is made up of 8 variables concerning subjects attitudes towards a variety of offences. The variables include attitudes towards driver skill and speed limits, driving without a licence, fines for offences and their effect as a deterrent. All variables were measured on five-point scales.

Table 2a. **Summary Of The Reliability Analyses Conducted On The Driving Offence Meta-Variables.**

<u>META-VARIABLE</u>	<u>N.of cases</u>	<u>N.of Variables</u>	<u>Cronbach's ALPHA</u>
OFFENDER SYMPATHY	909	12	0.9128
PERCEIVED DANGEROUSNESS	857	18	0.8422
PERCEIVED SERIOUSNESS OF OFFENCES	869	14	0.8101
PERCEIVED LIKELIHOOD OF DETECTION	913	11	0.8415
OFFENCE-ACCEPTABILITY	911	8	0.6341

Full details of the analyses and descriptions of the original variables are contained in Appendices B1 and B2 respectively.

2) DRIVING SKILLS.

Two meta-variables relating to driving skills were produced. Each meta-variable label and its meaning are given below, followed by a summary of the reliability analyses. A comprehensive list of the component variables within each meta-variable and their measurement are presented in Appendix B2.

COGNITIVE SKILLS - This meta-variable is made up of six variables concerning subjects' ratings of the level of difficulty in mastering certain cognitive driving skills. The skills under study include overtaking, spotting hazards, safe following distances and awareness of other traffic and pedestrians. All variables were measured on a five-point scale.

MANUAL SKILLS - This meta-variable is comprised of six variables concerned with subjects' ratings of the level of difficulty in mastering (mainly) manual driving skills. The skills in question include changing gear, correct use of mirrors, and steering and road position. All variables were measured on a five-point scale.

Table 3a. Summary Of The Reliability Analyses
Conducted On The Driving Skill
Meta-Variables.

<u>META-VARIABLE</u>	<u>N.of Cases</u>	<u>N.of Variables</u>	<u>Cronbach's ALPHA</u>
COGNITIVE SKILLS	919	6	0.7236
MANUAL SKILLS	921	6	0.8165

Full details of the analyses and descriptions of the original variables are contained in Appendices B1 and B2 respectively.

3) REASONS FOR DRIVING.

Six meta-variables relating to subjects' reasons for wanting to learn to drive, and what type of car is desirable and why, were produced. Each meta-variable label and its meaning are given below, followed by details on the principal components analyses that created them. A comprehensive list of the component variables within each meta-variable, their measurement and meanings are presented in Appendix B2.

IMAGE - This meta-variable is made up of five variables relating to the desirability of a fast car, the use of a car for fun and for image. All variables were measured on a five-point scale.

SOCIAL INFLUENCE - This meta-variable is made up of three variables relating to the social influence of peers and parents in the desire to learn to drive a car. All variables were measured on a five-point scale.

CAR FEATURES - This meta-variable is made up of five variables relating to the importance of 'functional' features of a car such as reliability, economy, handling and safety. All variables were measured on a five-point scale.

SMALL CAR DESIRABILITY - This meta-variable is made up of two variables relating to the desirability of a small or medium hatchback type of car. All variables were measured on a five-point scale.

LARGE CAR DESIRABILITY - This meta-variable is made up of two variables relating to the desirability of a saloon or sports car. All variables were measured on a five-point scale.

SOCIAL ACTIVITIES - This meta-variable is made up of two variables relating to the use of a car for social activities. All variables were measured on a five-point scale.

**Table 4a. Results Of The Principal Components Analysis
On The 'Reasons For Driving' Variables.**

Factor 1: IMAGE.

<u>Variable</u>	<u>Loading.</u>	Eigenvalue = 3.821
FAST	0.705	% of Variance = 18.2
GOOD	0.704	
WHYDRIV4	0.569	
FHATCH	0.530	
WHYDRIV1	0.504	

Variable Label.

FAST - importance of a car being fast.
GOOD - importance of the image of a car.
WHYDRIV4 - importance of the fun involved in being a car
 driver.
FHATCH - desirability of owning a fast hatchback.
WHYDRIV1 - importance of the mobility afforded by being a
 car driver.

Factor 2: SOCIAL INFLUENCE.

<u>Variable</u>	<u>Loading.</u>	Eigenvalue = 1.990
PAL	0.758	% of Variance = 9.5
WHYDRIV2	0.587	
WHYDRIV3	0.510	

Variable Label.

PAL - influence of peers on the perceived
 desirability of particular types of cars.
WHYDRIV2 - importance of peers in learning to drive.
WHYDRIV3 - importance of the perceived status associated
 with being a car driver.

Factor 3: CAR FEATURES.

<u>Variable</u>	<u>Loading.</u>	Eigenvalue	=	1.556
RELIABLE	0.690	% of Variance	=	7.4
HANDLE	0.661			
ECONOMY	0.634			
SAFETY	0.566			
SIZE	0.506			

Variable Label.

RELIABLE - importance of car reliability.
HANDLE - importance of car handling features.
ECONOMY - how important it is for a car to be economical.
SAFETY - importance of car safety features.
SIZE - importance of car size.

Factor 4: SMALL CAR DESIRABILITY.

<u>Variable</u>	<u>Loading.</u>	Eigenvalue	=	1.537
MHATCH	0.849	% of Variance	=	7.3
SHATCH	0.702			

Variable Label.

MHATCH - desirability of owning a medium hatchback.
SHATCH - desirability of owning a small hatchback.

Factor 5: LARGE CAR DESIRABILITY.

<u>Variable</u>	<u>Loading.</u>	Eigenvalue	=	1.131
SALOON	0.731	% of Variance	=	5.4
SPORTSCAR	0.477			

Variable Label.

SALOON - desirability of owning a saloon car.
SPORTSCAR - desirability of owning a sports coupe.

Factor 6: SOCIAL ACTIVITIES.

<u>Variable</u>	<u>Loading.</u>	Eigenvalue = 1.098
WHYDRIV7	0.826	% of Variance = 5.2
WHYDRIV5	0.439	

Variable Label.

- WHYDRIV7 - importance of 'other' reasons in wanting to learn to drive a car.
- WHYDRIV5 - importance of social activities in wanting to learn to drive.

To be included in a factor each variable had to have a factor score of 0.4 or above (Tabachnick and Fidell, 1989). Full details of the analysis and descriptions of the original variables are contained in Appendices B1 and B2 respectively.

4) ACCIDENT CAUSATION FACTORS.

Three meta-variables relating to causal factors of road traffic accidents were produced. Each meta-variable label and its meaning are given below, followed by a summary of the reliability analyses. A comprehensive list of the component variables within each meta-variable, their measurement and meanings are presented in Appendix B2.

ROAD HAZARDOUSNESS - This meta-variable is made up of six variables relating to subjects' ratings of the hazardousness of different road conditions. The road conditions included items such as heavy rain, thick fog and icy conditions. All variables were measured on a five-point scale.

INTERNAL FACTORS - This meta-variable is made up of seven variables relating to subjects' ratings of different factors as likely causation factors in road traffic accidents. The factors included can all be considered as internal attributes, such as driving ability, poor driving attitudes and lack of attention. All variables were measured on a five-point scale.

EXTERNAL FACTORS - This meta-variable is made up of seven variables relating to subjects' ratings of different factors as likely causation factors in road traffic accidents. The factors included can all be considered as external attributes, such as mechanical problems, bad road layout and bad luck. All variables were measured on a five-point scale.

Table 5a. Summary Of The Reliability Analyses On
Accident Causation Meta-Variables.

<u>META-VARIABLE</u>	<u>N.of Cases</u>	<u>N.of Variables</u>	<u>Cronbach's ALPHA</u>
ROAD HAZARDOUSNESS	922	6	0.7659
INTERNAL FACTORS	904	7	0.6102
EXTERNAL FACTORS	912	7	0.5189

Full details of the analyses and descriptions of the original variables are contained in Appendices B1 and B2 respectively.

5) SELF-PERCEPTION FACTORS.

Two meta-variables describing self-perception factors were produced. Each meta-variable label and its' meaning are given below, followed by details on the principal components analyses that created them. A comprehensive list of the component variables within each meta-variable, their measurement and meanings are presented in Appendix B2.

SELF-PERCEPTION FACTOR 1 - This meta-variable is made up of five variables relating to self-perception factors, including self-ratings of aggressiveness, competitiveness, sociability and feelings of superiority. All variables were measured on a five point scale from (1) strongly disagree to (5) strongly agree.

SELF-PERCEPTION FACTOR 2 - This meta-variable is made up of two variables relating to feelings of independence and level of respect towards teachers. Both variables were measured on a five point scale from (1) strongly disagree to (5) strongly agree.

Table 6a. Results Of The Principal Components Analysis On The 'Self-Perception' Variables.

Factor 1: SELF-PERCEPTION
FACTOR 1.

<u>Variable</u>	<u>Loading.</u>	Eigenvalue = 1.679	% of Variance = 23.00
COMPETIV	0.665		
SUPERIOR	0.611		
AGGRESS	0.572		
LOTSPALS	0.521		
SHYN	0.455		

Variable Label.

COMPETIV - attitude towards the statement 'I am a competitive person'.
 SUPERIOR - attitude towards the statement 'I often feel superior to others'.
 AGGRESS - attitude towards the statement 'I am aggressive person'.
 LOTSPALS - attitude towards the statement 'I have lots of friends'.
 SHYN - attitude towards the statement 'I am a shy person' (this variable was reversed).

Factor 2: SELF-PERCEPTION
 FACTOR 2.

<u>Variable</u>	<u>Loading.</u>	Eigenvalue	=	1.205
RESPECTT	0.784	% of Variance	=	17.2
INDEP	0.625			

Variable Label.
RESPECTT - attitude towards the statement 'I respect most of my teachers'.
INDEP - attitude towards the statement 'I am an independent sort of person'.

To be included in a factor each variable had to have a factor score of 0.4 or above (Tabachnick and Fidell, 1989). Full details of the analysis and descriptions of the original variables are contained in Appendices B1 and B2 respectively.

6) EMOTION EXPRESSION.

One meta-variable relating to driver behaviour and emotion-expression was produced. The meta-variable's label and its meaning are given below, followed by a summary of the reliability analysis. A comprehensive list of the component variables within the meta-variable, their measurement and meanings are presented in Appendix B2.

EMOTION-EXPRESSION - This meta-variable is made up of nine variables concerning driving related to emotion-expression. The variables include 'driving to let off steam', expression of power and driving for fun and excitement. All variables were measured on a five-point scale.

Table 7a. Summary Of The Reliability Analysis On 'Emotion Expression' Variables.

<u>META-VARIABLE</u>	<u>N.of Cases</u>	<u>N.of Variables</u>	<u>Cronbach's ALPHA</u>
EMOTION EXPRESSION	682	9	0.650

Full details of the analysis and descriptions of the original variables are contained in Appendices B1 and B2 respectively.

7) ATTITUDES TOWARDS THE POLICE.

One meta-variable relating to attitudes towards the police was produced. The meta-variable's label and its' meaning are given below, followed by a summary of the reliability analysis. A comprehensive list of the component variables within the meta-variable, their measurement and meanings are presented in Appendix B2.

POLICE - This meta-variable is made up of three variables concerning young peoples' attitudes towards the police. The variables include whether the police do a good job and the degree of liking for the police. All variables were measured on a five-point scale.

Table 8a. Summary Of The Reliability Analysis On
 'Attitudes Towards The Police' Variables.

<u>META-VARIABLE</u>	<u>N.of Cases</u>	<u>N.of Variables</u>	<u>Cronbach's ALPHA</u>
POLICE	936	3	0.600

Full details of the analysis and descriptions of the original variables are contained in Appendices B1 and B2 respectively.

8) DRIVING STYLES.

Two meta-variables relating to 'driving styles' were produced. The meta-variables' labels and meanings are given below, followed by a summary of the reliability analyses. A comprehensive list of the component variables within both of the meta-variables, their measurement and meanings are presented in Appendix B2.

FUTURE DRIVING STYLE - This meta-variable is made up of six variables concerning young peoples' predictions of what their future driving styles will be like. All variables were measured on a five-point scale.

YOUNG PEOPLE'S DRIVING STYLE - This meta-variable is made up of five variables concerning young peoples' perceptions of young peoples' driving styles. All variables were measured on a five-point scale.

Table 9a. Summary Of The Reliability Analyses On
 'Driving Style' Variables.

	N.of	N.of	Cronbach's
<u>META-VARIABLE</u>	<u>Cases</u>	<u>Variables</u>	<u>ALPHA</u>
FUTURE DRIVING STYLE	913	6	0.746
YOUNG PEOPLES' DRIVING STYLES	932	5	0.620

Full details of the analyses and descriptions of the original variables are contained in Appendices B1 and B2 respectively.

3.4 RESULTS SECTION 3.

THE EXAMINATION OF GROUP DIFFERENCES ACROSS DRIVING BEHAVIOUR, ACCIDENT AND OFFENCE-RELATED VARIABLES.

The summaries of five discriminant function analyses are presented below. Due to the large number of analyses presented in this thesis, only summary tables are presented in the results sections for the sake of brevity (with full details provided in Appendix B3). The discriminant function analyses are primarily on age by:

- 1) Driving Offences
- 2) Reasons For Driving
- 3) Accident Causation Factors
- 4) General Attitudes Towards Driving
- 5) Attitudes Towards Drink-Driving

The utility of the same variables in discriminating between the sexes is also examined, but as most of the analyses did not produce more than one discriminating variable on sex, these analyses are not considered in the same detail as those on age.

In each section the analysis by age is considered first, followed by a brief summary of the analysis by sex: as some analyses on sex did not produce any discriminating variables, or only one, often the summary is limited to a consideration of the significant standardized canonical discriminant function coefficient and group means, with some further details in the appendices. If the analysis by age is significant, then a summary table is presented and the analysis is discussed (with full details in Appendix B3). A brief examination is also made for any age-sex interaction effects through the use of analysis of variance techniques.

Full details of the significant discriminant function analyses, including group means, standard deviations, univariate F-Tests and degrees of freedom, canonical discriminant functions, structure matrix, pooled within-groups correlation matrix and classification table are contained within Appendix B3.

The age groups used in the analyses were as follows: age group 1 = 11-12 years, age group 2 = 13-14 years, age group 3 = 15-16 years, age group 4 = 17-18 years.

1) ATTITUDES TOWARDS DRIVING OFFENCES.

a) By Age:

Summary Of The Discriminant Function Analysis:

A direct discriminant function analysis was performed to discriminate between subjects of ages 11-18 on a set of 'driving offence' variables. The 'driving offence' meta-variables included in the analysis were as follows: subjects' ratings of how sorry they felt for drivers convicted for certain driving offences (OFFENDER SYMPATHY), subjects' ratings of how dangerous certain driving offences were (PERCEIVED DANGEROUSNESS), subjects' ratings of how serious they considered certain driving offences to be (PERCEIVED SERIOUSNESS OF OFFENCES), subjects' ratings for the perceived likelihood of detection for certain driving offences (PERCEIVED LIKELIHOOD OF DETECTION), and subjects' ratings of the acceptability of breaking certain road traffic laws (OFFENCE ACCEPTABILITY). Each meta-variable used in this analysis was produced as a scale from an original set of variables, as a result of reliability analyses using Cronbachs' Alpha. Details of the original variables and reliability analyses used to produce these meta-variables are contained in this Chapter in Results Section 2, and in Appendices B1 and B2.

Table 10a. Summary of Discriminant Function Analysis On Age By Attitudes Towards Driving Offences.

Age Groups(n)	Group Centroids			Variable Numbers	Rotated Discriminant Function Coefficients		
	F1	F2	F3		F1	F2	F3
1(180)	0.738	0.278	0.027	1	0.064	0.178	0.652
2(230)	0.130	-0.103	0.126	2*	0.363	-0.064	0.901
3(200)	-0.289	-0.206	-0.096	3*	-0.469	1.136	-0.399
4(130)	-0.808	0.114	-0.114	4*	0.978	-0.188	-0.201
				5*	-0.176	0.097	0.324

No.	Variable Label	Univariate Level of Significance: * = p< 0.05
1)	OFFENDER SYMPATHY	
2)	PERCEIVED DANGEROUSNESS	
3)	PERCEIVED SERIOUSNESS	
4)	PERCEIVED LIKELIHOOD OF DETECTION	
5)	OFENCE ACCEPTABILITY	

On the basis of the variables included in the analysis it was possible to significantly discriminate between the age groups. In the interpretation of the results, only standardized canonical discriminant function coefficients of over 0.50 will be considered.

As detailed in Table 10d in Appendix B3, only the first two discriminating functions were significant. The combined chi-square value was 211.20 (degrees of freedom = 15), $p < 0.0001$. After the removal of the first function there was still highly significant discriminating power, with a chi-square of 24.394 (degrees of freedom = 8), $p = 0.002$. After the removal of the first two functions however, the discriminating power remaining was not significant, with a chi-square of 3.4705, $p = 0.3246$.

As shown in Table 10a above, the first function maximally separates 11-12 year olds and 17-18 year olds, with those aged 13-16 years falling between these two groups. The second function maximally separates 11-12 year olds from 15-16 year olds, with 13-14 and 17-18 year olds falling between these two groups.

Table 10a shows that function one produced only one discriminating variable, PERCEIVED LIKELIHOOD OF DETECTION (the perceived likelihood of detection for certain driving offences). Function two produced one discriminating variable also, PERCEIVED SERIOUSNESS (the perceived seriousness of certain driving offences).

Results show that for function one, 11-12 year olds perceive the highest likelihood of detection for driving offences, while 17-18 year olds perceive the lowest (even without first-hand driving experience). The results show that as age increases the perceived likelihood of detection decreases.

From function two results show that 11-12 year olds also perceive driving offences in a more serious light than do the older age groups. At the ages 15-16 years we see the lowest rating for seriousness of driving offences.

The variables OFFENDER SYMPATHY, PERCEIVED DANGEROUSNESS and OFFENCE ACCEPTABILITY did not significantly discriminate between the age groups. Although, inspection of group means does show a reasonable difference on the variable PERCEIVED DANGEROUSNESS (the perceived dangerousness of certain driving offences) between 11-12 year olds (0.222) and 17-18 years (-0.167). The older the subjects are the less danger they perceive in committing driving offences.

So, results tend to indicate that as age increases, young

people perceive a lower likelihood of detection, lower seriousness and less danger associated with driving offences. Although, none of the age groups felt very sorry for drivers caught for the different offences.

b) By Sex:

An examination of the means for both sexes showed very little variation between them on any of the variables. The means table for the sexes is contained in Appendix B3. Although the discriminant function analysis on sex was significant, only one variable had a standardized canonical discriminant function coefficient above 0.5. The variable, OFFENCE ACCEPTABILITY, subjects' ratings of the acceptability of committing certain driving offences, had a standardized canonical discriminant function coefficient of 0.555, indicating that males rated the acceptability of driving offences higher than did females.

c) Examination for age-sex interactions.

Analysis of variance tests were conducted on each of the above meta-variables in order to examine for any age-sex interaction effects. Results indicated that there were no significant interaction effects at the $p < 0.05$ level of significance. The F-ratios and levels of significance for each variable are as follows: OFFENDER SYMPATHY ($F=1.918$, $p=0.125$); PERCEIVED DANGEROUSNESS ($F=1.518$, $p=0.325$); PERCEIVED SERIOUSNESS ($F=0.653$, $p=0.581$); PERCEIVED LIKELIHOOD OF DETECTION ($F=0.404$, $p=0.750$); OFFENCE ACCEPTABILITY ($F=0.744$, $p=0.526$).

2) REASONS FOR DRIVING.

a) By Age:

Summary Of The Discriminant Function Analysis.

A direct discriminant function analysis was performed to discriminate between subjects of ages 11-18 on a set of 'reasons for driving' variables. The age groups used in the analysis were as follows: age group 1 = 11-12 years, age group 2 = 13-14 years, age group 3 = 15-16 years, age group 4 = 17-18 years. The 'reasons for driving' meta-variables included in the analysis were as follows: subjects' ratings of the desirability of owning a car and the importance of its' image (IMAGF), subjects' ratings of the importance of parents/peers in the decision to want to learn to drive a car (PEERF), subjects' ratings of the desirability of certain functional features of a car, such as safety, economy and size (FEATURES), subjects' ratings of the desirability of owning a small or medium standard power hatchback (SMALCARF), and subjects' ratings of the desirability of owning a saloon or sports car (LARGCARF). Each meta-variable used in this analysis was produced as a scale from an original set of variables as a result of a principal components analysis. Full details of the original variables and principal components analysis used to produce these meta-variables are contained in this Chapter in Results Section I.

Table 11a. Summary Of The Discriminant Function Analysis
On Age By 'Reasons For Driving' Meta-variables.

Age Groups(n)	Group Centroids			Variable Labels	Rotated Discriminant Function Coefficients		
	F1	F2	F3		F1	F2	F3
1(170)	-0.601	-0.304	0.269	IMAGF*	1.186	0.120	-0.297
2(233)	0.014	-0.315	0.267	FEATURES	-0.330	0.319	0.036
3(202)	0.220	0.297	-0.208	SMALCARF*	-0.0004	0.936	-0.004
4(131)	0.414	0.498	-0.504	LARGCARF*	-0.127	-0.047	0.747
				PEERF*	-0.290	-0.169	0.709

Univariate Level of Significance: * = p< 0.05

On the basis of the variables included in the analysis it was possible to significantly discriminate between the age groups. In the interpretation of the results, only standardized canonical discriminant function coefficients of over 0.50 will be considered.

As detailed in Table 11d in Appendic B3, both the first and second discriminating functions were significant. The chi-square value for the first function was 224.097 (degrees of freedom = 15), $p < 0.0001$, and 26.765 (degrees of freedom = 8), $p = 0.0008$ for the second function. After the removal of the second function there was not any significant discriminating power left, the third discriminating function having a chi-square of 0.65, $p = 0.8848$.

As shown in Table 11a above, the first function maximally separates 11-12 year olds and 17-18 year olds, and the second function maximally separates 11-12/13-14 year olds and 17-18 year olds.

Table 11a shows that function one produced one discriminating variable, IMAGF (the desirability of owning a car and the importance of its' image), and that function two produced one discriminating variable, PEERF (the importance of peers and parents in the decision to learn to drive).

Results show that for function one, 11-12 year olds place much lower importance on the image of a car than do 17-18 year olds. An examination of the means indicates that as age increases from 11-12 to 17-18 years so does the importance of the image of the car.

The second discriminant function indicates that the highest influence of parents and peers in the desire to learn to drive can be seen at the age 13-14 and 11-12 years, and gradually decreases with age until 17-18 years where the lowest influence is found.

Although the variables FEATURES, SMALCARF and LARGCARF were not shown to be significant discriminating variables in the multivariate solution, the variables SMALCARF and LARGCARF did both produce significant univariate results.

So, results tend to indicate that as age increases, young people place more importance on the image of a car, and less importance on the influence of parents or friends in the decision to learn to drive.

b) By Sex:

An examination of the means for both sexes showed very little variation between them on four out of the five variables. A discriminant function analysis on sex indicated that there was only one variable with a standardized discriminant function coefficient above 0.5. The variable LARGCARF had a coefficient of 0.68849, indicating that males rated the desirability of having a saloon or sports car higher than did females. The means for the sexes are contained in Table 12i in Appendix B3.

c) Examination for age-sex interactions.

Analysis of variance tests were conducted on each of the above meta-variables in order to examine for any age-sex interaction effects. Results indicated that there was only one significant interaction effect at the $p < 0.05$ level of significance (the variable FEATURES). The F-ratios and levels of significance for each variable are as follows: IMAGEF ($F=0.319$, $p=0.812$); SENSIBF ($F=5.327$, $p=0.001$); SMALCARF ($F=0.325$, $p=0.807$); LARGCARF ($F=1.633$, $p=0.180$); PEERF ($F=0.623$, $p=0.600$). Results from a Tukey test on the variable FEATURES indicated that the group mean differences for age-sex interaction effects (at $p < 0.05$) were between the 11-12 year old females and the following groups: 15-16 year old females, 17-18 year old females, 11-12 year old males and 13-14 year old males. Results indicated that 11-12 year old females rated the importance of functional features of a car lower than do 15-18 year old females or 11-14 year old males.

3) ACCIDENT CAUSATION FACTORS.

a) By Age:

Summary Of The Discriminant Function Analysis.

A direct discriminant function analysis was performed to discriminate between subjects of ages 11-18 on a set of 'accident causation factor' variables. The 'accident causation factor' meta-variables included in the analysis were as follows: subjects' ratings of the hazardousness of certain road conditions, such as heavy rain, fog, ice, etc. (ROAD HAZARDOUSNESS), subjects' ratings of different factors and their likley causation of road traffic accidents, such as alcohol, poor driving attitudes and inexperience - all factors which may be attributed to internal factors of the driver (INTERNAL FACTORS), subjects' ratings of different factors and their likely causation of road traffic accidents, such as weather conditions, road conditions and mechanical problems - all factors which may be attributed to factors external to the driver (EXTERNAL FACTORS). Each meta-variable used in this analysis was produced as a scale from an original set of variables as a results of reliability analyses using Cronbachs' Alpha. Full details of the original variables and reliability analyses used to produce these meta-variables are contained in this Chapter in Results Section 2, and Appendices B1 and B2.

Table 12a. **Summary Of The Discriminant Function Analysis
On Age By Accident Causation Factors.**

Age Groups(n)	Group Centroids			Variable Numbers	Rotated Discriminant Function Coefficients		
	F1	F2	F3		F1	F2	F3
1(216)	0.222	-0.043	0.001	1	-0.114	1.047	-0.121
2(267)	0.005	-0.073	-0.036	2	-0.228	-0.116	1.101
3(222)	-0.222	0.018	-0.010	3*	1.098	-0.109	-0.228
4(154)	0.001	0.161	0.075				

No.	Variable Label			Univariate Level of Significance:			
1)	ROAD HAZARDOUSNESS			* = p< 0.05			
2)	INTERNAL FACTORS						
3)	EXTERNAL FACTORS						

On the basis of the variables included in the analysis it was possible to significantly discriminate between the age groups. In the interpretation of the results, only standardized canonical discriminant function coefficients of over 0.50 will be considered. As detailed in Table 12d in Appendix B3, only the first discriminating function was significant. The chi-square value was 28.444 (degrees of

freedom = 9), $p=0.0008$. After the removal of the first function there was not any significant discriminating power left, with a chi-square of 6.5485 (degrees of freedom = 4), $p=0.1618$.

As shown in Table 12a above, the first function maximally separates 11-12 year olds and 15-16 year olds, with those aged 13-14 and 17-18 years falling between these two groups. Table 12a shows that function one produced only one discriminating variable, EXTERNAL FACTORS (accident causation factors that can be attributed externally to the driver). Results show that for function one, 11-12 year olds perceive accident causation factors that can be attributed externally to the driver to be more important in explaining accidents than do the other age groups, with the 15-16 years olds giving the least importance to these external attribution factors. The importance attached to these external attribution factors increases again at the ages 17-18 years (when the subjects are old enough to drive, but do not yet do so), to a level that exceeds both the 13-14 and 15-16 year age groups. The variables ROAD HAZARDOUSNESS and INTERNAL FACTORS did not significantly discriminate between any of the the age groups.

So, results tend to indicate that as age increases, young people pay less importance to external factors when attributing the causes of road traffic accidents, up until the ages 17-18 years when there is a sudden increase in the importance placed on external attribution factors. The swing towards external attribution in the older subjects may be viewed in the context that these young people are now of the legal driving age, may be intending to learn to drive and have friends who are drivers, and so can possibly sympathise with drivers in terms of an external attribution bias.

b) By Sex:

An examination of the means for both sexes showed very little variation between them on any of the variables. A discriminant function analysis on sex indicated there were no variables with standardized discriminant function coefficients above 0.5. The variable ROAD HAZARDOUSNESS had a coefficient of 0.44, indicating that males rated the hazardousness of certain road conditions lower than females did. The means table for the sexes is contained in Appendix B3.

c) Examination for age-sex interactions.

Analysis of variance tests were conducted on each of the above meta-variables in order to examine for any age-sex interaction effects. Results indicated that there were no significant interaction effects at the $p<0.05$ level of significance. The F-ratios and levels of significance for each variable are as follows: ROAD HAZARDOUSNESS ($F=$

0.477, p= 0.720); INTERNAL FACTORS (F=1.765, p=0.152); EXTERNAL FACTORS (F=0.844, p=0.470).

4) GENERAL ATTITUDES TOWARDS DRIVING.

a) By Age.

Summary Of The Discriminant Function Analysis.

A direct discriminant function analysis was performed to discriminate between subjects of ages 11-18 on a set of 'general attitudes towards driving' variables. The 'general attitudes towards driving' meta-variables included in the analysis were as follows: young peoples' predictions of what their future driving styles will be like (FUTURE DRIVING STYLE); subjects' perceptions of young peoples driving styles (YOUNG PEOPLES DRIVING STYLE); attitudes towards the police (POLICE); attitudes towards driving as a means for thrill-seeking and emotion-expression (EMOTION EXPRESSION); subjects' ratings on a meta-variable measuring assertiveness and gregariousness (SELF-PERCEPTION FACTOR 1); a meta-variable comprised of feelings of independence and respect towards authority (SELF-PERCEPTION FACTOR 2); perceptions of the difficulty of mastering manual driving skills (MANUAL SKILLS); and perceptions of the difficulty of mastering cognitive driving skills (COGNITIVE SKILL).

Table 13a. Summary Of The Discriminant Function Analysis
On Age By 'General Attitudes Towards Driving'.

Age Groups(n)	Group Centroids			Variable Numbers	Rotated Discriminant Function Coefficients		
	F1	F2	F3		F1	F2	F3
1(144)	0.557	0.259	-0.014	1*	-0.613	-0.541	-0.044
2(187)	0.105	-0.321	-0.064	2	0.064	0.322	-0.398
3(153)	-0.182	-0.023	0.175	3*	0.639	0.006	0.517
4(125)	-0.577	0.210	-0.102	4*	0.351	-0.141	0.921
				5	0.361	0.078	-0.207
				6*	-0.490	0.710	0.254
				7	-0.211	-0.039	0.067
				8*	0.478	-0.067	-0.417

No.s	Variable Labels	Univariate Level of Significance: * = p< 0.05
1)	FUTURE DRIVING STYLE	
2)	YOUNG PEOPLES DRIVING STYLE	
3)	POLICE	
4)	EMOTION EXPRESSION	
5)	SELF-PERCEPTION FACTOR 1	7) MANUAL SKILLS
6)	SELF-PERCEPTION FACTOR 2	8) COGNITIVE SKILLS

Each meta-variable used in this analysis was produced as a scale from an original set of variables as a result of reliability analyses using Cronbachs' Alpha, or as a factor as a result of a principal components analysis. Details of the original variables, reliability analyses and principal components analyses used to produce these meta-variables are contained in this Chapter in Results Section 2, and Appendices B1 and B2.

On the basis of the variables included in the analysis it was possible to significantly discriminate between the age groups. In the interpretation of the results, only standardized canonical discriminant function coefficients of over 0.50 will be considered.

As detailed in Table 13d in Appendix B3, it can be seen that the first two discriminating functions were significant. The chi-square value of the first discriminant function was 126.79 (degrees of freedom = 24), $p < 0.0001$. After the removal of the first function there was still significant discriminating power left, with a chi-square of 40.232 (degrees of freedom = 14), $p = 0.0002$.

As shown in Table 13b above, the first function maximally separates 11-12 year olds and 17-18 year olds, with those aged 13-16 years falling between these two groups. The second discriminating function maximally separates 11-12 year olds and 13-14 year olds, with those aged 15-18 years falling in between these two groups.

Table 13b above shows that function one produced two discriminating variables, FUTURE DRIVING STYLE (young peoples' predicted future driving style) and POLICE (attitudes towards the police) evaluated at the 0.5 level, and two variables SELF-PERCEPTION FACTOR 2 (feelings of independence and respect for authority, and COGNITIVE SKILLS (perception of the difficulty in mastering cognitive driving skills) with coefficients of -0.49 and 0.47 respectively.

Results show that for function one, 17-18 year olds predicted that their future driving style will be faster, more skilful, riskier, will involve more racing with other drivers and thrill-seeking, than any of the other groups did (on the meta-variable FUTURE DRIVING STYLE). The 11-12 years olds had the lowest ratings on this variable in predicting their driving style than any other age groups. These results show that as age increases so does the desire to drive fast, take risks, race with other cars on public roads, the perception of skill and the desire to use cars as a vehicle for thrill-seeking.

Function one also showed that 17-18 year olds had the most negative attitudes towards the police, while 11-12 year olds had the most positive attitude towards the police. From the age 13 years plus, each group had negative attitudes towards the police, increasing at the ages 17-18 years.

The two variables SELF-PERCEPTION FACTOR 2 and COGNITIVE SKILLS had values just below 0.5 and so shall be examined here. Function one indicated that 17-18 year olds had the most respect for authority and the highest feelings of independence, while 13-14 year olds had the least respect for authority and the lowest feelings of independence. Values on the variable COGNITIVE SKILLS showed that as age increases the perception of the difficulty of mastering cognitive driving skills decreases. Seventeen to eighteen year olds had the lowest rating of the degree of difficulty while 11-12 year olds had the highest.

The second discriminating function produced two discriminating variables (FUTURE DRIVING STYLE and SELF-PERCEPTION FACTOR 2) which were already produced by function one and have been discussed above.

The variables YOUNG PEOPLES DRIVING STYLE, EMOTION EXPRESSION, SELF-PERCEPTION FACTOR 1 and MANUAL SKILLS did not significantly discriminate between any of the age groups. The means for these variables shall be considered (for details see Appendix B3). Subjects' attitudes towards the general driving styles of young drivers were fairly neutral, not indicating young drivers in general to be particularly fast or slow, safe or dangerous. Subjects' attitudes towards driving as a means for thrill-seeking again were fairly neutral, not indicating a positive or negative attitude towards it. Subjects' ratings of themselves in terms of assertiveness and gregariousness again were neither particularly high or low. Subjects' perceptions of the difficulty of mastering manual driving skills were fairly moderate as well, perceiving them as neither particularly easy or difficult.

So, results tend to indicate that as age increases, so does a negative attitude towards the police, a desire to drive fast and take risks, along with an increased perception of self-skill, and a decreased perception of the difficulty in mastering cognitive driving skills.

b) By Sex.

An examination of the means for both sexes from a separate discriminant function analysis showed that none of the variables could be used to significantly discriminate between the sexes (all variables had discriminant function

coefficients of below 0.43). The means table for the sexes is contained in Appendix B3.

c) Examination for age-sex interactions.

Analysis of variance tests were conducted on each of the above meta-variables in order to examine for any age-sex interaction effects. Results indicated that there was only one significant interaction effect at the $p < 0.05$ level of significance (the variable MANUAL SKILLS). The F-ratios and levels of significance for each variable are as follows: FUTURE DRIVING STYLE ($F=0.621$, $p=0.602$); YOUNG PEOPLES DRIVING STYLE ($F=1.343$, $p=0.259$); POLICE ($F=1.615$, $p=0.184$); EMOTION EXPRESSION ($F=0.560$, $p=0.642$); SELF-PERCEPTION FACTOR 1 ($F=0.897$, $p=0.442$); SELF PERCEPTION FACTOR 2 ($F=1.030$, $p=0.379$); MANUAL SKILLS ($F=2.931$, $p=0.033$); COGNITIVE SKILLS ($F=0.771$, $p=0.510$). Results from a Tukey test on the variable MANUAL SKILLS indicated that the group mean differences for age-sex interaction effects (at $p < 0.05$) were between the following sets of groups:

- i) 15-16 year old males and 11-18 year old females/11-12 year old males. Results indicated that 15-16 year old males perceived that manual driving skills were easier to learn than the other groups.
- ii) 13-14 year old males and 11-16 year old females. Results indicated that 11-16 year old females perceived manual driving skills as more difficult to learn than did 13-14 year old males.
- iii) 17-18 year old males and 11-12/15-6 year old females. Results indicated that 17-18 year old males perceived manual driving skills as easier to learn than 11-12/15-16 year old females.
- iv) 11-12 year old males and 15-16 year old females. Results indicated that 11-12 year old males perceived manual driving skills as more difficult to learn than do 15-16 year old females.

5) ATTITUDES TOWARDS DRINK-DRIVING.

a) By Age.

Summary Of The Discriminant Function Analysis.

A direct discriminant function analysis was performed to discriminate between subjects of ages 11-18 on a set of 'attitudes towards drink-driving' variables. The variables included in the analysis were as follows:

MOSTPDD	- beliefs about the prevalence of drink-driving.
DIMPROV	- attitudes towards the argument that alcohol improves driving performance.
MOSTYPDD	- attitudes about the prevalence of drink-driving among young people.
PARENTDD	- whether their parents disapproved of drink-driving.
OVERLL	- attitudes towards the belief that it is safe to drink over the legal limit and drive.
OKDD	- attitudes towards the safety of driving after having had a 'few' drinks.
TV	- exposure to media drink-driving campaigns.
MEGADD	- the rated seriousness of drink-driving as an offence.
DDLL	- attitudes towards drink-driving (over the legal limit) and the associated level of danger.
HOLD	- the importance of peer faith in their ability to hold their drink when driving.
STRICT	- attitudes towards imposing stricter penalties for drink-driving.
DDACCID	- whether subjects believed that people should not drink and drive in case it resulted in an accident.
BETTER	- beliefs about young peoples' driving skills after alcohol compared to older drivers.
ALIFT	- whether subjects would be prepared to accept a lift from a driver who had drunk over the legal limit.
MDDRINKS	- whether subjects drink alcohol with their parents.
PALSD	- whether subjects drink alcohol with their friends.
OFTEND	- the frequency with which subjects drink alcohol.
CAUGHT	- whether subjects believed that people should not drink and drive in case they get caught by the police.

Full details of the variables and their question format are contained in the Appendix B2. All variables were

measured on five point scales, except for the variables TV, MDDRINKS and PALSD.

On the basis of the variables included in the analysis it was possible to significantly discriminate between the age groups. In the interpretation of the results, only standardised canonical discriminant function coefficients of over 0.50 will be considered.

As detailed in Table 14d in Appendix B3, it can be seen that the discriminating function was significant. The chi-square value of the first discriminant function was 305.01 (degrees of freedom = 51), $p < 0.0001$. After the removal of the first function there was not enough significant discriminating power left, with a chi-square of only 43.637 (degrees of freedom = 32), $p = 0.0823$.

**Table 14a. Summary Of The Discriminant Function Analysis
On Age By 'Attitudes Towards Drink-Driving'.**

Age Groups(n)	Group Centroids			Variable Labels	Rotated Discriminant Function Coefficients		
	F1	F2	F3		F1	F2	F3
1(107)	-0.243	-0.301	-0.035	MOSTPDD*	-0.195	-0.045	0.249
2(163)	-0.334	0.293	0.125	DIMPROV	-0.010	-0.056	0.145
3(148)	0.512	0.072	-0.232	MOSTYPDD*	-0.213	0.222	0.122
4(100)	1.117	-0.264	0.177	PARENTDD	0.031	-0.312	0.128
				OVERLL	0.006	0.052	0.339
				OKDD*	-0.167	0.412	-0.506
				TV	0.061	0.055	-0.339
				MEGADD	0.057	-0.245	0.139
				DDL*	0.209	0.214	0.369
				HOLD*	-0.108	0.226	0.266
				STRICT	-0.015	-0.261	-0.509
				DDACCID	0.140	0.236	0.022
				BETTER	-0.056	0.243	0.065
				ALIFT*	0.139	0.262	0.087
				PALSD*	0.777	0.411	-0.065
				OFTEND*	0.171	-0.288	0.119
				CAUGHT*	-0.158	0.243	-0.417

Univariate Level of Significance:

* = $p < 0.05$

As shown in Table 14a above, the first function maximally separates 11-12/13-14 year olds from the 17-18 year olds, with those aged 15-16 years falling between these two groups.

Table 14a shows that function one produced one discriminating variable, PALSD (a dichotomous variables asking whether subjects drank alcohol with their friends).

Results show that for function one, 17-18 year olds had the highest reporting of drinking alcohol with their friends than any other age group. As age increases so does the reports of drinking alcohol with friends.

None of the remaining variables significantly discriminated between any of the the age groups. The means for the variables will be considered to give some indication of what the general attitudes towards drink-driving were with this age range (see Appendix B3 for details).

All age groups had a fairly neutral attitude on the variables MOSTPDD (most people drink and drive), MOSTYPDD (most young people drink and drive), OFTEND (how often subjects reported drinking alcohol: subjects reported drinking alcohol about once every two weeks on average) and CAUGHT (people should not drink and drive in case they get caught by the police).

All age groups had high ratings on the following variables: PARENTDD (whether their parents disapproved of drink-driving: results showed that most people, on average, said that their parents did disapprove), MEGADD (the rated seriousness of drink-driving as an offence: on average subjects rated it as a very serious offence), DDLL (how dangerous it is to drink over the legal limit and then drive: on average subjects rated it as very dangerous), STRICT (whether there should be stricter penalties for those caught drinking and driving: on average subjects thought that the penalties should be stricter), TV (whether subjects had seen anti-drinking and driving campaigns on TV: on average most subjects reported that they had), MDDRINKS (whether subjects drink alcohol with their parents: subjects high ratings on this dichotomous variable indicated that they did) and DDACCID (whether subjects believed that people should not drink and drive in case they had an accident: most people strongly believed that this was the case).

All subjects had fairly low ratings on the following variables: OVERLL (whether it is perceived safe to drink over the legal limit and then drive: on average subjects gave very low ratings for this variable, indicating that they did not think it was safe to drink over the legal limit and drive), OKDD (whether subjects felt that it was safe to drive after a few drinks: subjects' ratings on this variable indicated that they did not think it was safe to do so), HOLD (the importance of peers faith in subjects ability to hold their drink when driving:

subjects did not rate this variable very highly), BETTER (whether or not young people are better at driving after having drunk alcohol than older drivers: subjects' low ratings on this variable indicated that they did not think so), and ALIFT (whether subjects would be prepared to accept a lift from a driver who had drunk over the legal limit: again subjects' low ratings on this variable indicated that they would not).

b) By Sex.

An examination of the means for both sexes from a separate discriminant function analysis showed that none of the variables could be used to significantly discriminate between the sexes (all variables had discriminant function coefficients of below 0.49). The means table for the sexes is contained in Appendix B3.

c) Examination for age-sex interactions.

Analysis of variance tests were conducted on each of the above variables in order to examine for any age-sex interaction effects. Results indicated that there were no significant interaction effects at the $p < 0.05$ level of significance. The F-ratios and levels of significance for each variable are as follows: PARENTDD ($F=0.161$, $p=0.923$); MOSTYPDD ($F=0.622$, $p=0.601$); DIMPROV ($F=1.148$, $p=0.329$); MOSTPDD ($F=0.351$, $p=0.789$); HOLD ($F=0.479$, $p=0.697$); DDLL ($F=0.900$, $p=0.441$); MEGADD ($F=1.650$, $p=0.176$); OKDD ($F=1.096$, $p=0.35$); OVERLL ($F=0.774$, $p=0.509$); TV ($F=0.567$, $p=0.637$); PALSD ($F=0.273$, $p=0.845$); MDDRINKS ($F=0.359$, $p=0.783$); CAUGHT ($F=0.156$, $p=0.926$); STRICT ($F=1.669$, $p=0.172$); DDACCID ($F=0.994$, $p=0.395$); BETTER ($F=0.542$, $p=0.654$); ALIFT ($F=1.205$, $p=0.307$); OFTEND ($F=0.239$, $p=0.870$).

3.5 SUMMARY OF THE NON-DRIVER QUESTIONNAIRE RESULTS.

This section presents a brief summary of the Non-Driver Questionnaire results.

Overall, the results indicated that there were a number of significant multivariate dimensions along which the four non-driver age groups, and the sexes, could be discriminated.

Results indicated that in terms of risk-taking and driving there were two main dimensions along which the age groups could be discriminated. Generally, as age increased the perceived likelihood of detection for driving offences and the perceived seriousness of offences decreases. The age groups could not be discriminated in terms of their attitudes towards offenders, their perceptions of the dangerousness of driving offences, and their attitudes towards the acceptability of driving offences. The sexes could only be discriminated by the variable 'offence acceptability': males rated the acceptability of driving offences higher than did females.

Results also showed that there were two dimensions related to learning to drive, along which the age groups could be discriminated: as age increases young people place more importance on the image of a car, and the less importance on the influence of parents and peers in the decision to learn to drive. In terms of discrimination between the sexes, results indicated that males rated the desirability of having a saloon or sports car higher than did females.

In terms of accident attribution, results indicated that as age increases young people place less importance on external factors, up until the ages 17-18 years when there is a sudden increase. In terms of sex differences, it was found that males perceived the hazardousness of road conditions (e.g., rain, snow fog) lower than females did.

There were several attitudinal dimensions in relation to skill and risk-taking behaviours, along which the age groups could be discriminated. Results indicated that as age increases so does a desire to drive in a style that involves risk-taking and fast driving, a negative attitude towards the police, an increased perception of self-skill, and a decreased perception of the difficulty in mastering cognitive driving skills. The sexes could not be discriminated along any of these dimensions.

In terms of alcohol and driving, results indicated that as age increased so did the level of reported alcohol consumption with friends. Overall, subjects of all ages

tended to hold socially responsible attitudes towards drink-driving. The sexes could not be discriminated along any dimensions relating to alcohol and driving.

In summary, the results from the Non-Driver Questionnaire indicate that as age increases certain negative perceptions in relation to driving offences, a positive attitude towards risk-taking and a high perception of future driving skills increases. Generally, males rated the acceptability of offences higher, and the hazardousness of certain driving conditions lower, and the desirability of owning a fast car higher than females did.

CHAPTER 4.

DRIVER
QUESTIONNAIRE RESULTS.

CHAPTER 4.

DRIVER QUESTIONNAIRE RESULTS.

4.0 INTRODUCTION.

The Driver Results Chapter has been divided up into four sections: (1) details of sample characteristics, (2) creation of meta-variables through reliability and principal components analyses, and (3) results of discriminant function analyses on Driver Questionnaire variables and meta-variables, and (4) results of repeated measures analysis of variance tests on Driver Questionnaire skill rating variables.

In all analyses on the Driver Questionnaire data, subjects have been divided into the following age groups: Group 1 = 17 years old, Group 2 = 18 years old, and Group 3 = 19 years old. All subjects in these groups were fully qualified drivers (i.e., they all held full British driving licences).

As will be seen from the results in Section 3, there were very few significant discriminant functions for the age groups. It can be suggested that this lack of age group differences could be expected due to the very limited age range within this data set (from 17-19 years of age). Where significant results have been found for the 'sex of the driver' these have been reported.

4.1 OVERVIEW.

SECTION 1: Sample Characteristics.

Section 1 contains a breakdown of the driver sample by age and sex, and is presented in a summary table. Further information is presented on driving experience and exposure, and accident and offence histories.

SECTION 2: Creation Of Driving Offence, Behaviour and Attitude Meta-Variables.

This section contains information on the creation of eleven meta-variables from the results of reliability analyses and principal component analyses. The meta-variables are detailed in Section 2 within their respective areas of road user behaviour, as shown below.

1) Driving Offences.

Reliability analyses were conducted on offence-related variables to produce two driving offence meta-variables, which were used in subsequent analyses.

2) Attitudes Towards The Police.

One reliability analysis was carried out on a set of variables to produce a meta-variable relating to 'attitudes towards the police'. This meta-variable was used in a subsequent analysis.

3) Comparative Driving Speed.

One reliability analysis was conducted on a set of variables to produce a scale representing subjects' perceptions of how fast they would drive compared to other drivers on certain types of roads. This scale was used in a later analysis.

4) General Attitudes To Driving.

One principal components analysis was conducted on a set of 20 variables which produced seven factors relating to risk motivation, reckless driving, driving confidence, drink-driving, the perceived likelihood of an accident, accident anxiety, and attitudes towards other drivers. These factors were used in subsequent analyses.

SECTION 3: Examination of Group Differences Across Driving Behaviour, Accident and Offence-Related Variables.

Discriminant function analyses were undertaken on the following eight driving behaviour, accident and offence-related areas by age and sex.

1) Contravention Of Speed Limits.

A discriminant function analysis was conducted on a set of five variables relating to the contravention of speed limits.

2) Perceived Importance Of Car Features.

A discriminant function analysis was conducted on a set of seven variables relating to the perceived importance of different factors in a car (e.g. size, cost economy).

3) Reported Driving Behaviours.

A discriminant function analysis was conducted on a set of seven variables measuring subjects' reported driving behaviours (e.g. speeding, overtaking behaviours).

4) Attitudes Towards Risk and Driving.

A discriminant function analysis was conducted on a set of six meta-variables relating to attitudes towards risk-taking and driving.

5) The Perceived Likelihood Of An Accident While Undertaking Certain Driving Behaviours and Manoeuvres.

A discriminant function analysis was conducted on a set of eight variables relating to the perceived likelihood of an accident while undertaking certain driving behaviours and manoeuvres.

6) The Perceived Seriousness Of Accident-Involvement While Engaging In Certain Driving Behaviours.

A discriminant function analysis was conducted on a set of eight variables relating to the perceived seriousness of accident-involvement while engaging in certain driving behaviours.

7) The Perceived Seriousness Of Driving Offences, Likelihood Of Detection, and Attitudes Towards The Police.

A discriminant function analysis was conducted on a set of variables relating to the perceived seriousness of driving offences, likelihood of detection, and attitudes towards the police.

8) Attitudes Towards Drink-Driving.

A discriminant function analysis was conducted on a set of 13 variables measuring subjects' attitudes towards drink-driving.

SECTION 4: Examination of Group Differences Across Ratings of Skill For 'Self' and 'Others'.

Repeated measures analysis of variance tests were conducted on a set of eight variables to provide a measurement of group differences across ratings of skill for 'self' and 'others'.

4.2 DRIVER RESULTS SECTION 1: SAMPLE CHARACTERISTICS.

The Driver Sample.

1) Age and Sex Characteristics.

The table below presents some descriptive statistics on the sample of drivers who were included in the analysis of data from the Driver Questionnaire phase of the study.

A total of 125 drivers were included in the analysis of results. As can be seen from the table below, this total sample size of 125 included 1 subject whose age, but not sex, was known. Fourteen subjects, out of an original sample size of 139 drivers, were excluded from the analysis of results for failure to complete the second Driver Questionnaire.

Table 15. Breakdown Of The Driver Sample By Age and Sex.

SEX	AGE GROUPS			Not Defined	Total
	17	18	19		
MALE	30	21	14	0	65
FEMALE	25	13	21	0	59
Not Defined	0	0	1	0	1
Total	55	34	36	0	125

2) Driving Experience and Exposure.

a) Experience.

All of the 125 young people who participated in the Driver Questionnaires I and II, held full British driving licences. However, statistics on the driving experience of this sample of young drivers are unreliable as there was a high level of missing data (45.6 %). Due to this large amount of missing data, the variable 'driving experience' (as measured by the number of months that subjects had held a full British licence) will not be included in further analyses on data from the Driver Questionnaires, as it is based on a reduced and hence possibly non-representative sub-sample of drivers. However, it ought to be noted that when analyses were applied to the driving experience data that was available, results indicated a significant correlation between 'experience' and age (Pearson correlation: $r = .634$, $p < 0.001$), although this correlation is not as high as might be expected with a much wider age-range of subjects.

Despite the unreliability of the data on driving experience, due also to the restricted age-range of subjects (17-19 years), and their overall restricted driving experience (a total population mean of 10.6 months driving experience), it would not necessarily be expected that the variable 'experience' would assist greatly in the interpretation of further analyses on the Driver Questionnaire data. Additionally, where it is more usual to measure driving experience in terms of years, the measurement in the present study had to be reduced to 'months', to allow measurement with such a young sample of drivers. Although research in recent years has sometimes included the variable 'driving experience' (Brown and Groeger, 1989), this is usually when making comparisons between young, middle-age and/or older drivers, where each age group is comprised of a much wider age range (e.g., 17-25 years), than found in the present study. It makes less sense to examine the driving experience of subjects of consecutive years (17, 18 and 19 years) right at the beginning of their driving careers, than it does to examine driving experience when analysing for between-group variability with subjects spanning the entire spectrum of driving experience: the mean driving experience for this sample of young drivers was less than 1 year. Driving experience may not be as reliable an indicator of performance among young drivers as among older drivers, for several reasons: the driving experience of very young drivers can be expected to be contaminated

by many extraneous variables, such as the frequency of driving since passing the test, how soon they applied for a full licence since passing the test, the number of times the test was taken, and the length of time spent learning. The frequency with which young drivers obtain on-the-road driving experience, may be very low if they do not own their own car (and only 37% of the drivers in this sample did).

b) Exposure.

Driving exposure was measured by two potential indicators: the number of hours driven per week, and the number of miles driven per week. Results revealed that 27.2% of the data on 'hours driven per week' and 63.2% of data on 'miles per week' was missing. Pearson correlation tests indicated that there were low, non-significant correlations between age and (a) 'hours driven per week' ($r=.0021$, $p=.492$) and (b) 'miles driven per week' ($r=.1516$, $p=.157$). These high levels of missing data raised questions about representativeness and reliability and so precluded the inclusion of these measures in further analyses of the Driver Questionnaire data. However, as can be seen from the exposure data that are available, there are non-significant correlations with age, and as such the inclusion of these exposure variables could have been expected to contribute little to the interpretation of further analyses.

c) Accident and Offence Histories.

Data from this study on the accident and incident histories of subjects was not included in later analyses, due to the suspected low validity and unreliability of the data. Some doubt was cast on the data due to the high number of self-reported accidents (mean = 1.21) and offences (mean = 0.99). The results from Pearson correlation tests revealed very little variation between the age groups in terms of both both driver accident ($r=.1105$, $p=0.115$) and offence histories ($r=.1084$, $p=.120$). For these reasons the author felt that it would not add to the quality of further analyses to include these variables.

4.3 DRIVER RESULTS SECTION 2:

THE CREATION OF DRIVING OFFENCE, BEHAVIOUR AND ATTITUDE-RELATED META-VARIABLES.

Eleven meta-variables were created. These meta-variables were formed from the results of principle components analyses and reliability analyses. The results below are divided into different areas of road user behaviour: Driving Offences, Attitudes Towards The Police, Comparative Driving Speed, and General Attitudes Towards Driving. The meta-variables that have been produced are described within each relevant section, and their origins from reliability or principal components analyses examined. Full details of the variables and results from the analyses are held in Appendices C1 and C2.

1) DRIVING OFFENCES.

Two meta-variables relating to driving offences were produced. Each meta-variable label and its' meaning are given below. A comprehensive list of the component variables within each meta-variable, their measurement and meanings are presented in Appendix C2. All component variables were measured on five-point scales.

PERCEIVED SERIOUSNESS OF OFFENCES - The meta-variable SERIOUSNESS OF OFFENCES is comprised of 15 variables concerning subjects' ratings of how serious certain driving behaviours are. The behaviours included behaviours and offences such as drink-driving, speeding, dangerous overtaking and driving without a licence.

PERCEIVED LIKELIHOOD OF DETECTION - This meta-variable is comprised of 12 variables concerning subjects' ratings of the perceived likelihood of detection for certain driving offences and behaviours. The behaviours and offences included drink-driving, speeding, dangerous overtaking and driving without a licence.

Table 16a. Summary Of The Reliability Analyses
Conducted On The 'Driving Offence'
Meta-Variables.

META-VARIABLE	N.of cases	N.of variables	Cronbach's ALPHA
P. SERIOUSNESS OF OFFENCES	115	15	0.814
P. LIKELIHOOD OF DETECTION	107	12	0.760

2) ATTITUDES TOWARDS THE POLICE.

One meta-variable relating to drivers' attitudes towards the police was produced. The meta-variable label and its' meaning are given below, followed by a summary of the reliability analysis. A comprehensive list of the component variables, their measurement and meanings are presented in Appendix C2.

ATTITUDES TOWARDS THE POLICE - This meta-variable is comprised of three variables concerning subjects' ratings of their attitudes towards the police. The attitudes included whether they liked the police, whether they felt that the police do a good job and whether there should be more traffic police. All variables were measured on five-point scales.

Table 17a Summary Of The Reliability Analysis Conducted On 'Attitudes Towards The Police' Variables.

META-VARIABLE	N.of cases	N.of variables	Cronbach's ALPHA
ATTITUDES TOWARDS THE POLICE	125	3	0.700

3) COMPARATIVE DRIVING SPEED.

One meta-variable relating to drivers' ratings of how fast they would drive compared to other drivers on certain types of roads was produced. The meta-variable label and its' meaning are given below, with a summary of the reliability analysis. A list of the component variables, their measurement and meanings are presented in Appendix C2.

COMPARATIVE DRIVING SPEED - This meta-variable is comprised of 11 variables concerning subjects' ratings of how fast they would drive compared to other drivers on certain types of roads and under certain conditions (e.g. heavy/light traffic, at night/day, on country lanes/motorways). All variables were measured on five-point scales.

Table 18a. Summary Of The Reliability Analysis On 'Comparative Driving Speed' Variables.

META-VARIABLE	N.of cases	N. of variables	Cronbach's ALPHA
COMPARATIVE DRIVING SPEED	91	11	0.900

4) GENERAL ATTITUDES TO DRIVING.

Seven meta-variables relating to subjects' attitudes towards driving, confidence and skill were produced. Each meta-variable label and its meaning are given below, followed by details on the principal components analysis that created them. A comprehensive list of the component variables within each meta-variable, their measurement and meanings are presented in Appendix C2. All component variables were measured on five point scales.

RISK MOTIVATION - This meta-variable is made up of four variables relating to the enjoyment of fast driving, perception of self-driving skill and accident avoidance, and the perceived likelihood of detection for drink-driving.

RECKLESS DRIVING - This meta-variable is made up of three variables relating to the enjoyment of racing on public roads, aggressive driving and speed.

DRIVING CONFIDENCE - This meta-variable is made up of five variables relating to confidence in driving in terms of overtaking rate, perceived confidence in relation to others, controlled braking and confidence in hazardous conditions.

ATTITUDES TOWARDS DRINK-DRIVING - This meta-variable is made up of two variables relating to attitudes towards drink-driving and offenders.

PERCEIVED LIKELIHOOD OF AN ACCIDENT - This meta-variable is made up of two variables relating to the perceived likelihood of having an accident in the coming year.

ATTITUDES TOWARDS OTHER DRIVERS - This meta-variable is made up of two variables relating to a superior and aggressive attitude towards other road users.

ACCIDENT-ANXIETY - This meta-variable is made up of two variables relating to the degree of anxiety about having an accident in the forthcoming year.

**Table 19a. Results Of The Principal Components Analysis
On The 'General Attitudes To Driving'
Variables.**

Factor 1: RISK MOTIVATION.

<u>Variable</u>	<u>Loading.</u>	Eigenvalue = 4.11	% of Variance = 20.5
LESSL	0.858		
SUPERIOR	0.779		
IENJOY	0.452		
DDONE	0.444		

Variable Label.

- LESSL - attitude towards the statement 'I am less likely to have an accident than other drivers'.
- SUPERIOR - attitude towards the statement 'my driving is superior to that of most other drivers'.
- IENJOY - attitude towards the statement 'I enjoy driving fast on winding country lanes'.
- DDONE - attitude towards the statement 'the chances of being caught for drink-driving are not very high'.

Factor 2: RECKLESS DRIVING.

<u>Variable</u>	<u>Loading.</u>	Eigenvalue = 2.37	% of Variance = 11.8
ACCEL	0.747		
BUSY	0.656		
FNRACE	0.637		

Variable Label.

- ACCEL - attitude towards the statement 'I would rather accelerate than brake to get out of a difficult situation'.
- BUSY - attitude towards the statement 'the only way to get through busy traffic is to be aggressive'.
- FNRACE - attitude towards the statement 'it is fun to race with other drivers'.

Factor 3: DRIVING CONFIDENCE.

<u>Variable</u>	<u>Loading.</u>	Eigenvalue = 1.62
NERV	0.736	% of Variance = 8.1
BRAKE	0.726	
DCONF	0.582	
GREASY	-0.496	
MORE	0.425	

Variable Label.

- NERV - attitude towards the statement 'I am nervous when overtaking other cars'.
- BRAKE - attitude towards the statement 'I find it difficult to stop in time when cars in front brake suddenly.
- DCONF - attitude towards the statement 'most other drivers appear more confident than I feel'.
- GREASY - attitude towards the statement 'I am confident driving my car on wet greasy roads' (this variable was reversed).
- MORE - attitude towards the statement 'I am overtaken more than I overtake'.

Factor 4: ACCIDENT-ANXIETY.

<u>Variable</u>	<u>Loading.</u>	Eigenvalue = 1.51
MINOR	0.823	% of Variance = 7.6
WORRY	-0.727	

Variable Label.

- MINOR - attitude towards the statement 'I never worry about having a minor accident.' (this variable was reversed).
- WORRY - attitude towards the statement 'the possibility of having a serious accident worries me'.

Factor 5: ATTITUDES TOWARDS DRINK-DRIVING.

<u>Variable</u>	<u>Loading.</u>	Eigenvalue = 1.28
SORRY	0.859	% of Variance = 6.00
SHORT	0.775	

Variable Label.

- SORRY - attitude towards the statement 'I feel sorry for people who get 'done' by the police when they were just over the drink-driving limit'.
SHORT - attitude towards the statement 'it is O.K. to drink over the limit if you are only driving a short distance'.

Factor 6: PERCEIVED LIKELIHOOD OF AN ACCIDENT.

<u>Variable</u>	<u>Loading.</u>	Eigenvalue = 1.18
SERACC	0.849	% of Variance = 5.9
LIKELY	0.782	

Variable Label.

- SERACC - attitude towards the statement 'I am likely to have a serious accident in the coming year'.
LIKELY - attitude towards the statement 'I am likely to have a minor accident in the coming year'.

Factor 7: ATTITUDES TOWARDS OTHER DRIVERS.

<u>Variable</u>	<u>Loading.</u>	Eigenvalue = 1.06
ANNOY	0.867	% of Variance = 5.3
INFERIOR	0.637	

Variable Label.

- ANNOY - attitude towards the statement 'it annoys me to be overtaken'.
INFERIOR - attitude towards the statement 'inferior cars get in the way when I am driving'.

To be included in a factor each variable had to have a factor score of 0.4 or above (Tabachnick and Fidell, 1989). Full details of the analysis and descriptions of the original variables are contained in Appendices C1 and C2.

4.4 DRIVER RESULTS SECTION 3:

THE EXAMINATION OF GROUP DIFFERENCES ACROSS DRIVING BEHAVIOUR, ACCIDENT AND OFFENCE-RELATED VARIABLES.

The summaries of eight discriminant function analyses are presented below. Due to the large number of analyses presented in this thesis, only summary tables are presented in the results sections for the sake of brevity (with full details provided in Appendix C3). The discriminant function analyses are on age and sex by:

- 1) Contravention of speed limits.
- 2) The perceived importance of car features.
- 3) Reported driving behaviours.
- 4) Attitudes towards risk-taking and driving.
- 5) Perceived likelihood of an accident when engaging in certain driving behaviours.
- 6) Perceived severity of an accident when engaging in certain driving behaviours.
- 7) Attitudes towards driving offences and the police.
- 8) Attitudes towards drink-driving.

In each section the analysis by age is considered first, followed by a review of the analysis by sex. Discriminant function analysis summary tables are presented for each analysis and the results discussed if the analysis produced some significant discriminating variables (with full details held in Appendix C3). If the analysis did not produce any significant discriminating variables, then a limited summary of the analysis is presented, with the group means and univariate statistics presented in Appendix C3. A brief examination is also made for any age-sex interaction effects through analysis of variance tests.

Full details of the significant discriminant function analyses, including group means, standard deviations, univariate F-Tests and degrees of freedom, canonical discriminant functions, structure matrix, pooled within-groups correlation matrix and classification matrix are contained within Appendix C3.

The age groups used in the analyses were as follows: age group 1 = 17 years, age group 2 = 18 years, age group 3 = 19 years.

1) REPORTED CONTRAVENTION OF SPEED LIMITS.

a) By Age.

Summary Of The Discriminant Function Analysis:

A direct discriminant function analysis was performed to discriminate between subjects of ages 17, 18 and 19 years on a set of variables measuring subjects' reported contravention of speed limits. The variables measuring subjects' reported contravention of speed limits are as follows: Subjects were asked "How often do you break the following speed limits" 30mph (LIMIT30); 40mph (LIMIT40); 50mph (LIMIT50); 60mph (LIMIT60); 70mph (LIMIT70), and were required answer on a five point scale ranging from 1 (Never) to 5 (Always).

Results from the discriminant function analyses showed that neither of the discriminant functions were significant. The significance level for the first function was $p=0.1584$, with a chi-square of 14.332 (degrees of freedom = 10). The means and univariate analyses are presented in Appendix C3.

As Table 20b in Appendix C3 shows, only two out of the five variables had significant univariate F-ratios. The significant variables referred to the contravention of 40mph and 50mph speed limits. By considering the means in Table 20a in Appendix C3, it can be seen that as age increases so does the reported contravention of 30, 40, 50 and 70mph speed limits. The reported contravention of the 60mph speed limit increases between the ages 17 and 18 years, but declines very slightly again at the age of 19 years. An examination of the group means for each variable also indicates that for each age group the reported frequency of contravention decreases as the speed limit increases. The only instance in which neither an increase nor a decrease in reported frequency of contravention is found, is for group 2 (18 year olds) between the variables 50 and 60mph where the group mean stayed constant at 2.68.

Overall, the means indicated that all age groups contravened 30mph and 40mph speed limits fairly often, but occasionally/rarely contravened 50, 60 and 70 mph speed limits (as shown in Table 20a in Appendix C3).

b) By Sex.

A direct discriminant function analysis was also performed on sex by reported contravention of speed limits. On the

basis of the variables included in the analysis it was possible to significantly discriminate between the sexes. In the interpretation of the results, only standardized canonical discriminant function coefficients of over 0.50 will be considered.

Table 20c. Summary of Discriminant Function Analysis On Sex By Contravention Of Speed Limits.

Group Centroids		Variable	Discriminant Function Coefficients
Sex	F1	Labels	F1
Males	0.406	LIMIT30*	0.192
Females	-0.453	LIMIT40*	-0.253
		LIMIT50*	0.685
		LIMIT60*	0.014
		LIMIT70*	0.443

Univariate Level of Significance:* =p< 0.05

From Table 20f in Appendix C3, it can be seen that the discriminating function was significant. The chi-square value of the discriminant function was 18.450 (degrees of freedom = 5), p=0.0024. Table 20c shows that the discriminating function produced one discriminating variable, LIMIT50 (the reported frequency of contravening 50mph speed limits).

Results show that on the variable LIMIT50 males reported the highest frequency of contravening 50mph speed limits (detailed in Appendix C3). An examination of the group means for all variables, indicates that males reported higher rates of contravention of all speed limits ranging from 30mph up to 70mph.

An examination of the group means for each variable also indicates that for each group the reported frequency of contravention decreases as the speed limit increases (as shown in Table 20d in Appendix C3).

c) Examination for age-sex interactions.

Analysis of variance tests were conducted on each of the above variables in order to examine for any age-sex interaction effects. Results indicated that there were no significant interaction effects at the p<0.05 level of significance. The F-ratios and levels of significance for each variable are as follows: LIMIT 30 (F=0.151, p=0.860); LIMIT 40 (F=0.092, P=0.912); LIMIT 50 (F=0.528, p=0.592); LIMIT 60 (F=2.244, p=0.111); and LIMIT 70 (F=0.990, p=0.375).

2) THE PERCEIVED IMPORTANCE OF CAR FEATURES.

a) By Age.

Summary Of The Discriminant Function Analysis:

A direct discriminant function analysis was performed to discriminate between subjects of ages 17, 18 and 19 years on a set of variables measuring the perceived importance of different factors in a car (e.g. size, performance, appearance). The variables measuring the importance of different factors when buying a car were as follows: the manufacturer (MANUFACTURER); fuel economy (FUEL); performance (PERFORMANCE); appearance (APPEARANCE); safety features (SAFETY); cost (COST); size (SIZE). Subjects were asked to rate how important each factor was to them in a car using the scale (1) 'not at all important' to (5) 'extremely important'.

Results from the discriminant function analyses showed that neither of the discriminant functions were significant. The significance level for the first function was $p = 0.2230$, with a chi-square of 17.654 (degrees of freedom = 14). Only the means and univariate analyses are presented in Appendix C3.

As Table 21b in Appendix C3 shows, none of the the seven variables had a significant univariate F-ratio. By considering the means in Table 21a (Appendix C3), it can be seen that fuel economy, performance, appearance, safety features and cost are all fairly important factors to all the age groups. The manufacturer and size of the car were rated as less important by all age groups.

b) By Sex

A direct discriminant function analysis was also performed on sex by factors considered important in a car. On the basis of the variables included in the analysis it was possible to significantly discriminate between the sexes. In the interpretation of the results, only standardized canonical discriminant function coefficients of over 0.50 will be considered.

From Table 21f in Appendix C3, it can be seen that the discriminating function was significant. The chi-square value of the discriminant function was 16.497 (degrees of freedom = 7), $p = 0.0209$.

Table 21c shows that the discriminating function produced one discriminating variable, SAFETY (the importance of safety features in a car). Results show that on the variable SAFETY females reported safety features in a car

to be more important than did males (although the means suggest that safety features in a car are an important factor for both groups).

Table 21c. Summary of Discriminant Function Analysis On Sex By Factors Considered important In A car.

Sex	Group Centroids F1	Variable Labels	Discriminant Function Coefficients F1
Males	-0.388	SAFETY*	0.638
Females	0.416	FUEL*	0.256
		SIZE*	0.458
		APPEARANCE	-0.358
		MANUFACTURER	-0.172
		COST	-0.007
		PERFORMANCE	0.108

Univariate Level of Significance:* = $p < 0.05$

The variable SIZE (the size of a car) had a discriminant function coefficient of 0.458. An examination of the means indicates that the size of a car is more important to females than to males (although the means suggest that size is a very important factor for both groups).

An examination of the group means for the remaining variables (Table 21d, Appendix C3), indicates that the manufacturer is of only medium importance to both groups, but that fuel economy, performance, appearance and cost are all highly rated factors in terms of importance when buying a car.

c) Examination for age-sex interactions.

Analysis of variance tests were conducted on each of the above variables in order to examine for any age-sex interaction effects. Results indicated that there were no significant interaction effects at the $p < 0.05$ level of significance. The F-ratios and levels of significance for each variable are as follows: MANUFACTURER (F=0.661, $p=0.518$); FUEL (F=0.983, $p=0.377$); PERFORMANCE (F=0.263, $p=0.769$); APPEARANCE (F=1.758, $p=0.177$); SAFETY (F=0.938, $p=0.395$); COST (F=0.111, $p=0.895$); and SIZE (F=0.224, $p=0.800$).

3) REPORTED DRIVING BEHAVIOURS.

a) By Age

Summary Of The Discriminant Function Analysis:

A direct discriminant function analysis was performed to discriminate between subjects of ages 17, 18 and 19 years on a set of variables measuring subjects' reported driving behaviours. The variables measuring subjects' reported behaviours were as follows: the fastest speed at which subjects would be prepared to drive on a straight main road with a single lane in each direction with a 60mph speed limit (60MPH SPEED LIMIT); the number of car lengths which subjects would leave between their car and the one they are following when travelling at 45mph (GAP AT 45MPH); the fastest speed at which subjects would be prepared to drive on a winding country lane with a 60mph speed limit (60MPH COUNTRY LANE); the likelihood of overtaking at 40mph in the face of an oncoming car 400 yards away (OVERTAKING AT 40MPH); the likelihood of overtaking a car, even though it would mean cutting in front of it closely if an oncoming car were to appear (CUT-IN FRONT); the frequency with which subjects overtake on the left on motorways (OVERTAKE ON THE LEFT); the likelihood of overtaking a car at 40mph 350 yards away from a right hand bend (OVERTAKE NEAR A BEND). Full details of these variables are given in Appendix C2.

Results from the discriminant function analysis showed that neither of the discriminant functions were significant. The significance level for the first function was $p=0.0750$, with a chi-square of 22.131 (degrees of freedom = 14). Only the means and univariate analyses are presented in Appendix C3.

As Table 22b in Appendix C3 shows, only one out of the seven variables had a significant univariate F-ratio. The significant variable referred to the frequency with which subjects overtook cars on the left on motorways. By considering the means in Table 22a, Appendix C3, it can be seen that the reported rate of overtaking on the inside on motorways decreased after the age 17 years. There was little difference between 18 and 19 year olds on this variable. The 17 year old subjects reported overtaking on the inside on motorways most of the time, whereas 18 and 19 year olds reported occasionally doing so.

b) By Sex

A direct discriminant function analysis was also performed on sex by 'reported driving behaviours'.

Table 22c. Summary of Discriminant Function Analysis On Sex By Reported Driving Behaviours.

Sex	Group Centroids F1	Variable Labels	Discriminant Function Coefficients F1
Males	-0.545	60MPH SPEED LIMIT*	0.321
Females	0.494	GAP AT 45MPH	0.167
		60MPH ON A COUNTRY LANE*	0.617
		OVERTAKE AT 40MPH	0.043
		CUT-IN FRONT*	0.181
		OVERTAKE ON THE LEFT*	-0.356
		OVERTAKE NEAR A BEND	0.064

Univariate Level of Significance:* = < 0.05

On the basis of the variables included in the analysis it was possible to significantly discriminate between the sexes. In the interpretation of the results, only standardized canonical discriminant function coefficients of over 0.50 will be considered.

From Table 22f in Appendix C3, it can be seen that the discriminating function was significant. The chi-square value of the discriminant function was 28.153 (degrees of freedom = 7), p=0.0002.

Table 22c shows that the discriminating function produced one discriminating variable, 60MPH ON A COUNTRY LANE (the fastest speed that subjects would be prepared to drive at on a winding country lane with a 60mph speed limit).

Results show that on the variable 60 MPH ON A COUNTRY LANE males reported a much higher speed (60mph on average) than did the females (50mph on average). An examination of the group means for all variables (Table 22d, Appendix C3), indicates that males reported driving at higher speeds on country lanes (60MPH ON A COUNTRY LANE), leaving a shorter headway when following a car at 45mph (GAP AT 45MPH), driving faster on a two-lane main road (60MPH SPEED LIMIT), were more likely to overtake in the face of an

oncoming car (OVERTAKE AT 40MPH), were more likely to overtake a car even if it would mean cutting in closely if an oncoming car was to appear (CUT-IN FRONT), overtake a car 350 yards away from a right-hand bend (OVERTAKE NEAR A BEND). Females reported the highest frequency of overtaking on the left on motorways.

An examination of the group means for each variable also indicates that both males and females are prepared to drive above a 60mph speed limit (at about 65mph) on a two-lane main road; both groups would only leave a headway of between 3-4 car lengths between their car and the one in front when travelling at 45mph (the highway code suggests approximately 160 feet which is approximately 12 Ford Escort lengths); that both groups would keep within a 60mph speed limit on country lanes; both groups would be unlikely to overtake a car at 40mph in the face of an oncoming car 400 yards away; both groups would be unlikely to overtake a car if it would mean cutting-in closely if an oncoming car were to appear; women report frequently overtaking on the left on motorways while males report only occasionally doing so; both groups report being unlikely to overtake a car at 40mph when 350 yards away from an approaching right-hand bend.

c) Examination for age-sex interactions.

Analysis of variance tests were conducted on each of the above variables in order to examine for any age-sex interaction effects. Results indicated that there were no significant interaction effects at the $p < 0.05$ level of significance. The F-ratios and levels of significance for each variable are as follows: 60MPH SPEED LIMIT ($F=1.971$, $p=0.144$); GAP AT 45MPH ($F=2.717$, $p=0.071$); 60MPH ON A COUNTRY LANE ($F=1.794$, $p=0.171$); OVERTAKE AT 40MPH ($F=0.551$, $p=0.578$); CUT-IN FRONT ($F=0.673$, $p=0.513$); OVERTAKE ON THE LEFT ($F=1.680$, $p=0.193$); and OVERTAKE NEAR A BEND ($F=1.023$, $p=0.364$).

4) ATTITUDES TOWARDS RISK-TAKING AND DRIVING.

a) By Age

Summary Of The Discriminant Function Analysis:

A direct discriminant function analysis was performed to discriminate between subjects of ages 17, 18 and 19 years on a set of meta-variables relating to risk and driving behaviour. The meta-variables measuring attitudes towards risk-taking and driving were as follows: attitudes about the enjoyment of racing on public roads, aggressive driving and speed (RECKLESS DRIVING); a meta-variable relating the enjoyment of fast driving, perception of driving skills and accident avoidance and the perceived likelihood of detection for drink-driving (RISK MOTIVATION); drivers' ratings of how fast they would drive compared to other drivers on a range of different types of roads (COMPARATIVE DRIVING SPEED); attitudes towards the offence of drink-driving and its' offenders (ATTITUDES TOWARDS DRINK-DRIVING); ratings on a superior and aggressive attitude towards other road users (ATTITUDES TOWARDS OTHER DRIVERS); confidence in ones' own driving skills on the road (DRIVING CONFIDENCE). Full details of these meta-variables and their composition are given in Appendix C1 and C2.

Table 23a. Summary of Discriminant Function Analysis On Age By Attitudes Towards Risk-Taking and Driving.

Age Groups(n)	Group Centroids		Variable Labels	Rotated Discriminant Function Coefficients	
	F1	F2		F1	F2
1(55)	-0.508	-0.041	1	0.549	0.520
2(34)	0.405	-0.441	2	0.615	-0.716
3(36)	0.292	0.399	3	0.761	0.507
			4	-0.623	-0.276
			5	-0.621	0.702
			6	0.583	0.176

Variable Labels.

- 1 = Risk Motivation
- 2 = Reckless Driving
- 3 = Driving Confidence
- 4 = Attitudes Towards Drink-driving
- 5 = Atitudes Towards Other Drivers
- 6 = Comparative Driving Speed

On the basis of the variables included in the analysis it was possible to significantly discriminate between the age groups. In the interpretation of the results, only standardized canonical discriminant function coefficients of over 0.50 will be considered.

From Table 23d in Appendix C3, it can be seen that the first discriminating function was significant. The chi-square value of the discriminant function was 22.045 (degrees of freedom = 12), $p < 0.0370$.

Table 23a shows that from the first discriminating function all variables were high enough to be considered as discriminating variables. By considering the means in Table 23b (in Appendix C3), it can be seen that as age increases drivers show a higher 'RISK MOTIVATION' (a more positive attitude towards the enjoyment of fast driving, a higher perception of self-skill, and lower perception of the likelihood of detection), perceive themselves as driving faster than other drivers across a range of different road types (COMPARATIVE DRIVING SPEED), have greater confidence in their driving skills on the road (DRIVING CONFIDENCE), and have a more negative attitude towards drink-driving and its' offenders (ATTITUDES TOWARDS DRINK-DRIVING). The variable RECKLESS DRIVING (enjoyment of racing on roads, aggressive driving and speed) shows an increase between ages 17 and 18 years, but a decline again by the age of 19 years, but not to the same baseline level of 17 years. Results would tend to indicate that with a little driving experience (possibly along with greater driving confidence), young people report more enjoyment of what may be considered 'reckless' or 'dangerous driving'. This tends to peak at the age of 18 years and declines at the age of 19 years, but still indicating a positive rating towards reckless driving. Examining the variable ATTITUDES TOWARDS OTHER DRIVERS (a superior and aggressive attitude towards other road users) results indicate that there is a decline in this tendency between the ages 17 to 18 years, but a large increase again by the age 19 years.

b) By Sex

A direct discriminant function analysis was also performed on sex by attitudes towards risk and driving. On the basis of the variables included in the analysis it was possible to significantly discriminate between the sexes. In the interpretation of the results, only standardized canonical discriminant function coefficients of over 0.50 will be considered.

Table 23J. Summary of Discriminant Function Analysis On Sex By Attitudes Towards Risk-Taking And Driving.

Group Centroids		Variable	Discriminant Function Coefficients
Sex	F1	Labels	F1
Males	0.783	1*	0.581
Females	-0.901	2*	0.146
		3*	-0.298
		4	0.148
		5	-0.409
		6*	0.668

Univariate Level of Significance:* = $p < 0.05$

Variable Labels.

- 1 = Risk Motivation
- 2 = Reckless Driving
- 3 = Driving Confidence
- 4 = Attitudes Towards Drink-driving
- 5 = Attitudes Towards Other Drivers
- 6 = Comparative Driving Speed

From Table 23m (in Appendix C3) , it can be seen that the discriminating function was significant. The chi-square value of the discriminant function was 44.03 (degrees of freedom = 6), $p < 0.0000$.

Table 23j shows that the discriminating function produced two discriminating variables, RISK MOTIVATION (attitudes towards fast driving, perception of skill and likelihood of detection for drink-driving), and COMPARATIVE DRIVING SPEED (ratings of how fast subjects think they drive compared to other drivers on a range of different types of road).

Results show that females reported a lower 'RISK MOTIVATION' (discriminant function coefficient of 0.58121) (a more negative attitude towards driving fast, a higher perception of the likelihood of detection for drink-driving and a lower perception of their own skill) than did their male counterparts.

The variable COMPARATIVE DRIVING SPEED had a discriminant function coefficient of 0.66858. An examination of the

means (Table 23k, Appendix C3) indicates that females report driving slower on average than other drivers, compared to their male counterparts who rate their driving as much faster across a range of different types of roads.

An examination of the group means for the remaining variables (see Table 23k, Appendix C3 for full details), indicates that males report more reckless driving behaviours, have a higher level of confidence in their driving skills, and have a more superior and aggressive attitude towards other road users than do young female drivers. Although both males and females have a negative attitude towards the offence of drink-driving and its offenders, it is the females who hold the most negative attitude.

c) Examination for age-sex interactions.

Analysis of variance tests were conducted on each of the above meta-variables in order to examine for any age-sex interaction effects. Results indicated that there were no significant interaction effects at the $p < 0.05$ level of significance. The F-ratios and levels of significance for each variable are as follows: RISK MOTIVATION ($F=0.934$, $p=0.397$); RECKLESS DRIVING ($F=0.763$, $p=0.469$); DRIVING CONFIDENCE ($F=0.802$, $p=0.921$); ATTITUDES TOWARDS DRINK-DRIVING ($F=0.773$, $p=0.464$); ATTITUDES TOWARDS OTHER DRIVERS ($F=0.431$, $p=0.651$); and COMPARATIVE DRIVING SPEED ($F=1.88$, $p=0.158$).

5) THE PERCEIVED LIKELIHOOD OF AN ACCIDENT WHILE UNDERTAKING CERTAIN DRIVING BEHAVIOURS AND MANOEUVRES.

a) By Age

Summary Of The Discriminant Function Analysis:

A direct discriminant function analysis was performed to discriminate between subjects of ages 17, 18 and 19 years on a set of variables relating to the perceived likelihood of an accident while undertaking certain driving behaviours and manoeuvres. The variables measuring the perceived likelihood of an accident related to the following driving behaviours: driving at 45mph along a road which has a 30mph speed limit (45MPH IN A 30 LIMIT); following a car at 45mph with less than eight car lengths between oneself and the car in front (CLOSE-FOLLOWING DISTANCE); overtaking a car which is travelling at 40mph after having followed it for one mile, on a straight stretch of road with an oncoming car 400 yards away (OVERTAKING AT 40MPH); overtaking a car when it would mean having to cut in front of it closely if an oncoming car were to appear (CUT-IN); overtaking on the inside on motorways (OVERTAKE ON THE INSIDE); overtaking a car travelling at 40mph, having followed it for one mile, on a straight stretch of road for 350 yards which terminates in a right-hand bend (OVERTAKE-BEND). Details of the above variables are given in Appendix C2.

Results from the discriminant function analysis showed that neither of the discriminant functions were significant. The significance level for the first function was $p=0.8159$, with a chi-square of 7.596 (degrees of freedom = 12). Only the means and univariate analyses are presented in Appendix C3.

As Table 24b in Appendix C3 shows, none of the six variables had a significant univariate F-ratio. By considering the means in Table 24a (Appendix C3), it can be seen that all age groups perceived the likelihood of an accident through close-following another car to be very low (CLOSE-FOLLOWING DISTANCE), and the perceived likelihood of an accident through driving at 45mph in a 30mph speed limit (45MPH IN A 30 LIMIT) to be fairly low. Results show that 18 year old drivers perceive a lower likelihood of accident-involvement through overtaking on the inside on motorways (OVERTAKE ON INSIDE) than their 17 and 19 year olds counterparts. The 19 year olds rated the likelihood of an accident when overtaking in the face of oncoming traffic as lower than the 17 and 18 year olds. All age groups gave moderate ratings for the likelihood of an accident when overtaking a car if it would mean having

to cut in front of it closely if an oncoming car was to appear (CUT-IN), and moderate to high ratings for overtaking a car when approaching a right hand bend (OVERTAKE-BEND).

b) By Sex

A direct discriminant function analysis was also performed on sex by the perceived likelihood of an accident while undertaking certain driving behaviours and manoeuvres.

On the basis of the variables included in the analysis it was not possible to significantly discriminate between the sexes. The chi-square value of the discriminant function was 10.412 (degrees of freedom = 6), $p=0.1083$.

Univariate analyses show a significant result ($F=8.353$, $p=0.005$) for the variable 45MPH IN A 30 LIMIT (Table 24d, Appendix C2). Females reported a higher likelihood of an accident while speeding at 45mph in a 30mph limit, than did their male counterparts. Both groups gave moderate ratings for the likelihood of an accident when overtaking on the inside on motorways.

An examination of the group means for the remaining variables (Table 24c in Appendix C3), indicates that both males and females perceive a low likelihood of an accident through close-following of another car (CLOSE-FOLLOWING DISTANCE). Both males and females gave moderate to high ratings for the perceived likelihood of an accident on the following variables: OVERTAKING AT 40MPH (overtaking a car which is travelling at 40mph, with oncoming traffic 400 yards away), CUT-IN (overtaking a car when it would mean having to cut in front of it closely if an oncoming car was to appear), and OVERTAKE-BEND (overtaking when approaching a right hand bend).

c) Examination for age-sex interactions.

Analysis of variance tests were conducted on each of the above variables in order to examine for any age-sex interaction effects. Results indicated that there were no significant interaction effect at the $p<0.05$ level of significance. The F-ratios and levels of significance for each variable are as follows: 45MPH IN A 30 LIMIT ($F=0.631$, $p=0.535$); CLOSE-FOLLOWING DISTANCE ($F=0.383$, $p=0.683$); OVERTAKING AT 40MPH ($F=1.337$, $p=0.269$); CUT-IN ($F=1.211$, $p=0.304$); OVERTAKE ON INSIDE ($F=0.477$, $p=0.623$); and OVERTAKE-BEND ($F=0.723$, $p=0.489$).

6) THE PERCEIVED SERIOUSNESS OF ACCIDENT-INVOLVEMENT
WHILE ENGAGING IN CERTAIN DRIVING BEHAVIOURS.

a) By Age

Summary Of The Discriminant Function Analysis:

A direct discriminant function analysis was performed to discriminate between subjects of ages 17, 18 and 19 years on a set of variables relating to the perceived seriousness of accident-involvement while engaging in certain behaviours and manoeuvres. The variables measuring the perceived seriousness of accidents related to the following driving behaviours: driving at 45mph along a road which has a 30mph speed limit (45MPH); following a car at 45mph with less than eight car lengths between oneself and the car in front (GAP); overtaking a car which is travelling at 40mph after having followed it for one mile, on a straight stretch of road with an oncoming car 400 yards away (40MPH); overtaking a car when it would mean having to cut in front of it closely if an oncoming car was to appear (CUTTING-IN); overtaking on the inside on motorways (MOTORWAY-OVERTAKE); overtaking a car travelling at 40mph, having followed it for one mile, on a straight stretch of road for 350 yards which terminates in a right-hand bend (BEND-OVERTAKE). Details of the above variables are given in Appendix C2.

Results from the discriminant function analysis showed that neither of the discriminant functions were significant. The significance level for the first function was $p=0.5654$, with a chi-square of 10.578 (degrees of freedom = 12). Only the means and univariate analyses are presented in Appendix C3.

As Table 25b shows (in Appendix C3), none of the six variables had a significant univariate F-ratio. By considering the means in Table 25a (Appendix C3), it can be seen that all groups rated the seriousness of accident-involvement as high for the following variables: 40MPH (overtaking a car in the face of oncoming traffic); CUTTING-IN (overtaking a car when it would mean having to cut in front of it if an oncoming car was to appear); MOTORWAY-OVERTAKE (overtaking on the inside on motorways); and BEND-OVERTAKE (overtaking a car when approaching a right-hand bend. All age groups rated the seriousness of accident-involvement when driving at 45mph in a 30mph speed limit (45MPH) as moderate, but gave a low rating in terms of the seriousness of accidents through following a car too closely (GAP). The group means show that although there are no significant differences between the age groups on any of the variables, there are some differences

on the variables MOTORWAY-OVERTAKE and BEND-OVERTAKE. The table of means show that the 19 year olds rated the seriousness of accident-involvement when overtaking on the inside on motorways (MOTORWAY-OVERTAKE) and overtaking a car when approaching a right-hand bend (BEND-OVERTAKE) lower than the other two groups.

b) By Sex

A direct discriminant function analysis was also performed on sex by perceived seriousness of accidents through certain driving behaviours and manoeuvres.

On the basis of the variables included in the analysis it was not possible to significantly discriminate between the sexes. The chi-square value of the discriminant function was 8.739 (degrees of freedom = 6), $p=0.1888$.

An examination of the group means for the variables (Table 25c in Appendix C3) indicates that both groups perceive a low level of seriousness for accident-involvement arising from close-following another car, a moderate level of seriousness for driving at 45mph in a 30mph speed limit, and overtaking a car when it would mean having to cut in closely if a an oncoming car was to appear. Both groups perceived a high level of seriousness for accident-involvement arising from overtaking when approaching a right-hand bend, overtaking on the inside on motorways, and overtaking in the face of oncoming traffic.

A further examination of the group means indicates that females perceive a lower level of seriousness of accident-involvement on the following variables than did their male counterparts: overtaking a car which is travelling at 40mph on a straight road, with oncoming traffic 400 yards away (40MPH), and overtaking when approaching a right-hand bend (BEND-OVERTAKE).

c) Examination for age-sex interactions.

Analysis of variance tests were conducted on each of the above variables in order to examine for any age-sex interaction effects. Results indicated that there were no significant interaction effects at the $p<0.05$ level of significance. The F-ratios and levels of significance for each variable are as follows: 45MPH ($F=0.473$, $p=0.625$); GAP ($F=0.216$, $p=0.806$); 40MPH ($F=0.115$, $p=0.892$); CUTTING-IN ($F=1.945$, $p=0.150$); MOTORWAY-OVERTAKE ($F=0.324$, $p=0.724$); BEND-OVERTAKE ($F=0.402$, $p=0.670$).

7) ATTITUDES TOWARDS DRIVING OFFENCES AND THE POLICE.

Summary Of The Discriminant Function Analyses Results On Age and Sex

Two direct discriminant function analyses was performed to discriminate between 1) subjects of ages 17, 18 and 19 years and 2) males and females on a set of variables relating to the perceived seriousness of driving offences, perceived likelihood of detection, and attitudes towards the police. A summary is presented here as neither analysis produced significant discriminant functions. The variables used in the analyses were as follows: SERIOUSNESS OF OFFENCES (subjects' perceptions of the seriousness of certain driving offences), PERCEIVED LIKELIHOOD OF DETECTION (subjects' perceptions of the likelihood of detection for certain driving offences), and ATTITUDES TOWARDS THE POLICE (subjects' attitudes towards the police). Full details of these meta-variables, their measurement and meanings are presented in Appendix C1 and C2.

Results from the discriminant function analysis on age showed that neither of the discriminant functions were significant. The significance level for the first function was $p=0.0751$, with a chi-square of 11.462 (degrees of freedom = 6). As Table 26b (in Appendix C3) shows, only one of the three variables had a significant univariate F-ratio (ATTITUDES TOWARDS THE POLICE). By considering the means in Table 26a (in Appendix C3), it can be seen that 18 year old drivers had a much more positive attitude towards the police than either of the other two driver age groups. Nineteen year old drivers had the most negative attitude towards the police.

A direct discriminant function analysis was also performed on sex by the perceived seriousness of driving offences, perceived likelihood of detection, and attitudes towards the police. The significance level for the discriminant function was $p=0.3284$, with a chi-square of 3.4419 (degrees of freedom = 3). Results also showed that none of the variables had significant F-ratios. Tables 26c and 26d in Appendix C3 present the means, standard deviations and univariate statistics from this analysis.

Examination for age-sex interactions.

Analysis of variance tests were conducted on each of the above meta-variables in order to examine for any age-sex interaction effects. Results indicated that there were no significant interaction effects at the $p<0.05$ level of significance. The F-ratios and levels of significance for each variable are as follows: SERIOUSNESS OF OFFENCES ($F=1.605$, $p=0.208$); PERCEIVED LIKELIHOOD OF DETECTION

($F=0.787$, $p=0.459$); and ATTITUDES TOWARDS THE POLICE ($F=2.278$, $p=0.0512$).

8) ATTITUDES TOWARDS DRINK-DRIVING.

Summary Of The Discriminant Function Analyses Results on Age and Sex.

Two direct discriminant function analyses were performed to discriminate between 1) subjects of ages 17, 18 and 19 years, and 2) males and females on a set of variables relating to attitudes towards drink-driving. The variables included in the analyses were as follows: Generally speaking, how often do you have an alcoholic drink at home? (HOME); Generally speaking, how often do you have an alcoholic drink away from home? (AWAY); Compared to this time last year, how likely are you to drink over the legal limit and drive? (DD-LIKELIHOOD); Compared to this time last year, how likely is the average driver to drink over the legal limit and drive? (AVERAGE DRIVER-DD); Generally speaking, about how much would you drink on any single occasion if you were intending to drive? (INTEND TO DRIVE); To what extent are you on the look-out for police cars when driving after a few drinks? (LOOK-OUT FOR POLICE); In the last twelve months, how often have you driven when you thought you might have drunk over the legal limit? (12 MONTHS); Please state how much the following people can drink without exceeding the legal limit: (a) yourself (OWN LEGAL-LIMIT); (b) the average man (AVERAGE MAN LEGAL-LIMIT); (c) the average woman (AVERAGE WOMAN LEGAL-LIMIT); Please state how much the following people can drink on an average occasion without it affecting their driving: (a) yourself (NOT AFFECT 1); (b) the average man (NOT AFFECT 2); (c) the average woman (NOT AFFECT 3). Full details of the variables, their measurement and meanings are contained in Appendix C2.

Results from the discriminant function analysis on age showed that neither of the discriminant functions were significant. The significance level for the first function was $p=0.3864$, with a chi-square of 27.442 (degrees of freedom = 26). Results from the discriminant function analysis on sex showed that the discriminant function was not significant. The significance level for the discriminant function was $p=0.0747$, with a chi-square of 20.913 (degrees of freedom = 13).

In the analysis by age, Table 27b in Appendix C3 shows that none of the thirteen variables had a significant univariate F-ratio. By considering the means for the age

groups in Table 27a (Appendix C3), it can be seen that subjects of all age groups gave fairly high estimates for how much alcohol they thought the average man could drink without exceeding the legal drink-driving limit (AVERAGE MAN LEGAL-LIMIT) and how much he could drink without it affecting his driving (NOT AFFECT 2). Subjects of all ages scored low on the variables DD LIKELIHOOD, INTEND TO DRIVE, 12 MONTHS, and NOT AFFECT 3, indicating that they would be less likely to drink over the legal limit than last year, that they had a low estimate of how much alcohol they would drink if intending to drive, they had a low estimate of the number of times they had driven when they thought they may have been over the legal limit, and finally had a low estimate of how much alcohol they thought the average woman could drink without exceeding the legal limit. The table of means also indicates that all subjects gave medium responses for the variables NOT AFFECT 1, AVERAGE WOMAN LEGAL-LIMIT, LOOK-OUT FOR POLICE, HOME and AWAY, indicating that they had medium estimates of how much alcohol they could drink before driving without it affecting their driving; a medium estimate of how much alcohol the average woman can drink before driving without exceeding the legal limit; that they were neutral in their response towards looking out for police cars when driving home after a few drinks; and medium responses referring to the frequency with which they drink alcohol at home and away from home.

In the analysis by sex, Table 27d in Appendix C3 shows that only three variables had significant F-ratios ($p < 0.05$): DD-LIKELIHOOD, AVERAGE DRIVER DD, and NOT AFFECT 1). Results show that for the variable DYOU males are more likely than females, to be more likely to drink over the legal limit and drive than last year. Results for the variable AVERAGE DRIVER DD indicate that males are also more likely than females to believe that other drivers are more likely to drink over the legal limit and drive than they were a year ago. The variable NOT AFFECT 1, shows that males perceive themselves as able to drink more alcohol (measured in units) than females without it affecting their driving (males = 2.5 units, females = 1 unit).

An examination of the group means for the remaining variables (Table 27c in Appendix C3), indicates that males reported drinking more alcohol than their female counterparts both at home and away. Males also gave higher measurements than females for the amount of alcohol that the average man could drink without it affecting their driving. Results showed that both males and females thought that the average man could drink more alcohol than they could, without it affecting driving skills, but females, unlike their male counterparts, thought that the average woman could also drink more alcohol than them

without it affecting their driving. The variables INTEND TO DRIVE and LOOK-OUT FOR POLICE also indicated that males report drinking more alcohol than females and are also more likely to be on the lookout for police cars when driving after a few drinks, than females are. There is a slight difference between the group means on the variable 12 MONTHS, indicating that males reported having driven more times when they thought they may have been over the legal limit, than did females. The variables indicated that males gave higher estimates for the amount of alcohol that they, the average man and the average woman could drink without exceeding the legal limit, than females did. Both groups thought that the average man could drink more than they could before exceeding the legal limit, but males unlike females, thought that they could drink more than the average woman. A comparison of variables OWN LEGAL-LIMIT and NOT AFFECT 1, and AVERAGE MAN LEGAL-LIMIT and NOT AFFECT 2, and AVERAGE WOMAN LEGAL LIMIT and NOT AFFECT 3, indicates that both males and females perceive the amount of alcohol that they, the average man and the average woman could drink without affecting their driving, to be lower than the legal limit for each of these parties.

c) Examination for age-sex interactions.

Analysis of variance tests were conducted on each of the above variables in order to examine for any age-sex interaction effects. Results indicated that there were no significant interaction effects at the $p < 0.05$ level of significance. The F-ratios and levels of significance for each variable are as follows: HOME ($F=0.265$, $p=0.768$); AWAY ($F=0.177$, $p=0.838$); DD-LIKELIHOOD ($F=0.101$, $p=0.904$); AVERAGE DRIVER-DD ($F=1.321$, $p=0.272$); INTEND TO DRIVE ($F=0.531$, $p=0.590$); LOOK-OUT FOR POLICE ($F=0.865$, $p=0.426$); 12 MONTHS ($F=0.027$, $p=0.973$); OWN LEGAL LIMIT ($F=0.453$, $p=0.638$); AVERAGE MAN LEGAL LIMIT ($F=0.801$, $p=0.453$); AVERAGE WOMAN LEGAL LIMIT ($F=0.209$, $p=0.812$); NOT AFFECT-1 ($F=1.768$, $p=0.176$); NOT AFFECT-2 ($F=0.304$, $p=0.739$); and NOT AFFECT-3 ($F=0.136$, $p=0.873$).

4.5 DRIVER QUESTIONNAIRE RESULTS SECTION 4.

THE EXAMINATION OF GROUP DIFFERENCES ACROSS RATINGS OF SKILL FOR 'SELF' AND 'OTHERS'.

This section provides the results of repeated measures analysis of variance tests performed on a set of eight variables relating to the perception of ones' own and 'others' driving skills in four different skill scenarios.

The variables measuring the perceptions of ones' own driving abilities across the four skill scenarios were as follows: SELF ABILITY 1 (perceiving potential hazards); SELF ABILITY 2 (avoiding potential hazards); SELF ABILITY 3 (judging safe gaps in the traffic to make manoeuvres); and SELF ABILITY 4 (judging when it is safe to overtake). The variables measuring the perceptions of 'others' driving abilities across the four skill scenarios were as follows: OTHERS ABILITY 1 (perceiving potential hazards); OTHERS ABILITY 2 (avoiding potential hazards); OTHERS ABILITY 3 (judging safe gaps in the traffic to make manoeuvres; and OTHERS ABILITY 4 (judging when it is safe to overtake). All the above 'self' and 'other' skill variables were measured on a scale of 1 (poor) to 5 (excellent). The repeated measures analysis of variance tests on the 'self' and 'other' variables were by age (17, 18 and 19 years) and sex.

This analysis was conducted to indicate whether (1) there were any significant age or sex effects across the eight skill variables, (2) there was a significant difference between subjects' ratings of skill for 'self' and 'others' (a 'self-other' effect), (3) there were any significant skill scenario effects, and (4) there were any significant 'self-other' by 'skill scenario' effects.

The table below shows that there were no significant between subjects effects (at $p \leq 0.01$). There was however, a significant difference between the mean ratings of the two 'self-other' components ($p < 0.001$): subjects provided higher ratings of 'self' skill (3.466) than 'other' skill (2.956). There was also a significant difference between the mean ratings of the four 'skill scenario' components ($p < 0.001$): paired t-tests were employed to provide post-hoc comparisons between the four skill scenarios (the tables of results are presented in Appendix C4, table 28d). The post-hoc comparisons indicated that SCENARIO's 1 and 2 were significantly different from SCENARIO's 3 and 4: subjects provided higher mean ratings for the perceived skill associated with perceiving potential hazards and avoiding potential hazards, than the perceived skill associated with judging when it is safe to overtake or judging safe gaps in the traffic in which to make

manoeuvres. There were no significant 'self-other' by 'skill scenario' effects (at p=0.01). The means for each of the eight variables are contained in Table 28b in Appendix C4.

Table 28a. Summary of ANOVA on ratings of skill for oneself and for others by age and sex.

Between-Subjects Effects.

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN CELLS	183.88	112	1.64		
CONSTANT	8832.47	1	8832.47	5379.92	.000
AGES	.37	2	.18	.11	.894
SEX	8.70	1	8.70	5.30	.023
AGES BY SEX	.28	2	.14	.08	.919

Tests involving 'SELF-OTHER' Within-Subject Effect.

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN CELLS	175.60	112	1.57		
SELF-OTHER	67.41	1	67.41	42.99	.000
AGES BY SELF-OTHER	5.26	2	2.63	1.68	.192
SEX BY SELF-OTHER	2.16	1	2.16	1.38	.243
AGES BY SEX BY SELF-OTHER	9.24	2	4.62	2.95	.057

Tests involving 'SCENARIO' Within-Subject Effect.

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN CELLS	128.07	336	.38		
SCENARIO	10.26	3	3.42	8.98	.000
AGES BY SCENARIO	2.92	6	.49	1.28	.268
SEX BY SCENARIO	.59	3	.20	.51	.674
AGES BY SEX BY SCENARIO	3.97	6	.66	1.74	.112

Tests involving "'SELF-OTHER' BY 'SCENARIO'" Within-Subject Effect.

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN CELLS	109.18	336	.32		
SELF-OTHER BY SCENARIO	.33	3	.11	.34	.796
AGES BY SELF-OTHER BY SCENARIO	2.16	6	.36	1.11	.357
SEX BY SELF-OTHER BY SCENARIO	.81	3	.27	.83	.479
AGES BY SEX BY SELF-OTHER BY SCENARIO	1.12	6	.19	.57	.751

4.6 SUMMARY OF THE DRIVER QUESTIONNAIRE RESULTS.

Overall, the results indicated that there were a number of significant multivariate dimensions along which the three age groups (17, 18 and 19 years), and males and females, could be discriminated. This section presents a brief summary of these results, along with some of the interesting significant univariate findings.

Results showed that in terms of reported driving behaviours, 17 years olds reported overtaking on the inside on motorways more than their older 18 and 19 year old counterparts, while males reported driving at higher speeds, driving with closer following distances, and overtaking in dangerous locations more than females. However, females reported the highest frequency of overtaking on the left on motorways. An examination of some univariate F-ratios and group means indicated that as age increased so did the reported contravention of the 30, 40, 50 and 70mph speed limits. Males reported breaking all speed limits between 30 and 70mph more frequently than females.

In terms of general risk-taking and driving, it was found that as age increased young drivers exhibited a higher risk-motivation, perceived themselves as driving faster than other drivers, had greater confidence in their driving skills, and had a more negative attitude towards drink-driving and drink-driving offenders. Females reported a lower risk motivation and lower driving speeds on average than their male counterparts. In terms of the perceived likelihood of accident-involvement and seriousness, an examination of the group means indicated that all age groups perceived a lower likelihood of accident-involvement, and lower seriousness of accident-involvement, through close-following or speeding, than through dangerous overtaking manoeuvres.

However, while drivers across all the age groups, and from both sexes, perceived themselves to be more skilful than 'other' drivers across four different skill scenarios, there were no significant age group or sex effects in terms of self-other comparisons.

Results also showed that the three age groups of young drivers could not be discriminated by the perceived seriousness of offences, the perceived likelihood of detection for offences, attitudes towards the police, or the importance of different car features. However, males and females could be discriminated along a dimension relating to the perceived importance of safety features in a car: females rated safety features as more important

than did males.

In summary, the results from the Driver Questionnaire indicate that as age increases so does the frequency of breaking speed limits, the level of risk motivation, the level of confidence in driving skills, the perception of oneself as a 'fast' driver, and a socially responsible attitude towards drink-driving. However as age increased, certain dangerous overtaking behaviours also decreased. Overall, males reported driving at higher speeds and breaking speed limits more often, overtaking on the inside on motorways less, while also having a lower perception of the importance of car safety features, and a higher risk-motivation than their female counterparts.

CHAPTER 5.

THE PERCEIVED SERIOUSNESS OF DRIVING OFFENCES: A DIRECT COMPARISON BETWEEN THE 'DEVELOPMENTAL' GROUPS.

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A DIRECT COMPARISON BETWEEN THE 'DEVELOPMENTAL' GROUPS.

5.1 THE PERCEIVED SERIOUSNESS OF DRIVING OFFENCES.

This chapter presents results of analysis of variance tests performed on 15 variables measuring the perceived seriousness of 15 driving offences by 'developmental' group and sex. In the analyses below subjects have been divided into the following developmental groups: Group 1 = 11-12 year olds, Group 2 = 13-14 year olds, Group 3 = 15-16 year olds, Group 4 = 17-18 year old non-drivers, and Group 5 = 17-18 year old drivers. The definition 'Developmental Groups' was applied, as opposed to 'age groups', as Groups 4 and 5 contain subjects who are of the same age ranges but differ according to their status as drivers or non-drivers. Subjects were presented with the task of rating the perceived seriousness of 15 driving offences both within the Driver and Non-Driver Questionnaires. All the variables were rated on a five-point scale from 1 (not very serious) to 5 (very serious). The definition of each of these offence variables is presented below. The means for each developmental group and males and females are held in Appendix D1.

Variable Definitions.

- OFFENCE1 = not stopping at a pedestrian crossing when someone is trying to cross.
- OFFENCE2 = going too fast on roundabouts.
- OFFENCE3 = parking on double yellow lines.
- OFFENCE4 = parking on the pavement.
- OFFENCE5 = not indicating when turning right.
- OFFENCE6 = failing to give way to other drivers at junctions.
- OFFENCE7 = driving through traffic lights just after they have turned red.
- OFFENCE8 = following the car in front too closely.
- OFFENCE9 = overtaking a car when approaching a bend.
- OFFENCE10 = driving above the speed limit in town.
- OFFENCE11 = driving above the speed limit on motorways.
- OFFENCE12 = turning in a road where U-turns are not allowed.
- OFFENCE13 = driving a car alone without a full driving licence.

OFFENCE14 = driving when having drunk slightly over the legal limit.
 OFFENCE15 = driving when having drunk a lot over the legal limit.

Table 29ai. Multivariate Test of Significance On 'Driving Offence Variables' By Developmental Group.

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Wilks	.69311	6.06961	60.00	3968.84	.000

The above table indicates that there was a significant (p<0.0001) multivariate developmental group effect when examining all 15 'seriousness of offence' variables simultaneously.

Table 29aii. Analysis Of Variance On 'Seriousness Of Offences' By Developmental Group.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F(4,961)	Sig. of F
OFFENCE1	11.27771	1059.32897	2.81943	1.10003	2.56304	.037
OFFENCE2	121.78204	848.87862	30.44551	.88149	34.53854	.000
OFFENCE3	70.35988	1174.65679	17.58997	1.21979	14.42050	.000
OFFENCE4	72.26347	1243.05646	18.06587	1.29082	13.99569	.000
OFFENCE5	24.83194	798.48446	6.20799	.82916	7.48705	.000
OFFENCE6	9.39969	898.81813	2.34992	.93335	2.51772	.040
OFFENCE7	16.18498	1163.78952	4.04625	1.20850	3.34814	.010
OFFENCE8	21.77797	832.86901	5.44449	.86487	6.29516	.000
OFFENCE9	5.37847	567.99455	1.34462	.58982	2.27972	.059
OFFENCE10	8.85708	1027.17743	2.21427	1.06664	2.07592	.082
OFFENCE11	96.87255	1230.36715	24.21814	1.28030	18.91600	.000
OFFENCE12	37.64031	970.38012	9.41008	1.00766	9.33851	.000
OFFENCE13	26.71850	1083.44537	6.67963	1.12507	5.93706	.000
OFFENCE14	21.52062	803.31442	5.38016	.83418	6.44964	.000
OFFENCE15	3.57261	414.87031	.89315	.43081	2.07319	.082

Details of Tukey tests are held in Appendix D1.

From Table 29aii it can be seen that there were significant developmental group effects (p<=0.01) on 10 out of the 15 'offence variables'. From the above tables and the table of means (in Appendix D1), it can be seen

that generally, as the developmental stage increases the perception of the following offences decreases: driving too fast on roundabouts, parking on double yellow lines, parking on the pavement, and driving above the speed limit on motorways.

Post-hoc Tukey HSD tests (details in Appendix D1) revealed the following specific significant between-developmental group differences:

1) The 11-12 year olds differed significantly from all other developmental groups in their perceptions of the seriousness of driving too fast on roundabouts, parking on the pavement and on double yellow lines, driving above the speed limit on motorways, and turning in a road where U-turns are not allowed. The 11-12 year olds perceived all of these offences to be more serious than other developmental groups.

2) The 11-12 year olds perceived driving without a licence as more serious than the 13-14 year olds and the 17-18 year old drivers. The 11-12 year olds also perceived driving through red traffic lights as more serious than the 15-16 year olds; driving when having drunk slightly over the legal limit as more serious than the 13-14 year olds; following the car in front too closely as more serious than the 13-16 year olds; and not indicating when turning right more serious than either the 15-16 year olds or the 17-18 year old drivers.

3) The 13-14 year old non-drivers perceived the offences of parking on the pavement, and driving above the speed limit on motorways as more serious than the 17-18 year old drivers/non-drivers. The 13-14 year old non-drivers also perceived parking on double yellow lines as more serious than the 17-18 year old drivers. However the 13-14 year olds also perceived driving when slightly over the legal limit, and driving without a licence, as less serious than the 17-18 year old non-drivers.

Post-hoc Tukey HSD tests (details in Appendix D1) revealed that the only significant difference (at $p < 0.05$) between 17-18 year old non-drivers (Group 4) and 17-18 year old drivers (Group 5), was in terms of the perceived seriousness of 'driving too fast on roundabouts'. The 17-18 year old drivers perceived this offence as less serious than the 17-18 year old non-drivers (and also less serious than the 11-16 year old non-drivers).

**Table 29bi. Multivariate Test of Significance On
'Driving Offence Variables' By Sex.**

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Wilks	.91666	5.74007	15.00	947.00	.000

The above table indicates that there was a significant multivariate sex effect (at the $p < 0.0001$ level) when examining all 15 'seriousness of offence' variables simultaneously.

Table 29bii. Analysis Of Variance On 'Seriousness Of Offences' By Sex.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F(1,961)	Sig. of F
OFFENCE1	4.76244	1059.32897	4.76244	1.10003	4.32937	.038
OFFENCE2	10.16210	848.87862	10.16210	.88149	11.52827	.001
OFFENCE3	1.42784	1174.65679	1.42784	1.21979	1.17056	.280
OFFENCE4	2.93049	1243.05646	2.93049	1.29082	2.27026	.132
OFFENCE5	4.15649	798.48446	4.15649	.82916	5.01287	.025
OFFENCE6	.66546	898.81813	.66546	.93335	.71298	.399
OFFENCE7	8.93537	1163.78952	8.93537	1.20850	7.39375	.007
OFFENCE8	1.09595	832.86901	1.09595	.86487	1.26718	.261
OFFENCE9	5.43381	567.99455	5.43381	.58982	9.21269	.002
OFFENCE10	5.67633	1027.17743	5.67633	1.06664	5.32167	.021
OFFENCE11	76.41265	1230.36715	76.41265	1.28030	59.68345	.000
OFFENCE12	.61459	970.38012	.61459	1.00766	.60991	.435
OFFENCE13	22.82353	1083.44537	22.82353	1.12507	20.28626	.000
OFFENCE14	16.20175	803.31442	16.20175	.83418	19.42239	.000
OFFENCE15	3.00600	414.87031	3.00600	.43081	6.97754	.008

From the above table it can be seen that there were significant sex effects ($p < 0.01$) on 7 out of the 15 'offence variables'. Females rated the following 7 driving offences as more serious than males: driving too fast on roundabouts, driving through red traffic lights, driving above the speed limit on motorways, overtaking when approaching a bend, driving without a licence, driving when having drunk slightly, or greatly, over the legal limit.

5.2 SUMMARY OF THE COMPARISON BETWEEN DEVELOPMENTAL GROUPS.

Overall, results indicated that there were significant univariate and multivariate developmental group and sex effects on the set of driving offence variables. While there were significant age effects on 10 out of the 15 driving offence variables, the direction of these effects was not always simply in terms of a straightforward increase or decrease. Results indicated that while the 11-12 year olds were shown to differ significantly from most of the other developmental groups across many of the driving offence variables, the 13-14 year olds differed significantly specifically from the 17-18 year old drivers/non-drivers across several of the driving offence variables. The only significant difference between the 17-18 year old drivers and non-drivers was in their perceptions of the seriousness of driving too fast o roundabouts.

Females rated 7 of the 15 driving offences as significantly more serious than did their male counterparts: each of these 7 driving offences can be seen to represent offences which involve risk-taking and speed. It would seem that the relationship between sex and attitudes towards driving offences is more simple than that between developmental group and attitudes towards driving offences.

CHAPTER 6.

INTERACTIVE VIDEO RESULTS.

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6.0 INTRODUCTION.

The Interactive Video Results Chapter has been divided up into four main sections: (1) details of sample characteristics, (2) the creation of 'rating' meta-variables and their employment in the examination of group differences, (3) the use of 'interactive' variables in the examination of group differences, and (4) the creation of 'verbal commentary task' meta-variables and their employment in the examination of group differences. The three main types of variables (rating, interactive and verbal commentary) are defined below.

'Interactive' variables are defined as those variables which measured subjects' decisions through interaction with the system. Examples of interactive variables are: (a) the overtaking variables: subjects had to interact with the system to indicate in real-time when and where they would select to overtake, and (b) the braking variables: subjects had to indicate by interacting with the system in real-time when and where they would chose to brake when they saw something hazardous.

'Rating' variables are defined as those variables which measured subjects' attitudes and perceptions to a situation or behaviour presented via the interactive video. Typically, subjects were presented with rating variables immediately after they had made a decision by interacting with the system. Examples of 'rating' variables are (a) rating how dangerous a situation was, after having braked to avoid a hazard and (b) rating how confident they are that they could have avoided an accident in a hazardous situation.

'Verbal commentary task' variables are defined as those which measured subjects' awareness of other road users, the road environment in general, and the required behaviours and observations, as would be demonstrated by 'a good, safe driver'. Subjects did not interact with the system for these variables, neither were they required to provide ratings or enter their answer manually into the system. Subjects provided a verbal commentary in real-time across four separate scenes. The verbal

commentary variables are all dichotomous in so far as subjects were either aware, or not aware, of the various aspects of the road environment around them and the associated task demands (behaviours and observations).

In all analyses on the interactive video data subjects have been divided into the following Developmental Groups: Group 1= 11-12 year olds, Group 2 = 13-14 year olds, Group 3 = 15-16 year olds, Group 4 = 17-18 year old non-drivers, and Group 5 = 17-18 year old drivers. The definition 'Developmental Groups' was applied, as opposed to 'age groups', as Groups 4 and 5 contain subjects who are of the same age ranges but differ according to their status as drivers or non-drivers.

6.1 OVERVIEW.

SECTION 1: Sample Characteristics.

Section 1 contains a breakdown of the interactive video sample by age, sex and first-hand driving experience. This sample information is presented in a summary table.

SECTION 2a: Creation Of Hazard Evaluation and Risk-Taking 'Rating' Variables.

Reliability analyses were carried out on two sets of four variables to produce the meta-variables DANGER (a scale representing how dangerous subjects' perceived an unexpected and hazardous situation, requiring emergency braking, to be) and SPEED (a scale representing how fast subjects were prepared to drive across a variety of road traffic situations). These two meta-variables were used in later analyses.

SECTION 2b: Examination Of Group Differences Across Hazard Evaluation and Risk-Taking 'Rating' Variables.

Analysis of variance tests were performed on the following three hazard evaluation and risk-taking issues, by developmental group and sex:

- 1) Hazard Evaluation: Perceived Dangerousness Of Actions.
- 2) Preferred Driving Speed.
- 3) Chosen Deceleration In a Hazardous Situation.

SECTION 2c: Examination Of Group Differences Across Risk-Perception 'Rating' Variables.

A repeated measures analysis of variance test was performed on variables measuring the 'perceived likelihood of an accident' and the 'the perceived likelihood that the accident would be serious', by developmental group and sex.

A second repeated measures analysis of variance test was performed on variables measuring the 'perceived likelihood of an accident for self' and the 'perceived likelihood of an accident for others', by developmental group and sex.

Analysis of variance tests, by developmental group and sex, were performed on each of the above four 'risk-perception' variables, in order to clarify group differences.

SECTION 3: Examination Of Group Differences Across Hazard Perception and Risk-Taking 'Interactive' Variables.

i) Overtaking Strategies.

Analysis of variance tests were conducted on a set of overtaking variables in order to examine for developmental and sex group differences across risk-taking behaviours. The overtaking variables represented a wide range of possible overtaking scenarios.

ii) Hazard Perception and Response: 'Braking' Variables.

Analysis of variance tests were conducted on a set of 'braking' variables, in order to examine for developmental and sex group differences across hazard perception and response behaviours. The 'braking' variables represented a range of possible hazard perception and response scenarios.

SECTION 4a: Creation Of 'Road Environment Awareness' Meta-Variables From The Verbal Commentary Task Scenes.

This section contains information on the creation of six meta-variables from the results of reliability analyses on

sets of verbal commentary task variables. The verbal commentary task variables were grouped logically by the author according to the areas of measurement within 'road environment awareness', and then had reliability analyses performed on them. The area groupings are as follows:

- (i) Awareness Of Other Road Users (where there was no interaction with the subject's car).
- (ii) Awareness Of Other Road Users (where there was some interaction between other road users and the subject's car).
- (iii) Awareness of Road layout.
- (iv) Awareness of Road Traffic Signs and Markings.
- (v) Required Observations Before Actions/Behaviour.
- (vi) Required Actions and Behaviours.

SECTION 4b: Examination Of Group Differences Across 'Road Environment Awareness' Meta-Variables.

Analysis of variance tests were conducted on the six 'road environment awareness' meta-variables, to examine for developmental and sex group differences. The road environment awareness meta-variables included awareness of other road users, road traffic signs, road layout, and required observations and behaviours.

6.2 INTERACTIVE VIDEO RESULTS SECTION 1:

SAMPLE CHARACTERISTICS.

The Interactive Video Sample.

The table below presents some descriptive statistics on the sample of drivers and non-drivers who participated in the interactive video phase of the study.

A total of 236 subjects (out of the original sample who completed the questionnaires) participated in this phase of the study. The table below indicates that the sample consisted of 193 non-drivers aged between 11-18 years, and 43 drivers aged between 17-18 years. The subjects in the non-driver group did not hold full or provisional driving licences, while the subjects in the driver-group all held full British driving licenses.

Table 30a. Breakdown Of The Interactive Video Sample By Developmental Group and Sex.

<u>DEVELOPMENTAL GROUPS</u>						
<u>SEX</u>	11-12 Years	13-14 Years	15-16 Years	(Non- Drivers) 17-18 Years	(Drivers) 17-18 Years	Total
MALE	24	37	31	17	27	136
FEMALE	26	23	27	8	16	100
Total	50	60	58	25	43	236

All 236 subjects aged between 11 and 18 years completed the Interactive Video Driving Programme successfully. All of the interactive video data collected was complete and so no subjects had to be excluded from the sample. The Interactive Video Driving Programme (I.V.D.P) took approximately 45 minutes to complete with subjects individually.

SAMPLE REPRESENTATIVENESS.

The following tables present the results of analyses undertaken to examine the representativeness of the I.V.D.P. study sample (in terms of sex, age and driving status) in relation to the survey studies samples.

Table 30b. Crosstabulation of I.V.D.P. and Survey Studies Samples In Terms of Sex.

<u>SAMPLE</u>	<u>SEX</u>		Row Total
	Count		
	Males	Females	
I.V.D.P. Study	136	100	236
Survey Studies	556	511	1067
Column	692	611	1303

As can be seen from the above table there was not a significant difference in the representation of males and females between the I.V.D.P. and Survey studies (chi-square=2.14680, df=1, p=.1429).

Table 30c. Crosstabulation of I.V.D.P. and Survey Studies Samples In Terms of Age.

<u>SAMPLE</u>	<u>AGE GROUPS</u>				Row Total
	Count	11-12	13-14	15-16	17-18
I.V.D.P. Study	50	60	58	68	236
Survey Studies	250	298	235	250	1033
Column	300	358	293	318	1269

As can be seen from the above table there was not a significant difference (p<.05) in the representation of the four age groups between the I.V.D.P. and Survey studies (chi-square=3.44568, df=3, p=.3279).

However, it should be noted that there was a significant difference in the representation of drivers and non-drivers between the I.V.D.P. and Survey studies (chi-square=15.69682, df=1, p=.0001), as indicated in Table 30d.

Table 30d. Crosstabulation Between Drivers and Non-Drivers In The I.V.D.P. and Survey Studies.

	Count	DRIVING STATUS		Row Total
		17-18yr/ non- drivers/	17-18yr drivers	
SAMPLE				
I.V.D.P. Study		25	43	68
Survey Studies		161	89	250
Column		186	132	318

While an attempt was made to obtain representative samples across the I.V.D.P. and Survey Studies in terms of driving status, the level of representativeness obtained was lower than anticipated due to school timetable restrictions.

6.3 INTERACTIVE VIDEO RESULTS SECTION 2a:

CREATION OF HAZARD EVALUATION AND RISK-TAKING 'RATING' VARIABLES.

Two meta-variables were created from the results of reliability analyses on hazard evaluation and risk-taking 'rating' variables.

Reliability Analysis 1: Conducted On 'Perceived Dangerousness' Variables.

All the variables below were rated on a three-point scale in terms of the level of dangerousness, from 1 (not dangerous) to 3 (very dangerous). The incidents to which each variable refers are described below.

- 1. MOTORB - an oncoming motorbike turns right, straight in front of the subject's car.
- 2. DANGER2 - two cars, one immediately after the other began to pull out, right in front of the subject's car.
- 3. DANGER4 - a woman, holding a baby, suddenly ran out onto a zebra crossing, right in front of the subject's car.
- 4. FIESTA1 - as the subject's car enters a mini-roundabout, a Fiesta pulls onto theroundabout from the left, right in front of the subject's car.

Table 31a Results Of The 'Perceived Dangerousness Of Actions' Reliability Analysis.

	SCALE MEAN IF ITEM DELETED	SCALE VARIANCE IF ITEM DELETED	CORRECTED ITEM- TOTAL CORRELATION	ALPHA IF ITEM DELETED
MOTORB	6.3744	1.9185	.3870	.4892
DANGER2	6.7488	1.8326	.4010	.4760
DANGER4	6.5172	1.7757	.3955	.4796
FIESTA1	6.8424	2.0542	.2669	.5800
N OF CASES = 203.0				N OF ITEMS = 4
ALPHA = .6000				

The above variables were combined to form the meta-variable PERCEIVED DANGEROUSNESS: a scale representing how dangerous subjects' perceive unexpected, and hazardous situations requiring emergency braking, to be.

Reliability Analysis 2: Conducted On 'Preferred Driving Speed' Variables.

All the variables below were measured in 'miles per hour' (continuous variables), to indicate what would be the fastest speed that they would choose to travel at in the specified situations, as described below.

- 1. CORNER - driving around a reasonably tight right-hand bend, in a de-restricted speed limit.
- 2. SPEED1 - a 30mph zone with pedestrians and shops around.
- 3. SPEED7 - a country lane with a visible de-restricted speed limit sign.
- 4. SPEED8 - a continuation of the above scene, except that the subject's car drives past a sharp bend.

Table 31b Results Of The Preferred Driving Speed Reliability Analysis.

	SCALE MEAN IF ITEM DELETED	SCALE VARIANCE IF ITEM DELETED	CORRECTED ITEM- TOTAL CORRELATION	ALPHA IF ITEM DELETED
CORNER	90.6568	546.4477	.4154	.7122
SPEED1	96.7712	520.3730	.5250	.6592
SPEED7	79.8856	385.5400	.5295	.6704
SPEED8	87.6907	456.6911	.6268	.5942

N OF CASES = 236.0 N OF ITEMS = 4
ALPHA = .7223

The above variables were combined to form the meta-variable PREFERRED SPEED: a variable representing how fast subjects' are prepared to drive across a variety of situations.

6.4 INTERACTIVE VIDEO RESULTS SECTION 2b:

EXAMINATION OF GROUP DIFFERENCES ACROSS HAZARD EVALUATION AND RISK-TAKING 'RATING' VARIABLES.

This section provides results of the analysis of variance tests performed on the following three hazard evaluation and risk-taking issues: (1) perceived dangerousness of actions, (2) preferred driving speed, and (3) chosen deceleration in a hazardous situation.

1) The Perceived Dangerousness Of Actions.

The meta-variable PERCEIVED DANGEROUSNESS is a mean of four variables measuring subjects' ratings of the dangerousness of four different potentially hazardous situations. The meta-variable was constructed after a reliability analysis had been performed on the four component variables, as detailed in Interactive Video Results Section 2a.

Table 32a. Analysis Of Variance On 'Perceived Dangerousness' By Developmental Group and Sex.

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	50.526	5	10.105	3.647	.004
DEV.GROUP	46.497	4	11.624	4.196	.003
SEX	2.278	1	2.278	.822	.366
2-way Interactions	11.734	4	2.933	1.059	.378
DEV.GROUP SEX	11.734	4	2.933	1.059	.378
Explained	62.260	9	6.918	2.497	.010
Residual	534.705	193	2.770		
Total	596.966	202	2.955		

The above table indicates that there was a significant developmental group effect only: there were no sex or interaction effects. Results from a Tukey Test indicated that the largest differences ($p < 0.05$) are between the highest scoring groups (group 1 and group 2) and lowest scoring group (group 5). Details related to the Tukey Test are held in Appendix E1. The table of means in Appendix E1 (Table 32b) indicates that the 17-18 year old drivers perceive less danger than the younger non-driving subjects.

2) Preferred Driving Speed.

The meta-variable PREFERRED SPEED is a mean of four variables measuring subjects' chosen speeds across four different situations. The meta-variable was constructed after a reliability analysis had been performed on the four component variables, as detailed in Interactive Video Results Section 2a.

Table 33a. Analysis Of Variance On 'Preferred Driving Speed' By Developmental Group and Sex.

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	20231.661	5	4046.332	5.912	.000
DEV.GROUP	20083.302	4	5020.826	7.336	.000
SEX	488.644	1	488.644	.714	.399
2-way Interactions	2031.428	4	507.857	.742	.564
DEV.GROUP SEX	2031.428	4	507.857	.742	.564
Explained	22263.089	9	2473.677	3.614	.000
Residual	132088.911	193	684.399		
Total	154352.000	202	764.119		

As can be seen from the above table of results, there were significant developmental group effects only: there were no significant sex or interaction effects. Results from a Tukey Test indicated that the largest differences ($p < 0.05$) are between the highest scoring group (group 5) and lowest scoring groups (group 1 and group 3). Details related to the Tukey Test are held in Appendix E1. The table of means in Appendix E1 (Table 33b) indicates that in the I.V.D.P. the 17-18 year old drivers have the highest preferred driving speeds, while the 11-12 and 15-16 year olds had the lowest preferred driving speeds.

3) Chosen Deceleration In A Hazardous Situation.

The variable CHOSEN DECELERATION (chosen deceleration in speed) is the difference between the variables SPEED8 and SPEED7. The variable SPEED7 measures subjects' chosen speed on a country lane after they have just passed a de-restricted sign. The variable SPEED8 measures subjects' chosen speed further down the same road after subjects have passed a 'sharp bends' sign. Hence, the variable CHOSEN DECELERATION gives the chosen deceleration made by subjects when they approach a potentially hazardous area (sharp bends on a de-restricted country lane).

Table 34a. Analysis Of Variance On 'Chosen Deceleration' By Developmental Group and Sex.

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F
Main Effects	1753.286	5	350.657	3.688	.003
DEV.GROUP	1380.251	4	345.063	3.629	.007
SEX	274.385	1	274.385	2.886	.091
2-way Interactions	183.862	4	45.965	.483	.748
DEV.GROUP SEX	183.862	4	45.965	.483	.748
Explained	1937.147	9	215.239	2.264	.020
Residual	18350.429	193	95.080		
Total	20287.576	202	100.434		

The above table of results indicates that there is a significant developmental group effect only: there are no sex or interaction effects. Results from a Tukey Test indicated that the largest differences ($p < 0.05$) are between the highest scoring group (group 5) and lowest scoring groups (group 1, group 2 and group 3). Details related to the Tukey Test are held in Appendix E1. The table of means in Appendix E1 (Table 34b) indicates that in the I.V.D.P. the 17-18 year old drivers have the highest rate of deceleration, while the 11-12, 13-14 and 15-16 year olds have the lowest rate of deceleration. In the light of the previous results on 'preferred driving speed', it would seem likely that the older driving subjects had a higher rate of deceleration than the younger subjects, due to their higher initial speed.

6.5 INTERACTIVE VIDEO RESULTS SECTION 2c.

EXAMINATION OF GROUP DIFFERENCES ACROSS RISK-PERCEPTION 'RATING' VARIABLES.

This section provides results of repeated analysis of variance tests performed on the following two risk-perception issues: (1) the perceived likelihood of an accident and the perceived likelihood that the accident would be serious, and (2) the perceived likelihood of an accident for 'self', and the perceived likelihood of an accident for 'others'. Analysis of variance tests, by developmental group and sex, were also performed on each of the above four 'risk-perception' variables in order to clarify group differences.

1) The Perceived Likelihood Of An Accident and The Perceived Likelihood That An Accident Would Be Serious.

The variable ACCIDENT-LIKELIHOOD (how likely subjects thought they would be to have an accident if they overtook a parked lorry in the face of oncoming traffic) was measured on a 5-point scale where 1= very unlikely and 5 = very likely. The variable SERIOUS (with reference to the same overtaking scene, subjects were asked the likelihood of such an accident being serious) was measured on the same 5-point scale. This analysis will indicate whether there is a significant difference between subjects' ratings of the likelihood of an accident, and their evaluation of the likelihood that such an accident would be serious.

The ratings of 'the likelihood of an accident' and 'the likelihood that such an accident would be serious' represent two conceptual components of accident risk. In the analysis below these two ratings represent the two levels of the repeated measures variable 'risk components'.

The table below shows that in the repeated analysis of variance test there were no significant between subjects effects (at $p \leq 0.01$). There was however a significant difference between the mean ratings of the two components of risk ($p = 0.004$). Examination of the means (Table 35b and 35c in Appendix E1) reveals that overall subjects rated the perceived likelihood of an accident lower than the likelihood that such an accident would be serious.

Table 35a. Repeated Measures Analysis Of Variance Test On 'The Perceived Likelihood Of An Accident' and 'The Perceived Likelihood That An Accident Would' Be Serious By Developmental Group and Sex.

Tests of Between-Subjects Effects.

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN CELLS	259.37	226	1.15		
CONSTANT	4989.73	1	4989.73	4347.82	.000
DEV. GROUP	14.44	4	3.61	3.15	.015
SEX	1.19	1	1.19	1.04	.309
DEV.GROUP BY SEX	2.27	4	.57	.50	.739

Tests involving 'Risk Components' Within-Subject Effect.

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN CELLS	204.80	226	.91		
RISK COMPONENTS	7.48	1	7.48	8.26	.004
D.GROUP BY RISKCOMPONENTS	.66	4	.17	.18	.947
SEX BY RISKCOMPONENTS	.12	1	.12	.14	.711
D.GROUP BY SEX BY RISK -COMPONENTS	1.07	4	.27	.29	.881

Analysis of variance tests were performed on the two conceptual components of accident risk (ACCIDENT-LIKELIHOOD and SERIOUS) to clarify any developmental group, sex and interaction effects. Results indicated that there were no significant developmental group, sex or interaction effects ($p>0.01$) for either the variable ACCIDENT LIKELIHOOD or SERIOUS (and so these analyses are not reported in full). The means indicate that all developmental groups gave medium to high ratings for both the likelihood of an accident occurring and for the likelihood of it being serious. The means for the variables ACCIDENT LIKELIHOOD and SERIOUS are presented in Appendix E1 (Tables 35b and 35c).

2) The Perceived Likelihood Of An Accident For The 'Average Driver'and For 'Self'.

The variable ACCIDENT-FOR-AVERAGE-DRIVER (subjects' ratings of how likely they think the 'average driver' would be to have an accident when a cyclist swerves off of the pavement into the road in front of their car) was measured on a 5-point scale where 1= very unlikely and 5 = very likely. The variable ACCIDENT-FOR-SELF (how likely subjects thought that they would be to have an accident in the same situation) was measured on the same 5-point scale. This analysis will allow one to assess the perceived likelihood of having an accident across the two variables. This analysis will indicate whether there is a significant difference between subjects' ratings of the likelihood of the 'average driver' and the likelihood of 'self' being involved in an accident.

Table 36a. Repeated Measures Analysis Of Variance Test On The Perceived Likelihood Of An Accident For 'Average Driver' and For 'Self' By Developmental Group and Sex.

Tests of Between-Subjects Effects.

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN CELLS	144.80	210	.69		
CONSTANT	2720.51	1	2720.51	3945.60	.000
DEV. GROUP	6.11	4	1.53	2.22	.068
SEX	.22	1	.22	.32	.574
DEV.GROUP BY SEX	6.14	4	1.53	2.22	.067

Tests involving 'Self-Average' Within-Subject Effect.

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN CELLS	164.04	210	.78		
SELF-AVERAGE	84.26	1	84.26	107.87	.000
DEV.GROUP BY SELF-AVERAGE	27.11	4	6.78	8.67	.000
SEX BY SELF-AVERAGE	3.05	1	3.05	3.91	.049
DEV.GROUP BY SEX BY SELF	5.41	4	1.35	1.73	.144
-AVERAGE					

The ratings of the likelihood of accident-involvement for 'the average driver' and for 'self' represent two conceptual components of self-other skill assessment. In the above analysis these 'average driver' and 'self' ratings represent the two levels of the repeated measures variable 'self-other skill assessment'.

The above table shows that in the repeated analysis of variance test there were no significant between subjects effects (at $p < 0.01$). There was however a significant difference between the mean ratings of the two components of self-other skill assessment ($p < 0.001$). Examination of the means (Table 36b and 36e in Appendix E1) reveals that overall subjects rated the perceived likelihood of an accident for the 'average driver' to be higher than for themselves. In addition to this there was also a significant developmental group 'self-average' interaction ($p < 0.001$). Examination of the means (Table 36b and 36e in Appendix E1) reveals that the largest difference between the ratings for 'self' and 'average driver' are between group 2 (13-14 year olds) and group 5 (17-18 year old drivers). The means indicate that as age increases (from 13-18 years) and first-hand driving experience is obtained, the difference between subject ratings of accident likelihood for the 'average driver' and 'self' decreases.

Analysis of variance tests were performed on the two conceptual components of self-other skill assessment (ACCIDENT-FOR-AVERAGE DRIVER and ACCIDENT-FOR-SELF) to clarify any developmental group, sex and interaction effects.

Results indicated that there were significant developmental group effects ($p < 0.01$) on both ACCIDENT-FOR-AVERAGE DRIVER and ACCIDENT-FOR-SELF variables. Details of these significant analysis of variance tests are presented in Appendix E1.

Examination of Tukey Test results and the means for the variable ACCIDENT-FOR-AVERAGE DRIVER (Tables 36b and 36d in Appendix E1) indicate that the largest differences ($p < 0.05$) are between the highest scoring groups (group 1, group 2 and group 3) and lowest scoring group (group 5). Results show that the 17-18 year old drivers gave the lowest accident-likelihood rating for the 'average driver' out of all the developmental groups. It can be seen that the perception of accident likelihood decreases from the ages 13-14 years.

Examination of Tukey Test results and the means for the variable ACCIDENT-FOR-SELF (Tables 36e and 36g in Appendix E1) indicate that the largest differences ($p < 0.05$) are between (a) group 1 and (b) groups 4 and 5, and between (c) group 2 and (d) group 5. Results show that the perceived likelihood of an accident for oneself decreases with age and first-hand driving experience.

6.6 INTERACTIVE VIDEO RESULTS SECTION 3.

EXAMINATION OF GROUP DIFFERENCES ACROSS HAZARD PERCEPTION AND RISK-TAKING 'INTERACTIVE' VARIABLES.

This section provides results of two-way analysis of variance tests on variables measuring (1) subjects' overtaking strategies, and (2) their perception and response to hazards.

1) Overtaking Strategies.

The variables below represent measurements of subjects' overtaking behaviours during three scenes presented to them. Each of the three scenes depicted 'fast' country 'A' roads with de-restricted speed limits. The variables represent subjects' overtaking behaviours at each of the different overtaking locations, as described below. All of the component variables were dichotomous except for the component variables of the meta-variable OVERTAKING FREQUENCY (a measurement of the total number of times that subjects selected to overtake across the three scenes).

DOUBLE WHITE LINES - overtaking on double white lines. This was represented across all three scenes.

OVERTAKING FREQUENCY - subjects overtaking frequency across the three scenes. Subjects were allowed up to a maximum of five overtaking manoeuvres per scene (hence fifteen in total).

ONCOMING TRAFFIC - overtaking in the face of close oncoming traffic. This was represented across three scenes.

BEND - overtaking on or approaching a bend. This was represented across two of the three scenes.

SINGLE WHITE LINE - overtaking on single white lines. This was represented across three scenes.

BROW OF HILL - overtaking on or approaching the brow of a hill. This was represented across three scenes.

ROUNDBOUT - overtaking approaching a roundabout. This was represented on only one of the three scenes.

JUNCTION - overtaking at or approaching a junction. This was represented on only one of three scenes.

SAFE1 - overtaking in a 'safe' place (i.e., not at any of the above locations: on a straight, clear stretch of road with no oncoming traffic, hills, single or double white lines, roundabouts, junctions or bends). This was represented on only one of the three overtaking scenes.

Results from the two-way analysis of variance tests indicated that there were significant developmental group effects (at $p<0.01$) on the variables DOUBLE WHITE LINES and OVERTAKING FREQUENCY. Tables 37a and 38a present the results of the analysis of variance tests on these two variables. The means and standard deviations of these two variables are presented in Appendix E2 (Tables 37b and 38b). The remaining variables did not show any developmental group, sex or interaction effects (at $p<0.01$), and so are not reported any further here, but details of the analysis of variance tests, the means and the standard deviations are detailed in Tables 39a to 39n in Appendix E2. Appendix E2 does contain details of analysis of variance tests which indicate significant sex effects (at $p<0.05$) on two overtaking variables.

a) Double White Lines.

The meta-variable DOUBLE WHITE LINES is a sum of three dichotomous variables, which measured subjects' decisions to overtake on double white lines.

Table 37a. Analysis of Variance On The Meta-Variable
 'Overtaking On Double White Lines' By
 Developmental Group and Sex.

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F

Main Effects	11.974	5	2.395	3.108	.010
DEV.GROUP	11.766	4	2.942	3.818	.005
SEX	.052	1	.052	.068	.795
2-way Interactions	3.757	4	.939	1.219	.303
DEV.GROUP SEX	3.757	4	.939	1.219	.303
Explained	15.731	9	1.748	2.269	.019
Residual	174.116	226	.770		
Total	189.847	235	.808		

The above table indicates that there was a significant developmental group effect only, at $p=0.005$: there were no sex or interaction effects. Results from a Tukey Test indicated that the largest differences ($p<0.05$) are between the lowest scoring groups (group 3 and group 5) and the highest scoring group (group 1). Details related to the Tukey Test are held in Appendix E2 (Table 37c). The table of means in Appendix E2 (Table 37b) indicates that the younger subjects had a higher rate of overtaking on double white lines, than the 17-18 year old drivers, or the 15-16 year olds.

b) Overtaking Frequency.

The meta-variable OVERTAKING FREQUENCY is a sum of three overtaking frequency variables (one variable from each of the three scenes presented to subjects). Subjects were allowed up to a maximum of five overtaking manoeuvres per scene: hence the variable OVERTAKING FREQUENCY has a range from 0 to 15.

Table 38a. Analysis of Variance On The Meta-Variable
 'Overtaking Frequency' By Developmental
 Group and Sex.

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F

Main Effects	203.837	5	40.767	4.164	.001
DEV.GROUP	176.529	4	44.132	4.508	.002
SEX	17.714	1	17.714	1.809	.180
2-way Interactions	75.479	4	18.870	1.927	.107
D.GROUP SEX	75.479	4	18.870	1.927	.107
Explained	279.316	9	31.035	3.170	.001
Residual	1889.512	193	9.790		
Total	2168.828	202	10.737		

The above table indicates that there was a significant developmental group effect only, at $p=0.002$ level: there were no sex or interaction effects. Results from a Tukey Test indicated that the largest differences ($p<0.05$) are between the highest scoring groups (group 1 and group 2) and the lowest scoring group (group 5). Details related to the Tukey Test are held in Appendix E2 (Table 38c). The table of means in Appendix E2 (Table 38b) indicates

that the younger subjects have higher mean levels of overtaking across the three scenes, while the 17-18 year old drivers have the lowest. As age increases and subjects gain first-hand driving experience the tendency to overtake decreases.

2) Hazard Perception and Response.

Analysis of variance tests were undertaken on the five variables presented below (measuring subjects' decisions whether or not to brake in potentially hazardous situations) to examine for developmental group, sex and interaction effects. All of the variables, which are defined below, are dichotomous.

WOMAN & DOG - a measurement of whether subjects chose to brake when a woman with a dog ran out into the road straight in front of the subjects' car.

CYCLIST - this variable measures whether subjects chose to brake when a cyclist swerved off of the pavement straight in front of the subjects' car.

TWO-CAR - this is a measurement of whether subjects chose to brake when two cars (one after the other) pulled out into the path of the subjects' car.

CROSSING - this variable measures whether subjects chose to brake when a woman holding a baby ran out onto a crossing in front of the subjects' car.

D-CARRIAGEWAY - this is a measurement of whether subjects chose to brake when a car in the right-hand lane of the dual-carriageway pulled across straight in front of the subjects' car.

Results from the two-way analysis of variance tests indicated that there were no significant developmental group, sex or interaction effects (at $p < 0.01$) on any of the above variables. Details of the analysis of variance tests, the means and the standard deviations of these five variables are presented in Appendix E2 (Table 40a to 40j).

6.7 INTERACTIVE VIDEO RESULTS SECTION 4a.

CREATION OF 'ROAD ENVIRONMENT AWARENESS' META-VARIABLES FROM THE VERBAL COMMENTARY TASK SCENES.

Six meta-variables relating to 'road environment awareness' were created from component variables derived from the verbal commentary task scenes. These six meta-variables were formed from the results of reliability analyses.

All of the component verbal commentary variables employed in the six reliability analyses were dichotomous, in that subjects were either aware, or not aware, of the various aspects of the road environment around them and associated task demands (behaviours and observations). The assigned values were either 0 (no reported awareness) or 1 (reported awareness). The situation to which each meta-variable refers are described below.

Each meta-variable label and its meaning are given below, followed by a summary of the reliability analyses. Full details of the component variables within each meta-variable, their meanings, and the results from the reliability analyses are presented in Appendix E3 (Tables 41b to 41g).

AWARENESS OF ROAD TRAFFIC SIGNS

This meta-variable is comprised of 5 variables concerning awareness of visible road traffic signs and markings. The variables included elevated signs on 'A' roads and motorways, and signs/directions painted on the road.

AWARENESS OF NON-INTERACTING ROAD USERS

This meta-variable is comprised of 11 variables concerning awareness of other visible road users, whose positions and behaviours meant that subjects were not interacting with them. The variables included awareness of cars ahead, beside and behind the subject's car, awareness of parked vehicles, vehicles waiting to pull out from junctions/changing lanes, and awareness of pedestrians.

AWARENESS OF INTERACTING ROAD USERS

This meta-variable is comprised of 7 variables concerning awareness of other road users, whose position and behaviours meant that subjects were interacting with them.

The variables included awareness of overtaking vehicles, vehicles at junctions, vehicles braking suddenly, and vehicles causing an obstruction.

AWARENESS OF ROAD LAYOUT

This meta-variable is comprised of 5 variables concerning awareness of road layout. The aspects of road layout included a bridge, junctions, traffic lights and a layby.

AWARENESS OF REQUIRED ACTIONS/BEHAVIOURS

This meta-variable is comprised of 9 variables concerning awareness of the required actions, behaviours or manoeuvres a safe driver should make, given the current traffic situation and the driver's current course, across nine situations. The required actions and behaviours included signalling before making a manoeuvre, getting into the correct lane when approaching a junction, and adjusting speed according to the situation.

AWARENESS OF REQUIRED OBSERVATIONS BEFORE ACTION

This meta-variable is comprised of 5 variables concerning awareness of the required observations a safe driver should make before executing an action or manoeuvre. The required observations included looking for a clear space before joining a motorway or roundabout, observations of cars pulling out from junctions, and observations of following traffic.

The verbal commentary task variables were grouped logically by the author according to different aspects of awareness, and measurement, within the road traffic environment. Once the component variables had been grouped logically into six areas, reliability analyses were then performed. Table 41a presents a summary of the reliability analyses on the verbal commentary task variables.

Although the alphas produced by the reliability analyses varied in their magnitude, the logical grouping of variables according to the area of measurement and content was retained for specific reasons. It is believed that it is correct to expect low reliability between items within the same area grouping as the variables reflect measurements of subject performance over different situations. Subjects' performance on a particular type of variable (for example, awareness of other non-interacting

road users) will vary from situation to situation according to the difference in the levels of complexity between situations. Some scenes presented to subjects could be considered very 'busy' (many other road users, some interacting with the subject's car, and others not) and thus placing a greater demand upon the subject's cognitive capacity, while other scenes could be considered somewhat 'empty' with few other road users around, with less aspects to concentrate on, placing less demands upon subject's cognitive capacity. Hence, it is to be expected that performance on particular verbal commentary tasks will vary to some extent across situations. By grouping these variables logically, it provides one with a measurement on verbal commentary tasks across a wide range of road traffic situations.

Table 41a. Summary Of The Reliability Analyses
Conducted On 'Road Environment Awareness'
Variables.

<u>META-VARIABLE</u>	<u>N. of Cases</u>	<u>N. of Variables</u>	<u>Cronbach's ALPHA</u>
ROAD TRAFFIC SIGNS	236	5	0.3171
NON-INTERACTING ROAD USERS	236	11	0.3030
INTERACTING ROAD USERS	236	7	0.4670
ROAD LAYOUT	236	5	0.2480
REQUIRED ACTIONS/BEHAVIOURS	236	9	0.4727
REQUIRED OBSERVATIONS BEFORE ACTION	236	5	0.3439

Full details of the analyses are contained in Appendix E3 (Tables 41b to 41g).

6.8 INTERACTIVE VIDEO RESULTS SECTION 4b.

EXAMINATION OF GROUP DIFFERENCES ACROSS 'ROAD ENVIRONMENT AWARENESS' META-VARIABLES.

This section provides the results of two-way analysis of variance tests on meta-variables measuring awareness of the road environment.

The following six meta-variables represent measurements of different aspects of awareness of the road environment, and were created from component variables derived from the verbal commentary task scenes (as described in Section 4a):

- (1) ROAD TRAFFIC SIGNS
- (2) NON-INTERACTING ROAD USERS
- (3) INTERACTING ROAD USERS
- (4) ROAD LAYOUT
- (5) REQUIRED ACTIONS/BEHAVIOUR
- (6) REQUIRED OBSERVATIONS BEFORE ACTION

Full definitions of each of the above six meta-variables are presented in Section 4a.

Results from the two-way analysis of variance tests indicated that there were significant sex effects (at $p < 0.01$) on the variable INTERACTING ROAD USERS. Table 42a presents the results of the analysis of variance test on this variable, while Table 42f (in Appendix E4) presents the means and standard deviations.

The remaining variables did not show any developmental group, sex or interaction effects (at $p < 0.01$), and so are not reported any further here, but details of the analysis of variance results (some significant at $p < 0.05$), the means and the standard deviations are held in Tables 42b to 42L in Appendix E4.

Interacting Road Users.

The variable 'INTERACTING ROAD USERS' is a mean of seven dichotomous variables indicating subjects' awareness of other road users whose position and behaviours meant that subjects were interacting with them, across seven different situations (e.g., cars pulling out, overtaking or obstructing the subjects' car).

**Table 42a. Analysis Of Variance On The Meta-Variable
'Interacting Road Users' By Developmental
Group and Sex.**

Source of Variation	Sum of Squares	DF	Mean Square	F	Signif of F

Main Effects	1.040	5	.208	5.688	.000
DEV.GROUP	.304	4	.076	2.077	.085
SEX	.674	1	.674	18.425	.000
2-way Interactions	.189	4	.047	1.291	.274
DEV.GROUP SEX	.189	4	.047	1.291	.274
Explained	1.229	9	.137	3.734	.000
Residual	8.263	226	.037		
Total	9.492	235	.040		

The above table indicates that there were significant sex effects only (at $p < 0.01$): there were no significant developmental group, or interaction effects. The table of means (Table 42f in Appendix E4) indicates that while males were aware of other interacting road users 31% of the time, females were aware only 20% of the time. An examination of the means for the developmental groups indicates that as age increases and first-hand driving experience is obtained, so does awareness of other interacting road users. Results ranged from 21% for 11-12 year olds, to 32% for 17-18 year old drivers. The 17-18 year old male drivers had the highest awareness of all developmental-sex groups, with results of 38%.

6.9 SUMMARY OF THE INTERACTIVE VIDEO RESULTS.

Overall, results indicated that there were a number of differences between the developmental groups with respect to hazard evaluation, risk perception, risk-taking and 'road environment' awareness on the Interactive Video Driving Programme. This section presents a brief summary of these results.

Results on hazard evaluation indicated that in general, 17-18 year old drivers perceive less danger in potentially hazardous situations than the younger non-driving subjects. Results on specific variables measuring hazard perception and response (an examination of whether subjects chose to brake in potentially hazardous situations), indicated that there were no differences between the developmental groups.

The results on a general aspect of risk-perception indicated that there were no significant differences between the developmental groups. However, while there were no differences between the developmental groups in terms of their perceptions of the likelihood of an accident, and their perceived seriousness of an accident, results indicated that, overall, subjects rated the perceived likelihood of an accident lower than the likelihood that such an accident would be serious.

Examination of a specific comparative aspect of risk-perception, that of subjects' perceptions of the likelihood of accident-involvement for 'self' and for 'the average driver', showed that there was an overall 'self-other' effect: subjects rated the perceived likelihood of an accident for the 'average driver' to be higher than for themselves. Furthermore, as age increased (between 13 to 18 years) and driving experience was obtained, the difference between subject ratings of accident likelihood for the 'average' driver and 'self' decreases. Results also indicated that in general terms, as age increases and driving experience is obtained, the perception of the likelihood of an accident for both 'oneself' and for the 'average driver' decreases.

In terms of speed as an example of a risk-taking behaviour, results showed that 17-18 year old drivers have a higher preferred driving speed than younger non-driving subjects. These older subjects also had a higher rate of deceleration when approaching a potentially hazardous area, but it would seem likely that this was due to their higher initial speed.

A consideration of overtaking behaviours as an example of risk-taking showed that there were some differences

between the developmental groups: younger subjects had a higher overall frequency of overtaking, and also a higher rate of overtaking on double white lines. In general, as age increases and subjects obtain first-hand driving experience it would appear that the tendency to overtake decreases.

An examination of subject awareness of different aspects of the road environment revealed one significant developmental group difference: as age increased and first-hand driving experience was obtained, the awareness of interacting road users increased. However, while there were no significant differences between the sexes on any of the hazard evaluation, risk perception or risk-taking variables, there was one difference in terms of 'road environment' awareness. Results indicated that males had greater awareness of other interacting road users than females.

In summary, the results from the Interactive Video Driving Programme indicate that as age increases and driving experience is gained, subjects perceive less danger in potentially hazardous situations, perceive a lower likelihood of an accident for both themselves and the 'average driver', have a greater awareness of required actions and behaviours, prefer to drive at higher speeds requiring greater deceleration in hazardous areas, but also choose to overtake less.

CHAPTER 7.

DISCUSSION.

CHAPTER 7.

DISCUSSION.

7.0 INTRODUCTION.

Sections 7.1 to 7.6 below provide detailed summaries and discussions of the results from the Non-Driver Questionnaire, Driver Questionnaire and Interactive Video Driving Programme (I.V.D.P.). Each of these sections deals with a particular area of road user behaviour, and within each there is an integration of the results from the different samples (driver and non-driver) and the different methodologies (survey and interactive video).

It is useful to highlight two methodological points which have an impact upon the discussion of the results, both within this study, and between this study and previous research.

Firstly, with respect to a comparison of results between different samples and methodologies, one point needs to be noted. While there were four non-driver age groups formed within the I.V.D.P. study, due to the restricted sample size of 17 and 18 year old drivers, only one driver age group was formed (17-18 years). This meant that while comparisons could be made between the non-driver age groups and one driver age group, comparisons between drivers of 17 and 18 years were not possible.

Secondly, a point to be noted when comparing the results from previous studies with those of the present study, is that previous studies have often used wide and disparate age range samples, whose definitions of 'young' drivers often range from 25 years downwards. Any age differences within the driver sample in the present study cannot be termed as differences between 'young' and 'old' drivers, but rather differences between 'younger' and 'older' drivers within a young driver sample: hence any differences between the age groups within this young driver sample will serve to qualify previous research findings, by highlighting the developmental changes that occur within this group of drivers, a group who researchers often treat as homogeneous.

Following on from sections 7.1 to 7.6, which present summaries and discussions of the results, sections 7.7 to 7.12 present discussions of methodologies, issues of

generalization, implications for driver and pre-driver education, recommendations for future research and conclusions.

7.1 DRIVING OFFENCES AND LAW ENFORCEMENT.

7.1.1 Summary Of Results.

The results from the Non-Driver and Driver Questionnaire studies pertaining to driving offences and law enforcement are summarised below.

The results from the Driver Questionnaire study showed that there were no significant age, sex or interaction effects on *meta-variables* measuring the perceived seriousness of driving offences and the perceived likelihood of detection for driving offences. Results indicated that while all young drivers tend to perceive a reasonable likelihood of detection for driving offences, they also only rate the seriousness of these offences as moderate. Related to this may be the attitude of these young drivers towards the police: while there was a significant univariate age effect (with 19 year olds having the most negative attitude towards the police), overall, all age groups had a fairly neutral attitude towards the police.

The results from the Non-Driver Questionnaire study indicated that in general as age increases (and young people reach an age when they can learn to drive) the perceived dangerousness, seriousness and likelihood of detection for driving offences decreases, the acceptability of driving offences increases, and a more negative attitude towards the police increases. An exception to these results is that at the ages 17-18 years, the perceived seriousness of offences increases again. Results also indicated that males rated the acceptability of driving offences higher than did females.

A more detailed analysis of a set of 15 driving offence variables was conducted in a direct comparison between the age groups and sexes within both the driver and non-driver samples. Analysis of variance tests were performed on 15 variables measuring the perceived seriousness of 15 different driving offences: interesting univariate and multivariate developmental group and sex effects were revealed. Females were found to rate the following 7 (out of 15) driving offences as significantly more serious than did their male counterparts: driving too fast on roundabouts, driving through red traffic lights, driving above the speed limit on motorways, overtaking when

approaching a bend, driving without a licence, and driving when having drunk slightly, or greatly, over the legal limit. All of the 7 variables which indicate significant differences between males and females can be defined as serious, risk-taking offences, often involving speed. However, the 8 variables for which there are no significant sex effects, can be defined as less serious offences in terms of the perceived risk associated with them: these less serious offences involve signalling omissions, illegal parking, contravention of the lower speed limits, failure to give way to other drivers or pedestrians, close-following and illegal U-turns.

While there were significant developmental effects on 10 out of the 15 driving offence variables, the direction of these effects was not always simply in terms of a straightforward increase or decrease. It was interesting to note that as the developmental stage increased the perceived seriousness of the following offences decreased: driving too fast on roundabouts, parking on double yellow lines or on the pavement, contravention of the speed limit on motorways or around town. Of further importance is the finding that the perceived seriousness of driving without a licence, and driving when having drunk slightly over the legal limit decreased between the ages 11-14 years, but increased between 15-18 years within the non-driver sample, but again decreased with the 17-18 year old drivers.

Close examination of these results indicates that while the relationship between sex and the perceived seriousness of offences is a fairly simple one (allowing a clear definition and categorisation of the significant offence variables), the relationship with developmental groups is not: there is no clear categorisation of the offences that revealed developmental group differences, and these observed effects were not simple in their direction.

7.1.2 Discussion Of Results.

Previous research has emphasised the over-representation of young drivers in conviction rates for driving offences, even after exposure has been controlled (Pelz and Schuman, 1971). The findings presented by this study on the development of young peoples attitudes and perceptions, in relation to driving offences and law enforcement, do give some cause for concern. The results from the present study are similar to previous research findings in some respects, while also providing some different results and new insights into the issue of young people's attitudes towards driving offences and law enforcement.

In contrast to MacMillan's study (1975) which found that

women rated all driving offences (except driving without insurance) as more serious than did their male counterparts, and Brown and Copeman's study (1975) which found that young males rated offences less serious than other groups, the present study did not reveal any sex, or age-sex interaction effects, on a meta-variable measuring the 'perceived seriousness of offences', within either the driver or non-driver sample. However, significant univariate and multivariate sex effects were found in the analysis of 15 variables measuring the 'perceived seriousness of driving offences'. These results provide a relatively clear categorization of which variables reveal significant sex effects: unlike previous studies, sex effects were revealed only on the more serious, risk-taking offences, often involving speed.

In terms of age effects, the study by MacMillan (1975) found that young male drivers were significantly more tolerant of moving motoring offences than older drivers, while Brown and Copeman (1975) found that young drivers (and young male drivers) rated driving offences as less serious than older drivers (or young female drivers). While there was no 'older' driver group in the present study with which to compare young drivers, significant developmental group effects were found within the young driver and non-driver sample. Although significant age effects were not found within the driver sample, only the non-driver sample, when one 'driving offence' meta-variable was employed, significant univariate and multivariate developmental group effects were found across the age groups within the driver and non-driver samples, in the analysis of 15 variables measuring the 'perceived seriousness of driving offences'. However, unlike MacMillan's (1975) and Brown and Copeman's (1975) studies, the age effects across the driver and non-driver samples were not evident on all of the 15 driving offence variables. Additionally, the age effects were not as straightforward as one might expect in the light of previous research: on five of the driving offence variables the variable-age relationship was not linear: in particular, the perceived seriousness of driving when having drunk slightly over the legal limit increased between 15-18 years within the non-drivers (after a decrease between 11-14 years), but decreased again with the 17-18 year old drivers. This finding is important, as other research has suggested that one of the characteristics associated with the offence of drink-driving is a low perception of the seriousness of the offence (Clayton, 1984).

Another finding by MacMillan (1975) was that young males were more tolerant of 'moving motoring offences' than other groups of drivers. Although the present study, unlike MacMillans, did not reveal any age-sex interaction

effects there were some age and sex effects which are in a similar vein to those found by MacMillan: as age increased the acceptability of driving offences (as measured by one meta-variable) also increased, while males also rated the acceptability of driving offences higher than did females.

MacMillan's study not only showed that young drivers hold lower perceptions of the seriousness of driving offences, but but also that these young drivers were more aggressive, competitive and faster drivers than older drivers. Similar results were found in the present study (and reported in more detail later on): as age increased so did a positive attitude towards reckless driving, aggressive attitudes and an increased perception of one's driving style as 'fast'.

One of the other driving offence results, that as age increased (within the non-driving sample) the perceived likelihood of detection decreased, is also of importance, as previous research has suggested that drink-drive offenders have lower perceptions of the likelihood of detection than non-offenders (Guppy, 1986).

From the above results it would appear that there is some cause for concern with respect to the development of young people's attitudes towards driving offences and law enforcement. Results have suggested that as age increases from 11-18 years with non-drivers, there is a decrease in the perceived likelihood of detection for offences, a decrease in the perceived seriousness of some offences, and a reduction in a positive attitude towards the police. In addition to this, the combined analysis of drivers with non-drivers indicates that perceptions of the seriousness of at least some offences decreases as age and driving experience increases. These results may assist in shedding some light on previous research findings which have revealed that violations increase steadily until 18 years, and then tend to decline (Ferdun et al, 1967; Harrington, 1972). In particular, while research by Harrington and McBride (1970) indicated that speed was the most frequent violation in drivers aged 16-19 years, an examination of the 15 'perceived seriousness of offences' means from the present study, reveals that overall, the two speeding offences were rated as the least serious offences out of all the 'moving motoring offences' (2 out of 13 offences). These perceptions that young people develop towards driving offences, may in part determine their transgression of these road traffic laws, and hence deserve special consideration in the design of educational programmes.

7.2 RISK-TAKING BEHAVIOURS.

7.2.1 Attitudes Towards Risk-Taking.

7.2.1.1 Summary Of Results.

In terms of general risk-taking and driving, results from the Driver Questionnaire study revealed that in general, as age increased young drivers reported a higher risk motivation, a more positive attitude towards reckless driving, a greater confidence in their driving skills, a perception of themselves as faster drivers than others, a more aggressive and superior attitude towards other drivers, and a more negative attitude towards the offence of drink-driving and its offenders.

While there was a reported increase in reckless driving (the enjoyment of racing on roads, aggressive driving and speed) between the ages 17 and 18, there was also a decline again by the age of 19 years, although not to the same baseline level of 17 years. There was also a small decline in the reporting of a superior and aggressive attitude towards other drivers between the ages 17 to 18 years, but a large increase again by the age 19 years.

In terms of significant sex effects, females drivers reported a lower risk motivation, a less positive attitude towards reckless driving, a higher perception of the importance of car safety features, lower driving confidence and driving at lower speeds on average than other drivers, compared to their male counterparts.

These general findings on speeding, driving confidence and drink-driving within the driver sample have been examined in further detail in later sections (Speeding: Section 7.2.2; Perceptions of Skill: Section 7.3.1; Drink-Driving: Section 7.4), as they complement the more detailed findings produced by other analyses.

It was not feasible to address the issue of driving behaviours with the non-drivers in the same manner that had been used with the drivers, for obvious reasons. However, it was possible to ask the non-driving subjects questions that related to their perceptions of their future driving styles (in other words, what sort of driving behaviours they thought they would exhibit when they became drivers). Results indicated that there were several significant multivariate and univariate age (but not sex) effects across risk-taking items pertaining to driving skills, self perceptions, perceptions of future driving style, and attitudes towards driving for thrill-seeking and emotion expression. Between the ages

11 and 16 years there is an increase in the perception of driving as a means for thrill-seeking and emotion-expression, but a decrease again by the ages 17-18 years. As age increased so did the perceived importance of the image of a car. There were also significant multivariate age effects on the meta-variable 'future driving style': as the age of the driver increased, the perception that their driving style would be fast, skilful and involve taking risks, also increased. In addition to this, there was however a significant age effect in terms of self perceptions: as age increased there was also an increasing perception of independence and respect for authority.

While it was not possible to ask the non-drivers specific questions about their 'normal driving behaviours' in the Non-Driver Questionnaire, in the same way that drivers were asked in the Driver Questionnaire, it was possible to address this issue through the I.V.D.P. (as subjects were provided with a simple simulated car driving task). The next sub-sections on risk-taking behaviours provide more in-depth details on the reported speeding (Section 7.2.2), overtaking (Section 7.2.3) and close-following (Section 7.2.4) behaviours of both the driver and non-driver samples.

7.2.1.2 Discussion Of Results.

The results from the present study into the general area of young drivers and attitudes towards risk-taking mostly complements previous research findings (Schuman, Pelz, Ehrlich and Selzer, 1967; MacMillan, 1975; Quimby and Watts, 1981; Evans and Wasielewski, 1983; Wasielewski, 1984; Jessor, 1987; Wilson, 1987).

Studies by Schuman et al (1967), Quimby and Watts (1981), Evans and Wasielewski (1983), and Wasielewski (1984) among others, have indicated that younger drivers often adopt a 'riskier' style of driving than older drivers. Schuman et al (1967) and Quimby and Watts (1981) have suggested that young drivers are more likely to engage in risk-taking behaviours in order to 'let off steam'. However, Schumann et al (1967) also suggested that while there is a decline in the use of the car for thrill-seeking and emotion-expression with age, there is also an associated increase in confidence in driving ability.

Results from the Driver Questionnaire study showed that while drivers reported a higher risk motivation as age increased between 17-19 years, a more positive attitude towards reckless driving was reported between the ages 17 to 18, but a decline again at 19 years (although not to the same level as at 17 years). In addition to these

risk-taking attitudes, results also suggested that there is an increase in driving confidence between the ages 17-19 years. These significant results may suggest that as age increases from 17-18 years (and possibly driving experience) along with greater driving confidence, young people report more enjoyment of what may be considered 'reckless' or 'dangerous driving': this tends to peak at the age of 18 years but decline somewhat at the age of 19 years.

Whereas MacMillan (1975) reported a decline in aggressive attitudes as the age of drivers increased, the results from the Driver Questionnaire study indicate a different pattern in the formative driving years. There was a small decline in the reporting of a superior and aggressive attitude towards other drivers between the ages 17 to 18 years, but a large increase again by the age 19 years. It may be that after one or two years experience driving, young people have had experiences on the road which reduce an aggressive and superior attitude, but with a little more experience again by the age 19 years, plus increased confidence, their superior and aggressive attitude towards other road users increases again to a much higher level.

Other research, by Wilson (1987) (which employed a wider age-range of young drivers than the present study), has reported that young drivers rate themselves as being more rash, faster and less compliant than older drivers. Results from the present study indicated that these 'speed' age-related differences occur from a very young age: the perception of oneself as a fast driver was shown to increase between the ages 17-19 years. A more detailed discussion of 'speeding', in terms of reported and observed behaviour, is conducted in the next section (Section 7.2.2).

The Driver Questionnaire study also produced results on sex differences in relation to risk-taking within the young driver sample, that are similar to those produced by previous researchers with wider age-range samples. Research by Wilson (1987) indicated that women drivers were less likely to overtake, less likely to drive fast, and less willing to take risks than men, while MacMillan found that women were less aggressive in their driving than men, and Jessor (1987) found that women reported taking less risks 'for fun' than men. Similarly, in the present study it was revealed that young females had a lower risk motivation, a less positive attitude towards reckless driving, and perceived themselves as less fast drivers than their young male counterparts. It is interesting to note that while earlier research by Jonah and Dawson (1982) found that young drivers (16-25 years) rated the importance of car safety features lower than older drivers, the present study, while not producing any

age effects, produced a sex effect instead. The lack of an age effect may be due to the limited age-range employed in the present study, but the significant sex effect is what one might expect given that other results indicated that females also have a less positive attitude towards risk-taking than males.

In summary, it can be seen that while previous research has highlighted differences between young and older drivers in terms of general attitudes towards risk-taking, this study has shown that very similar differences can be found in terms of a developmental pattern with a sample of young (17-19 year old) drivers.

Although the results from the sample of young drivers indicated differences between the sexes in their general attitudes towards risk-taking, the results from the sample of non-drivers (aged 11-18 years) did not. There were no differences between the non-driving males or females in terms of their attitudes towards driving for thrill-seeking and emotion-expression, or their perceptions of their future driving styles. However, some interesting age-effects were discovered.

Similar to the findings of earlier researchers (Schuman et al, 1967; Evans and Wasielewski, 1983; Wasielewski, 1984; Jessor, 1987; Wilson, 1987) that some risk-taking behaviours are related to the age of the driver, results from the Non-Driver study indicated that as age increased (between 11-18 years), so did a perception that their future driving style would be fast, skilful and risk. While there was a simple age effect in the perception of one's future driving style, the results on 'driving a car as a means for thrill-seeking and emotion-expression' were more complex: between the ages 11-16 years there was an increase in the perception of driving as a means for thrill-seeking and emotion-expression, but a decrease again by the ages 17-18 years, suggesting the development of a more responsible attitude.

7.2.2 Speeding.

7.2.2.1 Summary Of Results.

The above findings on subjects' perceptions of their own driving speed in relation to other drivers, can be seen in the context of their reported driving behaviours. The results from the analysis into reported driving speeds (in terms of transgression of speed limits), revealed that there were in fact no significant age effects: so while the perception of oneself as a fast driver increases with

age, the self-reported behaviour of speeding among these young drivers does not. Similar results were found on variables that required drivers to state how fast they drive on a variety of roads: there were no significant age effects. Overall, subjects reported being unlikely to exceed a 60mph speed limit on a winding country lane, but they were prepared to break a 60mph speed limit on a two-lane main road. These results which indicate no age effects within the driver sample are in contrast to those reported above on the non-driving subjects, where the perception that one would be a fast driver increased with age (between 11 and 18 years).

While there are no significant age effects for the transgression of speed limits, an examination of the means does indicate that in general, as age increases so does the reported contravention of the 30, 40, 50, 60, and 70 mph speed limits. However, it can also be seen from the group means (Table 20a and 20d, Appendix C3) that the reported frequency of contravention decreases as the speed limit increases.

It is interesting to note here the findings on 'driver speed' from the I.V.D.P. Results showed that the 17-18 year old drivers had a higher preferred driving speed than their younger and non-driver counterparts. These older subjects also had a higher rate of deceleration when approaching a potentially hazardous area, but it would seem likely that this was due to their higher initial speed. These I.V.D.P. results concerning 'driver speed' do not indicate any significant differences between the four non-driver age groups, and as such are different from the non-driver questionnaire study which found significant age effects in terms of predictions of their 'future driving style' (part of which indicated that as the age of the non-drivers increased so did a perception that their future driving style would be fast).

The results on general risk-taking showed that females perceived themselves as driving slower on average than other drivers, compared to their male counterparts, and the findings on the reported contravention of speed limits complements this: there were significant univariate sex effects across all of the contravention of speed limit variables, indicating that males reported higher rates of contravention of all speed limits ranging from 30mph to 70mph. This results fits in with previous research findings that males tend to drive faster than females (Wilson, 1987). In addition to this, the findings across a range of reported driving behaviour variables also indicated that males reported driving at a much higher speed (60mph on average) on a winding country lane, than did females (50mph on average). There was also a univariate sex effect which showed that males reported driving faster

on two-lane main roads than females.

However, the findings from the I.V.D.P. did not indicate any significant sex differences in terms of either 'preferred driving speed' or the rate of deceleration when approaching a potentially hazardous area.

7.2.2.2 Discussion Of Results.

The above results on reported driving speeds, indicated that while the perception of oneself as a fast driver increased with age, the self reported behaviour of speeding did not. These results are in contrast to some of the earlier findings on self-reported driving behaviours, which have indicated a relationship between speed and the age of the driver (Schuman et al, 1967; Quenault et al, 1968; Harrington, 1972; Spolander, 1982; Wasielewski, 1984).

The present study replicated two of the speeding items used by MacMillan (1975) that produced both age and sex effects ('what is the fastest speed that you would be prepared to drive at on a) a straight open road and b) a narrow winding country lane?'). The results from the present study can be seen in comparison to those of MacMillan (1975): while there were no significant age effects, there were significant sex effects (men reported driving faster than women on both open and narrow roads). However, as was noted earlier, some caution is needed in the interpretation of these results as subjects may have been reporting their 'usual' driving speeds, as opposed to their fastest speeds: hence these results into driving speeds may be rather conservative.

Some of the interesting results from the Driver Questionnaire study are the findings on the transgression of speed limits. Contrary to earlier findings by Quenault et al (1968), that young drivers were more likely to drive faster in 30mph speed limits than older drivers, the present study indicated that there were no significant age effects on the transgression of the 30 and 60mph speed limits (only on the 40 and 50mph speed limits). It can be seen from the means that as age increased so did the reported transgression of all the speed limits. However, it can also be seen that the reported frequency of transgression decreases as the speed limit increases. What is not clear from these results is whether these young drivers are less likely to break the higher speed limits due to their lack of experience on the types of roads with higher speed limits, or because they feel it is more dangerous to do so.

An examination of some of the previous research indicates

similar findings between those studies that have used self-report methods (e.g., Schuman et al, 1967; MacMillan, 1975; Spolander, 1982), and those that have used observational methods (e.g., Quenault et al, 1968; Wasielewski, 1984; Wilson, 1987) to produce data on driver speed and age effects: generally, there has been a trend for the observed and reported driver speeds to decrease as the age of the driver increases. However, the two methods of questionnaire self-reports and observations through interactive video simulation, in the present study have produced disparate results.

While the findings on 'driver speed' from the I.V.D.P. indicated that the 17-18 year old drivers had a higher preferred driving speed than their younger and non-driver counterparts, there was no direct comparison that could be made with the questionnaire results (as the driver and non-driver results on 'driver speed' were measured by different items). However, the fact that the I.V.D.P. results on 'preferred driving speed' did not indicate any significant differences between the four non-driver age groups, while the Non-Driver Questionnaire results on 'perceptions of 'future driving styles' did, may suggest that different results are being produced by the different methodologies.

While the findings from the Driver Questionnaire study indicated that males reported driving at higher speeds, and breaking speed limits more often than females, the findings from the I.V.D.P. did not produce any speed-related sex effects.

These results may be used to suggest that the *interactive nature* of the I.V.D.P. (in this case, where subjects were asked to provide details of the speed that they would choose to drive along at, as 'their' car was driving along a particular road), may have resulted in decreasing any differences between the sexes, and between the non-driver age groups. What is not clear from the two sets of results, is whether measurement of 'driving speeds' using interactive video techniques, results in raising the speeds of female drivers/younger non-drivers, up to the same level as the male drivers/older non-drivers, or whether it results in reducing the speeds of male drivers/older non-drivers down to the level of the female drivers/younger non-drivers.

One explanation for the different results produced by the survey and interactive video methodologies may lie in the possible differential response biases produced by each methodology. The main differences between the methodologies are that while surveys generally present information in a textual format, interactive video presents subjects with identical visual representations of

particular decision situations: hence interactive video is more likely to produce similar mental representations across the different age and sex groups than survey methods. It would be expected that a method which allows greater opportunity for response bias (in this case, survey methods), would also be more likely to produce between-group differences, which are a reflection of differences in the interpretation of the question, rather than true differences in the decision-making process.

7.2.3 Overtaking Behaviours.

7.2.3.1 Summary Of Results.

The results from the driver sample indicated some significant age and sex effects in the frequency of different overtaking manoeuvres. Although there were no significant age effects in terms of the overall frequency of overtaking manoeuvres, seventeen year old drivers reported overtaking on the inside on motorways quite frequently, whereas 18 and 19 year olds reported only occasionally doing so. Males were more likely than females to overtake a car even if it would mean cutting in closely if an oncoming car was to appear. However, females reported the highest frequency of overtaking on the inside on motorways. Overall, with the exception of overtaking on the inside on motorways, subjects reported being unlikely to engage in dangerous overtaking manoeuvres,

When subjects' overtaking behaviours were examined using the I.V.D.P. (with a wider age ranged sample) however, there were very few group effects in terms of overtaking behaviours (overtaking on double or single white lines, near the brow of a hill, near a bend, in the face of oncoming traffic, or at a safe location). While there were no differences between the sexes in terms of overtaking behaviours, there was an important significant developmental group difference: in general, as age increases and driving experience is obtained, the overall tendency to overtake decreases.

7.2.3.2 Discussion Of Results.

In the examination of overtaking behaviours, the Driver Questionnaire study was successful in producing age effects within a sample of very young drivers (17-19 years), that had only previously been produced by previous researchers, in part, between groups of 'young' and 'older' drivers. Similar to the findings in the present study, earlier work by Quenault et al (1968), Spolander (1982) and Harris (1986), amongst others, has indicated

that young drivers exhibit a higher frequency of 'risky' overtaking manoeuvres, than older drivers.

While there were significant age and sex effects in terms of the reported overtaking behaviours in the Driver Questionnaire study, which are consistent with previous research findings, there were no significant sex effects, only developmental group effects, in terms of observed overtaking behaviours on the I.V.D.P.

The results from the I.V.D.P., which indicated that as age increased and driving experience was obtained, the overall tendency to overtake decreased, are also similar to previous research (Quenault et al, 1968; Spolander, 1982). This result is what one might expect in light of the existing research that as age increases there is a decline in the tendency to exhibit risk-taking behaviours (Jonah, 1986), but not what one might expect given the other findings from the present study, that as age increases from 17-19 years, there is also an increase in risk motivation. What is interesting is that this particular finding (the overall frequency of overtaking) was produced using the I.V.D.P., which utilised an interactive method of measurement (where subjects interacted with the system to indicate in real-time when they would choose to overtake), as opposed to the survey instruments which utilised passive measuring techniques. It may be that using an interactive mode of measurement presents the task to young (and particularly non-driving) subjects in a more realistic way. However, it should be remembered that the survey instrument was used to examine differences in overtaking behaviours between drivers, while the I.V.D.P. was examining for differences between developmental groups (which contained only one group of drivers).

The frequency of overtaking by the 17-19 year old subjects, where overtaking frequency decreased with age, can be viewed alongside the research by Sivak et al (1989). Sivak et al used a form of computer simulation to measure subjects' performance on simulated intersection crossings (although it is not clear from their article how sophisticated the computer program was). They found that young drivers (18-21 years) attempted proportionally more intersection crossings than older subjects, but that there were no age differences in terms of 'probability of success'. Comparing the results from the two studies it may be suggested that although younger drivers do attempt potentially dangerous manoeuvres more frequently than older drivers, this frequency may be seen to be at its highest at 17 years and has been shown to decline at both 18 and 19 years.

7.2.4 Close-Following.

7.2.4.1 Summary Of Results.

Results from the Driver Questionnaire study revealed that there were no significant multivariate age group or sex effects in terms of reported following distances: results showed that overall the young drivers would only leave a headway of 3-4 car lengths between their car and the one in front when travelling at 45mph (the Highway Code suggests approximately 160 feet which is approximately 12 Ford Escort car lengths). This can be seen as one of the risk-taking behaviours exhibited by the young drivers of 17-19 years, both males and females, and is in line with previous research (Evans and Wasielewski, 1983).

7.2.4.2 Discussion Of Results.

The results from the Driver Questionnaire study on the 'close following' behaviours of young drivers, revealed that this risk-taking behaviour is common to both males and females, and drivers aged between 17-19 years. Although the present study, with the use of survey techniques, did not find any age effects within a young driver sample, previous research, with the use of observational techniques, has found age effects within samples of drivers containing much wider age ranges: hence differences have been produced between groups of 'young' and 'older' drivers.

An observational study by Evans and Wasielewski (1983) found that out of a set of variables, age made the greatest contribution to the following distance adopted by drivers, indicating that younger drivers adopted closer following distances than older drivers. Other research by Quimby and Watts (1981) using a simulated driving task indicated that young drivers chose to drive with smaller safety margins than older drivers. Some explanation for this may lie in the perception of risk that young drivers attach to close-following behaviours. A study by Finn and Bragg in 1986 indicated that young drivers rated themselves (and other young drivers) at less risk of an accident when 'tailgating' than older drivers.

7.2.5 Specific Driver Age Effects For Risk-Taking Behaviours.

While some of the above results from the present study have indicated either an increase or decrease in certain perceptions and behaviours between the ages 17 to 19 years, they have also indicated a distinct change as

drivers reach 19 years of age. These changes are summarised and discussed below.

Firstly, the reported contravention of 60mph speed limits increases between the ages 17 to 18 years, but declines slightly again at the age of 19 years.

Secondly, there is an increase between the ages 17 and 18 years in a positive attitude towards 'reckless driving' (the enjoyment of racing on roads, aggressive driving and speed), but a significant decline again by the age 19 years.

Thirdly, in terms of attitudes towards other drivers, there is a decline between the ages 17 and 18 years in the tendency to hold a superior and aggressive attitude towards other drivers, but a significant increase again by the age 19 years.

Fourthly, there is an increase in a positive attitude towards the police between the ages 17 and 18 years, but a significant decline again by the age 19 years.

This paints a picture of the 19 year old driver as being less likely to break 60mph speed limits, holding less positive attitudes towards risk-taking, more negative attitudes towards the police, an increased superior and aggressive attitude towards other drivers, and a lower perception of the likelihood of an accident when engaging in a dangerous overtaking manoeuvre.

There is very little previous research with which to compare these precise results, for very few studies have considered the development of perceptions and behaviours in the first few years of driving. One of the studies that has, by Ferdun et al (1967), using a sample aged from 16-17 and 18-19 years, found that there were differences in the frequency of accident and moving violations. Ferdun et al found that while the frequency of accidents decreased with age, the frequency of moving violations increased steadily until 18 years, then decreased. This increase in moving violations from the age 16 to 18 years, followed by a decrease, can be seen as part of a similar behavioural pattern in the present study, where 19 year olds were less likely to break 60mph speed limits, and also held less positive attitudes towards reckless driving. However, these results may be linked to their perception of the likelihood of detection for offences such as speeding and reckless driving, for these 19 year old drivers also have a more negative attitude towards the police.

The increase in a superior and aggressive attitude towards other drivers, may be partly explained by an increased

confidence in one's driving skill with age. The issue of driving skill and confidence is summarised and then discussed in the next section (7.3.1).

7.3 RISK PERCEPTIONS AND HAZARD EVALUATION.

7.3.1 Perceptions of Skill.

7.3.1.1 Summary Of Results.

The issue of young people's subjective level of skill was addressed in both the Driver and Non-Driver Questionnaire studies and in the I.V.D.P. As will be seen below, there are some disparities in the findings.

There was a significant multivariate age effect, and univariate sex effect, on the Driver Questionnaire meta-variable 'driving confidence': results showed that firstly, as age increased drivers had greater confidence in their driving skills, and secondly, that males had a higher level of confidence in their driving skills than females. The above results on a general measure of driving confidence, are somewhat different to results on more specific measurements of driving skill. When subjects were asked to produce ratings of skill for themselves and for 'other' drivers across four different skill scenarios, results showed that drivers across all age groups (17-19 years), and from both sexes, perceived themselves to be more skilful than 'other' drivers across all the skill scenarios. However, there were no significant age or sex effects.

The issue of perceived driving skill was also addressed with the non-driving sample, but due to their lack of driving experience the questions were presented in a format that asked subjects to provide judgements on their perceptions of their *future* driving skills. The results produced with the non-drivers were not dissimilar to those produced on the metavariable 'driving confidence' with the driver sample.

The findings from the non-driver sample indicated that there were significant multivariate age effects in terms of the perception of the difficulty of mastering cognitive driving skills. As age increased it was found that the perception of the difficulty of mastering cognitive driving skills decreases: 17-18 year old non-drivers had the lowest ratings of the degree of difficulty involved, while 11-12 year olds had the highest. No age groups differences were found in terms of the perceived difficulty of mastering manual driving skills. There were

no significant sex effects on either manual or cognitive driving skills.

An examination of the perception of self-skill from the survey studies tends to suggest that, with both drivers and non-drivers, as age increases so does the perception of skill. In addition to this all drivers perceived themselves as more skilful than 'other' drivers. However, sex effects were apparent within the driver sample only: male drivers perceive a higher level of confidence in their driving than female drivers.

The issue of skill perception was also addressed using the I.V.D.P. Subjects provided perceptions of the likelihood of accident involvement for themselves and for the 'average driver' in a situation where a cyclist swerves off of the pavement into the road in front of their car. Overall, subjects rated the perceived likelihood of an accident for the 'average driver' to be higher than that for themselves. There was a significant developmental group 'self-average' interaction: as age increased (between 13 to 18 years) and driving experience was obtained, the difference between subject ratings of accident likelihood for the 'average driver' and 'self' decreases. Furthermore, as age increased and driving experience was obtained, the perception of the likelihood of an accident for both 'oneself' and for the 'average driver' decreases. This last finding is in line with the above survey findings that as age increases so does the perception of skill. There were no significant sex effects on the measurement of perceptions of the likelihood of accident-involvement with the I.V.D.P.

7.3.1.2 Discussion Of Results.

The results from the Driver Questionnaire study, that as age increases from 17-19 years, so does the level of confidence in one's driving ability, are similar to some previous research findings in the area (Schuman et al, 1967). However, while a general measure of driving confidence for oneself produced an age effect, a more specific measure of driving skill for oneself and 'others' across four specific situations did not. The results into the issue of the perception of skill for 'self' and 'others', while not producing any age or sex effects, did produce findings that are in line with previous research (Naatanen and Summala, 1975; Svenson, 1981; Spolander, 1982; Mathews and Moran, 1986; Sivak et al, 1989 and some that are different (Finn and Bragg, 1986): that drivers from a wide age range, as well as young drivers, perceive themselves to be more skilful than the 'average' driver, or 'other' drivers. However, the research by Finn and Bragg (1986), which also considered ratings of skill for

peers and older drivers (as opposed to the 'average' driver) has provided some evidence for an age effect. They found that while the young drivers perceive their age and sex to be at greater risk of accident-involvement than are older male drivers, they also perceive their own risk of accident-involvement to be significantly lower than that of their male peers.

From the findings from the Driver Questionnaire study, it would seem that both age and sex effects can be detected on general, but not specific, measures of driving skill and confidence.

While an examination of the results from the Non-Driver study indicates that there were no sex differences in skill perception, it also suggests that as age increases so does the perception of skill: as age increased the perception of the difficulty of mastering cognitive driving skills decreased. However, no age group differences were found in terms of the perceived difficulty of mastering manual driving skills. The work by Mathews and Moran (1986) is relevant to consider here: they found that young drivers rated themselves as superior to both their peers and older drivers in terms of vehicle handling skills, but only superior to their peers in terms of driving judgments.

Overall, the survey results have indicated that all drivers perceive themselves as more skilful than 'other' drivers, and that in general, as age increases so does the perception of self skill.

While there were no significant age effects in terms of ratings of skill for 'self' and 'others' from the survey data, there were significant self-other age effects from the interactive video data. Results from the I.V.D.P not only indicated that overall, subjects rated the accident-likelihood for the 'average' driver to be higher than that for themselves, but also that there was a significant developmental group 'self-average' interaction: as age increased and driving experience was obtained, the difference between subject ratings of accident likelihood for the 'average' driver and 'self' decreases.

This self-other developmental group interaction effect, produced using interactive video technology, is very important as it has not been reported from other methodologies, or with similar or older subjects before. This finding has implications for the design of education and training programmes and is discussed further in Sections 7.6.1, 7.7 and 7.10.

A further finding from the I.V.D.P, which compliments both

the survey studies and previous research, is that as age increases the perception of the likelihood of an accident for both oneself and the 'average' driver decreases.

While much of the above evidence suggests that young drivers tend to have high perceptions of their driving skills, there is also evidence to suggest that objectively they are less skilful when compared to older drivers (Shinar et al, 1978; Blaauw, 1982; Broughton, 1988). The inaccurate perception that young drivers hold of their driving skills, may be related to their risk-taking behaviours, and their over-representation in accident statistics. This may also help to explain why general media propaganda is unsuccessful: these young drivers may not identify with those who are in need of advice and instruction.

7.3.2 Accident Likelihood and Seriousness.

7.3.2.1 Summary Of Results.

The Driver Questionnaire study examined the perceived likelihood of accident-involvement, and seriousness, across six driving situations. The results showed that there were no significant multivariate age, sex, or age-sex interaction effects in terms of either the perceived likelihood of accident-involvement, or the perceived likelihood that an accident would be serious. However, univariate driver sex effects were apparent in the perceived likelihood of accident-involvement while speeding at 45mph in a 30mph speed limit: females reported a higher likelihood of an accident than did their male counterparts. A further examination of these means indicates that all driver age groups perceived a lower likelihood of accident-involvement, and lower likelihood that an accident would be serious, through close-following or speeding, than through dangerous overtaking manoeuvres.

When a further examination between the variables measuring 'the likelihood of engaging in a behaviour', 'the perceived likelihood of accident-involvement', and 'the perceived likelihood that an accident would be serious' across four overtaking situations is made, a distinct pattern emerges. In each of these four overtaking situations, subjects of all age groups reported a lower perceived likelihood of engaging in the relevant behaviour than the likelihood that an accident would occur, and also gave a lower likelihood that an accident would occur than the likelihood of the accident being serious.

The issue of perceptions of accident likelihood and

likelihood of seriousness were also studied utilising the I.V.D.P. Results on the I.V.D.P. were similar to those in the driver study in that there were no significant age, sex, or age-sex interaction effects in terms of the perceived likelihood that an accident would occur, or the likelihood that it would be serious.

The above issues of accident-likelihood and seriousness were considered too complex to be addressed in a questionnaire with the non-driver sample, which included subjects as young as 11 years old. However, some questions relating to the causes of road traffic accidents were addressed in the non-driver study, and are of interest here. Within the Non-Driver Questionnaire study subjects were asked to rate the perceived hazardousness of road conditions (such as rain, ice, fog and snow). Results showed that there were no significant age, sex or interaction effects in terms of the perceived hazardousness of road conditions. The Non-Driver Questionnaire study also examined the importance of internal and external accident causation factors. Results showed that there were no significant age or sex effects in terms of the perceived importance of accident causation factors that could be attributed internally to a driver (such as attitudes, experience and impairment). However, there were significant multivariate age effects (but not sex) in terms of the importance of accident causation factors that could be attributed externally to a driver (such as weather conditions and mechanical problems): as age increases young people pay less importance to external factors when attributing the cause of road traffic accidents, up until the ages of 17-18 years of age, when there is a sudden increase in the importance placed on external attribution factors.

7.3.2.2 Discussion Of Results.

While the present study did not find any developmental effects in the perceived likelihood of accident involvement within a very young sample of drivers, previous research has found age differences between samples of 'young' and 'older' drivers (Finn and Bragg, 1986; Sivak et al, 1989): 'young' drivers have tended to hold lower perceptions of risk than 'older' drivers. The above results may be seen to indicate that although differences in 'risk perception' (in terms of accident-likelihood) do exist between 'young' and 'older' drivers, these differences are not apparent between very young drivers: young drivers need to be considered as an homogeneous group and compared to much older drivers (usually over 35 years) for such risk perception differences to become apparent. Another difference between the present study and that by Sivak et al (1989),

is that while Sivak et al did not produce any sex differences in terms of the perceived likelihood of accident-involvement while speeding, the present study did: female drivers reported a higher perceived likelihood of an accident when speeding, than their male counterparts did.

The present study found that young drivers perceived less risk associated with close-following behaviours or speeding, than through dangerous overtaking manoeuvres. Along a similar line, research presented by Sivak et al (1989) indicated that the largest age difference was found in terms of the perceived risk associated with speed (young drivers gave the lowest risk ratings). The overall finding from the present study that young drivers aged 17-19 years believe that speeding and close-following have a lower likelihood of resulting in an accident, and a lower likelihood that the accident will be serious, than other dangerous behaviours, indicates that they do not perceive these driving behaviours as dangerous as others. These findings are in line with previous research findings that young drivers are more prone to speeding and close-following behaviours than are older groups of drivers (Schuman et al, 1967; Evans and Wasielewski, 1983; Wasielewski, 1984).

While the studies by Finn and Bragg (1986) and Sivak et al (1989) did find age differences in terms of accident-likelihood, and the present study did not, these disparities in results may be due as much to the methodological approach employed, as to the age range of the samples. While the present study used survey techniques, Finn and Bragg used still pictures and videotaped material, and Sivak et al used colour slides. These results will be compared to the results from the I.V.D.P. used by this study, later in this discussion section.

It was noted in the summary of results that young drivers rate the perceived likelihood of accident-involvement lower than the likelihood that such an accident would be serious when engaging in dangerous overtaking behaviours. This may lead one to suggest that young drivers may be more willing to engage in these dangerous behaviours, for although they believe that if an accident were to occur there is a high likelihood that it would be serious, their belief that an accident is likely to occur in the first place is lower. There is no other reported research in the area to compare on the issue of 'accident-likelihood and seriousness', to indicate whether this relationship changes between young and 'older' drivers. However, the results from the present study also indicated that young people reported a lower likelihood of engaging in these dangerous overtaking behaviours, than the likelihood that

an accident would occur. The above results would tend to suggest that the low likelihood of engaging in one of these overtaking behaviours is not motivated by the perception of accident-likelihood or accident severity: one explanation, which has not been explored, may lie in the perceived likelihood of detection for engaging in dangerous driving behaviours. Research in another area of dangerous driving (drink-driving), has indicated that offenders have lower perceptions of the likelihood of detection for the offence (Guppy, 1986): it may be possible that this perception-behaviour relationship is generic.

From the above results it would appear that for young drivers education would be better aimed at road safety attitudes and the likelihood of (and actual) consequences of certain driving behaviours, rather than a pure skills-instructional approach. Education which places emphasis on the likelihood of accident-involvement, the likelihood of police detection, and the severity of the consequences for particular dangerous driving behaviours, may have more impact upon young drivers' perception of risks associated with driving behaviours.

It was also noted in the summary of results that the I.V.D.P. study, like the driver survey study, found no significant age, or age-sex interaction effects in terms of the perceived likelihood of accident involvement (unlike the results of Finn and Bragg in 1986, and Sivak et al in 1989), or the likelihood that it would be serious. However, unlike the driver survey study which indicated a sex effect in a measure of the perceived likelihood of accident involvement, the I.V.D.P. study did not. It is interesting to note that neither the study by Sivak et al in 1989, which employed colour slides in the assessment of risk perception, or the present I.V.D.P. study, which employed an interactive video mode of risk assessment, found any sex differences. These results may suggest that sex differences in risk perception are more apparent in passive, non-pictorial assessment environments.

Findings from both the driver survey study and the I.V.D.P., study indicated that overall young people rate the perceived likelihood of an accident lower than the likelihood that such an accident would be serious. This may be used to suggest that young drivers are less likely to pay attention to the severity of the consequences of their actions (in terms of accidents), if they do not believe that an accident will occur. These results, combined with other findings on driver skill and confidence, from both the present study and previous research, may in part explain why young drivers are over-represented in accident statistics.

Differences were also found between the non-driver survey study and the study by Finn and Bragg (1986) in the perceptions of the causes of accidents. The present study found no age, sex or interaction effects in the perceived hazardousness of road conditions (such as ice, fog and snow), unlike Finn and Bragg (1986) who found differences between 'young' and 'older' drivers on a similar set of variables. However, it should be noted again, that not only are there differences in the sample composition between the two studies, but also in methodologies employed (the present study used survey techniques while Finn and Bragg employed the use of still pictures).

Another important result from the non-driver survey study, was the finding that there were significant age effects in the perceived importance of external accident causation attribution factors. As age increased young non-drivers placed less importance on external factors when attributing the cause of accidents, until 17-18 years. At the ages 17-18 years there was a sudden increase in the importance that these young people placed upon external attribution factors. The swing towards external attribution in the older subjects may be viewed in the context that these young people are now of the legal driving age, when they may be intending to learn to drive (and indeed have friends who are drivers), and so can possibly sympathise with drivers in terms of an external attribution bias.

If young people who are of a driving age place greater emphasis on external factors in the attribution process, than their younger counterparts of non-driving ages, this may represent a possible attribution bias, an inaccuracy. If 17-18 year old non-drivers do hold inaccurate perceptions of the relative contribution of external factors in the accident causation process, when they become learner drivers this may have a negative impact upon their attitudes and ability to learn from accidents, other peoples as well as their own (Whitlock, 1971). If they place too much importance upon external factors in accident causation, this may lead them to perceive that they have little control over future accident avoidance, and hence may not attempt to learn from it in terms of internal factors, such as driving attitudes. There is some evidence to support the view that accidents do not affect drivers' perceptions of their skill, and as such that drivers do not learn from accidents. Preston and Harris (1965) examined the effect of accident history upon subjective levels of skill. They found that there was no difference between drivers with accident histories and drivers with accident-free histories in terms of how they rated their level of skill with respect to other drivers.

7.3.3 Hazard Perception and Evaluation.

7.3.3.1 Summary Of Results.

The I.V.D.P. examined the issues of hazard perception and evaluation with driving and non-driving subjects between the ages of 11-18 years. In terms of hazard evaluation results indicated that in general, 17-18 year old drivers perceive less danger in potentially hazardous situations than the younger and non-driving subjects. However, when presented with specific hazardous situations, which required subjects to perceive the hazard and then respond to it (in terms of emergency braking), there were no significant differences between the developmental groups. There were no significant differences between the sexes in terms of either the perceived dangerousness of potentially hazardous situations, or in terms of perceiving and then responding to hazards.

The above results may indicate that when presented with an interactive method of measurement (where subjects are required to perform an action, in this case, braking), the differences apparent in the ratings of the perception of danger between 17-18 year old drivers and the other non-driving and younger development groups, decline: in other words the differences between the developmental groups in hazard related perceptions are greater than those in hazard related behaviours.

7.3.3.2 Discussion Of Results.

While the results from the present study have indicated no developmental effects with respect to hazard response (whether subjects did respond to a hazard or not), the results from two earlier studies by Quimby and Watts (1981) and Currie (1969) should also be noted here. While Quimby and Watts found that younger drivers had longer reaction times to potentially hazardous situations, Currie found that pure reaction times were not related to driver accident history. The evidence from the present study, and that of Quimby and Watts, suggest that while younger drivers may have longer reaction times to potentially hazardous situations (than older drivers), there was no significant developmental group differences in terms of the number of subjects who responded to hazards, and those who did not. In addition to this, other research has indicated that the style of perceptual response may be a better predictor of driving performance than simple perceptual accuracy or reaction times (Pelz and Krupat, 1974). It was not possible to examine the style of response with the I.V.D.P, as subjects could not

physically control the speed of the car. However, the I.V.D.P. results do provide an interactive measurement of young people's ability to perceive and respond to hazards.

The earlier research reported by Finn and Bragg (1986) suggested that young drivers fail to accurately perceive the level of risk associated with hazardous situations (and hence the need to show caution). However, results from the I.V.D.P. indicated that an average of 76% of young people (drivers and non-drivers) did respond to a series of five potential hazards (and hence also accurately perceive and evaluate them as hazards). This overall mean figure may appear deceptively low, for the average percentage of subjects responding to four of the hazards was 88%, while only 27% responded to the fifth hazard. This raises the question of intentional risk-taking: young people may engage in risk-taking behaviours, not so much due to an inability to accurately perceive and evaluate hazards, but rather because they are motivated to do so. This concept of intentional risk-taking has been addressed in the present questionnaire studies, and by previous researchers (e.g., Schuman et al, 1967).

The results from the I.V.D.P. suggest that while there are significant developmental group differences in the *evaluation* of hazards, there are none in the *actual response* to hazards. The fact that there were no developmental group differences in response to hazards, but that the older driving subjects perceived less danger associated with hazardous situations, may be partly explained by the earlier finding that older subjects had more confidence in their driving skills: subjects who have higher confidence in their driving abilities may therefore perceive less danger in a hazardous situation, while being able to produce the appropriate response to a hazard in a similar way to a driver who perceives greater danger in the same situation. The results on perceptions of driving skill indicated that all drivers perceived that a higher level of skill was involved in the perception and response to potential hazards, than in undertaking specific driving manoeuvres.

7.4 ATTITUDES TOWARDS DRINK-DRIVING.

7.4.1 Summary of Results.

Results showed that there were no significant age, or age-sex interaction effects within the driver sample on a set of very specific variables relating to attitudes towards drink-driving. However, other findings reported in an earlier section (7.1.1) have revealed age

differences in the perceived seriousness of driving when having drunk over the legal limit.

An analysis on 17 drink-driving variables with the non-driver sample revealed that there was one significant multivariate age effect: as age increased between 11 and 18 years, so did the frequency of reporting of drinking alcohol with friends. There were eight other significant univariate age effects. As age increased the belief that most people, and most young people, drink and drive decreased; the belief that it is safe to drive after a few drinks decreased; the belief that it is dangerous to drink over the legal limit and then drive increased; the importance of peers' faith in subjects' ability to hold their drink when driving decreases; whether subjects would be prepared to accept a lift from a drink-driver decreased; the reported frequency of alcohol consumption increased; and the belief that people should not drink and drive in case they are apprehended increased.

The analysis of drink-driving variables within both the driver and non-driver samples indicates that generally, all the subjects between 17-19 years, had socially responsible attitudes towards drink-driving.

While there were no significant sex effects within the non-driver sample, there were significant univariate sex effects on three variables within the driver sample. Males were more likely than their female counterparts, to be more likely to drink over the legal limit than the previous year, and were more likely to believe that other drivers were more likely to drink and drive than they were the previous year. In addition to this, males perceived themselves as able to drink more alcohol without it affecting their driving, than did females.

7.4.2 Discussion Of results.

While much previous research has indicated that a large minority of drivers under 25 years report drinking over the legal limit and driving (Guppy, 1986; Clayton et al, 1984), other research has indicated that drivers between 16-19 years are under-represented (2.8%) among drink-drivers (Sabey et al, 1988). The results from the present study indicated that young people in both the driver and non-driver samples appeared to hold socially responsible attitudes towards drink-driving.

Research by Clayton et al (1984) reported that a perception of the ability to drink over the legal limit and still be safe to drive, a disregard for the legal limit, and little social pressure against drink-driving, were all factors associated with the offence. However,

the findings from both the Driver and Non-Driver Questionnaire studies indicated that young people of all age groups held responsible attitudes on these variables. The differences in the results between the present study and that by Clayton (1984), must be viewed in the context in which the data was collected. Clayton's data for his 1984 study was collected in the late 1970's, while the data from the present study was collected in 1989: in these intervening years there has been much education on alcohol use and misuse in the media, and particularly in schools, which may have helped to produce attitude changes in the area of drink-driving as a result of these efforts.

Other research by Farrow (1987), with 16-19 year olds, indicated that drink-driving offenders were more likely to associate alcohol with social events than non-drink-drivers. The reporting of drinking socially was one of the factors that increased with age in the present non-driver sample: although there was no evidence that young people from any age group within the non-driver sample held positive attitudes towards drink-driving.

The finding that drink-driving is three times more prevalent in men than in women (Farrow, 1985), does have some relevance to the findings of the present study, for although there were no sex differences in the Non-Driver study, there were in the Driver study. Results from the Driver Questionnaire study revealed that firstly, males perceived that they could drink a larger quantity of alcohol than females did, without it affecting their driving, and secondly, males were more willing to report than females that they were more likely to drink and drive over the legal limit this year than in the previous year. These results do suggest, as do the accident statistics, that the problem of drink-driving is more prevalent in young males than in young females.

7.5 ROAD ENVIRONMENT AWARENESS.

7.5.1 Summary Of Results.

Subjects were measured on their level of 'road environment awareness' (awareness of other road users, road signs layout and design, and the required observations and behaviours) in the I.V.D.P study. The 'road environment awareness' meta-variables were derived from the verbal commentary task scenes. While there were no significant differences between the developmental groups on any of the 'road environment meta-variables' at the $p < 0.01$ level, there were some differences at the $p < 0.05$ level that indicated that as age increased and driving experience was

obtained, the awareness of the required actions/behaviours that a safe driver should make increased, but the awareness of road traffic signs decreased.

There were also significant sex differences on the variable 'awareness of interacting road users'. This variable was used to measure awareness of other road users, whose position and behaviour meant that they were interacting with the subject's car. The results showed that while males were aware of interacting road users 31% of the time, females were aware only 20% of the time.

7.5.2 Discussion Of Results.

The results from the I.V.D.P. study on 'road environment awareness' suggest that there are developmental group differences in awareness of very simple and very complex road environment factors. It may be suggested that while the younger subjects were less competent than the older ones at reporting awareness of the more complex factors in the traffic environment, this left them greater cognitive capacity to become aware of the more simple traffic environment factors, such as road signs.

Although results indicated that as age increased, and driving experience was obtained, the reported awareness of the 'required actions/behaviours' increased, the level of awareness was still very low, even among the 17-18 year old drivers (who were aware of the required actions/behaviours only 35% of the time). The low level of reporting may be partly explained by the method of data collection (verbal commentary provided by the subject), but this cannot completely explain the low level of reported awareness. A similar study by Spicer (1964) examined the role of perceptual attention in driving performance. Spicer showed 15-17 year old subjects films presenting a variety of traffic situations. Unlike the present study, where verbal commentaries were used, subjects in Spicer's study were given a checklist from which they were asked to select items which were of importance to them (items which they would pay particular attention to when driving). Results showed that drivers with accident-histories were less accurate, compared to non-accident drivers, in perceiving essential features of road traffic situations. Although the methods of data collection employed by Spicer and the present author were different, the results from Spicer's study may prove useful in interpreting the developmental group effects from the I.V.D.P. Awareness of the 'required actions/behaviours' did increase from the 11/12 year old non-drivers (an awareness of the required behaviours 23% of the time), to the 17-18 year old non-drivers (an awareness 29% of the time), to the 17-18 year old drivers

(an awareness 35% of the time). These results may suggest that the skill required to perceive these factors of the traffic environment increase as age increases and driving experience is obtained, and that this increase in skill may be associated with a decrease in the likelihood of accident-involvement (Spicer, 1964). These results may also have implications for on-the-road training of female drivers, who showed themselves to have a lower awareness of 'interacting road users' than their male counterparts. However, it must be noted that both males and females were very poor at reporting an awareness of 'interacting road users'. A study by Forsyth (1989) considered which aspects of the driving test that candidates failed on. Twenty-six percent of drivers who failed the driving test committed the 'serious error' of 'not taking effective observations before emerging from a junction'. These results indicate that drivers who are not classified as competent to hold a full driving licence, omit certain 'required observations': only 34% of young drivers in the present study reported awareness of the 'required observations before action'.

The findings on the I.V.D.P., that males were more aware of 'interacting road users' than females, compares well with earlier findings by Storie (1977) that females are more prone to errors of perception than males.

The overall relatively low reporting of road environment awareness factors may in part explain the relatively high level of confidence these young people hold towards their current/future driving skills, and their positive attitude towards risk-taking. These young people do not hold all the information about road traffic situations necessary to make accurate judgments about their skills and behaviour.

While the I.V.D.P. study has indicated that there are age and driving experience related differences in which factors young people pay attention to, research by Quimby and Watts (1981) has indicated that young drivers also have longer reaction times to hazards. Other research by Currie (1969) found that drivers with fewer accidents perceived danger sooner than drivers who had repeated accidents, suggesting that the speed of hazard perception may be an important factor in predicting driving performance.

The above research and findings from the I.V.D.P. also suggest that there are differences between drivers in what factors in the road environment they focus perceptual attention on, that these differences may be age and driving experience related, and have been shown to be related to driving performance.

An understanding of drivers' perception of the road

environment at different developmental stages, may not only assist in predicting driver performance among young drivers, but also has implications for driver and pre-driver education: it is important to know which aspects of the road environment cause young people perceptual awareness problems, in order to focus the correct level of training on the correct issues at different developmental stages.

Overall, it would appear from the I.V.D.P. study, that while perceptual awareness of road environment factors does increase with age and driving experience, the level of awareness at any one time is very low: while this may be attributable partly to the methodology employed, a large part of this low awareness must be attributed to the ability of young people to accurately perceive and evaluate salient features of the road traffic environment around them.

7.6 GENERAL DISCUSSION.

The two sub-sections below contain discussions of 'age effects' (7.6.1) and 'sex effects' (7.6.2). However, remedial measures in terms of driver and pre-driver education, which take account of age and sex effects, are outlined in a separate conclusions section (7.9.1).

7.6.1. Of Age Effects.

It would appear from the results on the non-driver sample, that as age increases so does a negative attitude towards the police, a greater perception that one's future driving style will be 'risky' and skilful, an increased perception of self-independence and respect for authority, an increase in socially responsible attitudes towards drink-driving, an increase in the perceived importance of the image of a car, and an increase in the perceived importance of external accident causation factors at the ages of 17-18 years. In addition to these findings, results also indicated that as age increases there is a decreased perception of the difficulty of mastering cognitive driving skills, and a decrease in the perceived dangerousness, seriousness, and likelihood of detection for driving offences. There was also a general increase in the perception of driving as a means for thrill-seeking and emotion-expression with age, but a decrease by the ages 17-18 years. While results from the Non-Driver Survey study indicated that as age increases so does a perception that one's future driving style will be risky, results from the I.V.D.P. revealed that speed did not increase with age. All non-drivers perceived themselves

to have a lower likelihood of accident involvement than the 'average' driver. The perceived seriousness of driving without a licence, and driving when having drunk over the legal limit decreased between 11-14 years, but increased again at 15-18 years.

Overall, results from this study present a picture of the young non-driver (11-18 years) as someone who has a positive attitude towards risk-taking, high confidence in their future driving skills, negative attitudes towards the police and the seriousness, dangerousness and likelihood of detection for driving offences, but mostly responsible attitudes towards the offence of drink-driving.

The picture that the present study paints of the young driver (17-19 years) is somewhat different. It would appear from the driver survey results that overall these young drivers engage in dangerous close-following behaviours, and perceive themselves to be (a) more skilful than 'other' drivers, (b) less likely to have an accident than the 'average' driver. They also perceive the likelihood of accident-involvement to be lower than that of accident seriousness. While these young drivers perceive a medium to high likelihood of detection for driving offences, they also only perceive driving offences to be moderately serious. While these young drivers generally hold socially responsible attitudes towards the offence of drink-driving, the 17-18 year olds perceive the offence of driving when having drunk slightly over the legal limit to be less serious than their non-driving 11-18 year old counterparts.

Other results showed that as age increases so does a negative attitude towards the police, a greater risk motivation and a more positive attitude towards reckless driving, a greater confidence in driving skills, a greater perception of oneself as a fast driver, and a more aggressive and superior attitude towards other drivers. However, while the survey study indicated that the perception of oneself as a fast driver increased with age, the I.V.D.P. results indicated that the behaviour of breaking speed limits did not. The 17-18 year old drivers did prefer to drive at faster speeds than the non-driving 11-18 year olds, but they were also less likely to overtake across a range of situations. In addition to this, the I.V.D.P. also revealed that as age increased the tendency to overtake on the left on motorways decreased. The 17-18 year old drivers also perceived less danger in hazardous situations than the non-drivers, but there were no group differences in the actual behavioural response to hazards. While the perceptual awareness of the 'required behaviours that a safe driver would make' increased with age and with driving experience, the overall awareness of

important road environment factors was very low at all developmental stages.

The findings that all the young people, both drivers and non-drivers, have very low awareness levels of road environment factors, may partly explain their high levels of confidence towards their current/future driving styles, and their positive attitudes towards risk-taking: these young people do not hold all the information about road traffic situations necessary to make accurate judgments about their skills and behaviours. The results into perceptions of driving skills indicated that drivers perceived themselves to be more skilful and less likely to be involved in an accident than the 'average' driver. If these high perceptions that young people hold of their driving skills are inaccurate, as some research would suggest (Shinar et al, 1978; Blaauw, 1982; Broughton, 1988), this may partly explain the overrepresentation of young people in road traffic accidents. The additional fact that there were no developmental group differences in response to hazards, but that the older driving subjects perceived less danger associated with hazardous situations, may also be partly explained by the finding that older subjects also have more confidence in their driving skills. It may be suggested that while subjects with a high level of confidence in their driving skills may perceive less danger in a hazardous situation, they are able to produce the appropriate response to a simulated hazardous situation, just like other drivers who perceive more danger in the same situation.

The results on risk-taking perceptions, attitudes and behaviours, mostly complement previous research findings, that young drivers engage in more risk-taking behaviours, and have a more positive attitude towards risk-taking, than older drivers. However, what is different is that while previous studies have indicated differences between younger and older drivers, the present study has indicated that these age-group differences occur between drivers in their formative driving years, and also importantly start at very early ages, long before these young people become drivers.

The reports from the present study which indicate that young people do engage in risk-taking behaviours on the road, and have positive attitudes to risk-taking while driving, can be viewed along with Jessor's (1987) study which indicated that risk-taking while driving is part of a larger pattern of behaviour involving intentional risk-taking for fun in other areas of behaviour (especially in the consumption of alcohol). The present study did indicate that the reported level of alcohol consumption and the reported drinking of alcohol with friends, increased with age.

This study has indicated that some very early age differences do exist in terms of certain dangerous driving behaviours (particularly overtaking behaviours). The general observed trend for a decrease in dangerous overtaking behaviours with age is what one might expect in the light of previous research into risk-taking (Jonah, 1986), but is at odds with other findings of the present study, that as the age of drivers increases there is a more positive attitude towards reckless driving and a higher risk motivation. As with the perception of speed and the actual behaviour of speeding, there would appear to be some disparity between ones' perception of oneself as a driver and ones' reported and simulated driving behaviours. One explanation may lie in the fact that the reports of risk-taking behaviours, particularly speeding, may be suggested to be somewhat conservative, as drivers responses may have been affected by the knowledge of road traffic laws and speed limits. Hence, it may be assumed that the risk-taking behaviours of these young drivers is at the same level reported here, or higher. The speeding behaviours of young drivers when viewed in this light, might not be that different from their perceptions of themselves as drivers.

The evidence from this study and from others suggests that young people not only engage in dangerous driving practices (MacMillan, 1975), but also engage in deliberate risk-taking behaviours (Schuman et al, 1967; Jessor, 1987). Some evidence suggests that participation in risk-taking behaviours may be linked to young peoples' perception of their skill (Spolander, 1982; Clayton, 1984; Finn and Bragg, 1986; Mathews and Moran, 1986), and their ability to accurately perceive and respond to hazards (Spicer, 1964; Pelz and Krupat, 1974; Crancer et al, 1979). This misperception of skill may play a role in the risk-taking behaviours of young drivers. The mismatch between young drivers' subjective and objective levels of skill (Finn and Bragg, 1986; Mathews and Moran, 1986), may contribute to their proportionally higher accident rate. However, this evidence on perception of skill, and perception of hazards, also suggests that young drivers may unwittingly engage in risky driving behaviours: as these drivers perceive themselves to have a high level of skill, and do not perceive high levels of danger in hazardous situations, they may not realise when they are actually involved in risky driving. However, other results from the present study, and from previous ones (Schuman et al, 1967; Jessor, 1987), has indicated that young drivers do engage in some deliberate risk-taking behaviours. The evidence from the present study on young drivers' low perception of the seriousness of driving offences, may also partly explain why they are willing to engage in certain risk-taking and offence-breaking driving

behaviours. Young drivers may underrate the level of risk involved in certain driving and offence-related behaviours (such as speeding), while also overrating their level of skill.

The survey studies provided direct means of risk assessment allowing the discrimination between deliberate and non-deliberate risk-taking. The objective level of risk adopted by the different age groups can be inferred by their driving manoeuvres, close-following distances and speeds adopted. In order to take into account the subjects' subjective level of risk, the level of perceived dangerousness was also measured. Across four overtaking situations, subjects rated the perceived dangerousness to be moderate, but also gave low ratings of their likelihood of engaging in these behaviours. This would suggest that drivers of all ages would be prepared to engage in moderately dangerous driving behaviours. It would seem that these young drivers, 17-19 year olds, did perceive a moderate level of risk involved in the dangerous overtaking behaviours that they occasionally engaged in, but that they had a high risk threshold which may relate to their high perceptions of skill. Similar results were found in an earlier study into overtaking behaviours by Harris (1986). The fact that drivers in Harris's study engaged in behaviours they believed to have a *high* likelihood of resulting in an accident, while drivers in the present study reported engaging in overtaking behaviours that had a *moderate* likelihood of resulting in an accident, may be explained by the differences in the measurement of 'risk': while Harris's study asked drivers about the level of risk in a general sense, the present study asked drivers about the likelihood of *their* involvement in an accident.

The issue of intentionality in risk-taking has important implications for driver education: a different approach is required with drivers who subjectively do not consider themselves to be driving dangerously, than with drivers who deliberately engage in what they know to be dangerous driving practices. The results on the overtaking behaviours of drivers 17-19 years, and their perceptions of the dangerousness of these behaviours, would seem to indicate that, at least in certain conditions, young drivers are willing to take risks in order to undertake certain manoeuvres.

If a driver believes himself to be more skilful and safer than others, he may engage in unintentional risk-taking behaviours. These unintentional risk-takers may not pay attention to road safety information which is directed towards drivers in general, as these drivers consider themselves to be more skilful and safer than most other drivers. The high perception of driving skills may

explain why general media propaganda is unsuccessful: these drivers do not identify with those in need of instruction.

The deliberate risk-taking behaviours of young drivers also has important implications for remedial actions. Education from a skills-instructional approach may not work with deliberate risk-taking drivers: a better approach may be to increase their perceived likelihood of detection for dangerous driving behaviours, or the perceived likelihood of accident-involvement. As can be seen from the results on accident-likelihood and accident seriousness, it may not prove useful to try to increase the perception of accident severity in order to reduce risk-taking, as these young drivers already perceive the severity of potential accidents to be higher than the likelihood that an accident would occur in the first place.

Overall, it can be seen that the risk-taking behaviours of young people on the road may be jointly determined by four main factors: an inaccurate perception of self-skill; inaccurate perceptions of hazards; inaccurate evaluations of the level of risk associated with hazardous situations; and a high risk motivation. These four main factors have been demonstrated to be apparent within all the tested age groups, but to varying degrees.

7.6.2 Of Sex Effects.

It would appear from the results from the Driver Survey that female drivers report a lower risk motivation, a less positive attitude towards reckless driving, a higher perception of the importance of car safety features, a higher perceived likelihood of accident-involvement when speeding, lower driving confidence and report driving at slower speeds than their male counterparts. There were some differences between the sexes in their attitudes towards drink-driving; in particular young male drivers perceived a higher safe drink-driving limit than females. Both males and females perceived themselves to be more skilful than 'other' drivers.

This study would tend to suggest that while both young male and female drivers rate their driving skills superior to those of 'other' drivers, males have the highest level of confidence overall. Statistics show that young drivers as a group are over-represented in road traffic accidents, and that such a high perception of self skill on the part of both young males and females is inaccurate. The particularly inaccurate high confidence in self driving skills of young male drivers, may not only explain their higher levels of risk-taking and lower perceived

likelihood of accident-involvement, but also their perceptions of how much alcohol they can drink and still be safe to drive. This high perception of skill, combined with societal attitudes which generally expect males to be more competitive than females, may help to explain their positive attitude towards risk-taking and their high risk motivation.

However, while males have a higher perception of their driving skill than females, results from the I.V.D.P. revealed that there were no differences between the sexes in their performance of perceiving and responding to hazards, and their evaluation of hazards. In contrast, when subjects were required to provide a running verbal commentary on aspects of the road environment that a 'safe' driver would pay attention to (an active, but less clearly structured task), results did indicate differences in performance between the sexes: males had a greater reported awareness of 'interacting road users' than females. These findings are in line with previous research by Storie (1977) that females are more prone to errors of perception than males. The results from the I.V.D.P. on young peoples' performance at reporting road environment awareness factors (a verbal commentary task) indicated that, overall, this task produced less sex differences than where apparent from the survey methodology results. A brief review of the sex differences elicited by the different methodologies will be presented shortly below.

In contrast to the above reported differences between male and female drivers, the results from the Non-Driver Survey reveal that there were no sex differences in perceptions of their future driving styles, or in the perception of the difficulty in mastering driving skills. There were also no sex differences between the non-driver age groups in terms of attitudes towards drink-driving. However, males rate the acceptability of driving offences higher, but the perceived seriousness of some driving offences lower, than females. All the driving offences which males rate as less serious than females, can be categorized as serious, risk-taking offences, often involving speed. However, there were no sex differences in terms of the perceived likelihood of detection for driving offences.

It would appear that many differences between the sexes in terms of risk-taking perceptions and behaviours, only become apparent when these young people become drivers.

While the Driver Survey study produced sex differences in terms of the perceived likelihood of accident-involvement while speeding, neither the I.V.D.P. which employed an interactive mode of risk assessment, or the study by Sivak et al (1989) which employed colour slides in the

assessment of risk perception, found any sex differences. These results may suggest that sex differences in risk perception are more apparent in passive, non-pictorial assessment environments. Further differences in the performance between the sexes, in relation to the assessment methodology, are discussed shortly below.

Unlike MacMillan's (1975) study which found that females rated all driving offences (except driving without insurance) as more serious than their male counterparts, the present study only found sex differences on the more serious risk-taking offences, often involving speed. Similar to the work by MacMillan (1975), Jessor (1987) and Wilson (1987) on sex differences in young drivers attitudes towards risk-taking, the present study found that female drivers had a less favourable attitude towards risk-taking than male drivers. The findings on the reported contravention of speed limits complement the findings on attitudes towards risk-taking and previous research on 'speeding' (MacMillan, 1975; Wilson, 1987): male drivers were more likely to break all speed limits, and to drive faster on both open and narrow roads than female drivers.

The Driver Survey study also indicated that there were some sex differences in risk-taking overtaking behaviours. However, while the Driver Survey study indicated sex differences in reported speeding and overtaking behaviours, the results from the I.V.D.P. did not confirm this. It may be that the interactive nature of the I.V.D.P. reduced any speed and overtaking-related sex differences. One explanation for this may lie in the possible differential response biases produced by the two different methodologies. It may be argued that the I.V.D.P., which presents subjects with identical visual representations of particular decision situations, is more likely to produce similar mental representations of the task across the different age and sex groups, than the survey method which relies mostly on textual (and sometimes diagramatic) representations of the decision situations. It would be expected that a method which allows greater opportunity for response bias (in this case, survey methods), would also be more likely to produce between-group differences. The use of the I.V.D.P. to present simulated decision situations to young people, may reduce some group differences, due to the ability to provide subjects with similar mental representations of the required decision situation, thus allowing group differences to reflect true differences in decision-making, rather than differences in the interpretation of the question posed to them.

Overall, results from this study would suggest that sex differences, particularly in terms of risk-taking

perceptions and behaviours, do not tend to become strongly apparent until these young males and females become drivers. The major differences between young male and female drivers are highlighted more by survey methodology than by interactive video methodology, and would seem to lie in their attitudes towards risk-taking activities, reported risk-taking behaviours, and confidence in their driving skills.

7.7 COMPARISON OF METHODOLOGIES.

This section examines differences between the survey and interactive video methodologies, and differences between the three types of data collected from the I.V.D.P. The three types of data collected in the I.V.D.P. were: (1) verbal commentary, (2) quantitative judgements based upon viewing scenes, and (3) decision-making through interaction with the system.

In a comparison of methodologies, differences in the results produced from *within* the I.V.D.P. will be examined first. One of the issues considered in this study was whether developmental group differences could be produced using the simple strategy of presenting subjects with a video image of a car being driven along different roads (like that offered by standard video technology), or whether interaction with the system would be required (allowing subjects to partly determine the sequence of events). Results from the I.V.D.P. study revealed that significant developmental effects were produced across most 'rating' variables (the perceived dangerousness of potential hazards, preferred driving speed, chosen deceleration, and ratings of skill for 'self' and 'others'), but only on some 'interactive' variables (overtaking frequency and some overtaking behaviours), and some verbal commentary variables (awareness of road traffic signs, and interacting road users). It would appear that there are less apparent developmental group effects on variables which require 'active' performance from the subject (such as producing a verbal commentary or interacting with the system to perform judgments in decision situations), than on variables which are measuring perceptions and attitudes.

Results from the simulated driving task on the I.V.D.P., and the survey studies, can be used to suggest that there are greater differences between the developmental groups in their attitudes and perceptions, than there are in their actual behaviours. Examples of this include the I.V.D.P. results on hazard evaluation and hazard perception/response: there were significant developmental

effects in the evaluation of potential hazards (the 17-18 year old drivers perceived less danger in hazardous situations, than the 11-18 year old non-drivers), but no significant developmental effects in the performance of responding to hazards. Another example of this discrepancy between perceptions and behaviours are the Driver Survey results on 'driver speed': while there were age effects in the perception of oneself as a fast driver (as measured by the Driver Questionnaire), these disappeared in the measurement of reported 'speeding' behaviours (also measured by the Driver Questionnaire). Additionally while there were speed-related sex differences within the driver sample in terms of reported driving speeds, these were not apparent in the driving speeds observed in the I.V.D.P. It may be that there are differences between perceptions of oneself as a driver and actual driving behaviours, or it may be that the interactive nature of the I.V.D.P. may have decreased any differences between the sexes, or non-driver age groups in terms of driving speed.

The evidence from the Driver Survey study on 'reported speeding behaviours' and perceptions of oneself as a fast driver, would tend to suggest that the former explanation *may be* more likely. However, other differential results produced by the different methodologies, would tend to also suggest that the measurement technique may influence between-group differences. These are discussed below.

Some methodological differences were apparent in the reported and observed overtaking behaviours. While the Driver Survey study did not produce any age differences between drivers in their reported overtaking frequencies, the I.V.D.P. produced developmental group effects in the observed overtaking frequencies (as age increased the tendency to overtake decreased). Additionally, while the results from the driver survey study indicated that subjects reported being unlikely to engage in dangerous overtaking behaviours, the observed simulated overtaking behaviours on the I.V.D.P. did not support this.

Similarities were found between the survey and interactive video methodologies in terms of perceptions of skill. Both methodologies showed that drivers of all ages perceived themselves to be more skilful than 'others' or the 'average' driver, and that as age increased so did the perception of skill. However, only the I.V.D.P. produced significant 'self-average driver' developmental group effects: as age increased and driving experience was obtained the difference in the perceived skill for 'self' and the 'average' driver decreased. This may be viewed as suggesting that the presentation of skill-rating situations on interactive video, as opposed to questionnaire methods, assists young people in producing

more accurate perceptions of their own skills in relation to others. Road traffic situations may appear more realistic to young drivers when presented in the I.V.D.P. than in the Driver Questionnaire. This self-other developmental group interaction effect, produced using interactive video technology, is very important as it has not been reported from other methodologies, or with similar or older subjects before, and has implications for the design of education and training programmes.

Neither the Driver Survey study nor the I.V.D.P produced any age effects within this very young sample, in terms of the perceived likelihood of an accident, or the likelihood that an accident would be serious. However previous research which has employed still pictures and videotaped material (Finn and Bragg, 1986) and colour slides (Sivak et al, 1989), has found differences between samples of 'young' and 'older' drivers in terms of the perceived likelihood of an accident. While univariate sex differences in terms of accident-likelihood, and seriousness, were apparent in the Driver Survey study, they were not in the I.V.D.P. It is interesting to note that neither the study by Sivak et al (1989), which employed colour slides in the assessment of risk perception, nor the present I.V.D.P. which employed an interactive video mode of risk assessment, found any sex differences. These results may suggest that sex differences in risk perception are more apparent in passive, non-pictorial assessment environments. As discussed earlier in Section 7.6.2 (the overall discussion of sex effects), it may be that the interactive nature of the I.V.D.P. reduces any sex differences. One explanation for this may lie in the possible differential response biases produced by the two different methodologies (survey versus interactive video techniques). It was suggested earlier that the I.V.D.P., which presents subjects with identical visual representations of particular decision situations, is more likely to produce similar mental representations of the task across the different age and sex groups, than the survey method which relies mostly on textual (and sometimes diagramatic) representations of the decision situations. It would be expected that a method which allows greater opportunity for response bias (in this case, survey methods), would also be more likely to produce between-group differences. The use of the I.V.D.P. to present simulated decision situations to young people, may reduce some group differences, due to the ability to provide subjects with similar mental representations of the required decision situation, thus allowing group differences to reflect true differences in decision-making, rather than differences in the interpretation of the question posed to them.

There has been a lack of available published research in

the field of road user behaviour which has compared data collected from questionnaires with that collected using an interactive video system (as opposed to a standard video tape). Additionally, the employment of interactive video as a testing technique to study road safety with subjects so young is a relatively novel concept. The results from this study have highlighted that there are differences between the results produced by the survey and interactive video methodologies on some aspects of driver judgments and behaviours. The areas which have produced the most differences between the two methodologies are driving speed, overtaking behaviours, perception of self skill in relation to other drivers, and the perceived likelihood of an accident. The employment of the I.V.D.P with a range of young subjects, has highlighted many areas where there are developmental group differences. These findings are not only important when deciding at which ages to target certain educational material, but also important as a guide to which methods of presentation of information to use.

In terms of pre-driver education, interactive video may be viewed as a means of presenting increased visual realism to subjects with little, or no, first-hand driving experience, providing them with visual representations and a framework in which to produce their road safety judgements and perceptions. It presents subjects with the need to make judgements in real-time. Informal discussions with subjects, after the interactive video testing had been completed, indicated a great enthusiasm and feeling of realism when using the interactive video system. Indeed, many non-drivers stated that the system felt realistic to them (although none of the non-drivers had first hand driving experience), and that they felt it helped them to produce responses and judgements more easily. Comments from the non-drivers allow one to tentatively suggest that issues which may appear rather abstract to the young non-driver, become more of a reality when presented in the I.V.D.P.

7.8 DISCUSSIONS OF THE MEDIATORS OF RISK-TAKING.

As outlined earlier in the Introduction (Chapter 1), there has been much research which has focused on young drivers' accident risk and risk-taking behaviours (Jonah, 1986). The evidence on the high risk-taking behaviours of young drivers has led some researchers to conclude that this tendency may stem from age differences in risk perception and/or risk utility, which have often been defined and examined separately (Hodgdon et al, 1981; Slovic and Fischhoff, 1982; Wilde, 1976, 1982; Wilde and Murdoch,

1982). While several researchers have found the theory of risk utility useful in examining the decision-making process of the road user (Fishburn, 1968; Wilde, 1976), many have chosen to focus on the question of risk perception. According to risk perception theory, risk-taking behaviour is mediated by the level of perceived risk in the outcome of the behaviour. Factors such as the perceived probability and perceived severity of an accident and/or apprehension may be relevant in establishing the level of perceived risk (Mathews and Moran, 1986). Risk perception is a subjective measure of danger: what one driver perceives as dangerous another driver may not. Jonah (1986) states that risk perception can refer to two concepts: (1) the perceived likelihood of an accident, or (2) the perceived likelihood that the event will result in negative consequences. Some of the existing evidence on risk perception will be summarised briefly below in relation to some of the findings of the present study.

While some previous research has found that young drivers perceive themselves to have a higher likelihood of accident-involvement than older drivers (Berger and Persinger, 1980; Jonah and Dawson, 1982; Mathews and Moran 1986;), other studies have found the opposite results (Finn and Bragg, 1986). The present study did not find any age-related differences in the perceived likelihood of accident-involvement within a sample of 17-19 year old drivers. However, results from the Interactive Video study not only found that all developmental groups perceived themselves to have a lower likelihood of accident-involvement than the 'average' driver, but there was also a significant developmental group 'self-average' interaction effect: as age increased (from 11-18 years) and driving experience was obtained, the difference between subject ratings of accident likelihood for the 'average' driver and 'self' decreases.

Both the present study and previous researchers (Brown and Copeman, 1975; Jonah and Dawson, 1982; Finn and Bragg, 1986) have also found age differences in terms of the perceived risk associated with various driving behaviours. Research into hazard perception and evaluation has found that young drivers are less likely to recognize potential hazards (Quimby and Watts, 1981), and are likely to rate driving situations as less hazardous than older drivers (Finn and Bragg, 1986). Brown (1982) has argued that one factor in young drivers' high accident rates may be their 'overconfidence' in their driving skills. The present study (with a sample of young drivers aged 17-19 years) has shown firstly, that the perception of driving skill increases with age, and secondly, that all young drivers perceive themselves to be more skilful than 'other' drivers. Research by Spolander (1982) has indicated that

confidence in driving skills increases with age in the first few years of driving, while research by Mathews and Moran (1986) indicated that young drivers have more confidence in their driving reflexes than do older drivers.

The second concept of risk perception referred to by Jonah (1986) was the perceived likelihood that the event will result in negative consequences (e.g., an accident). While the present study did not find any driver age effects in the perceived likelihood that an accident would be serious, an interesting pattern was found between Jonah's two concepts of risk perception. Results showed that young drivers across all age groups perceived the likelihood that an accident would be serious, to be higher than the likelihood that an accident would occur. These results suggest that it would be more profitable to focus remedial attention on Jonah's first concept of risk perception, perceptions of accident-likelihood, than on the second, perceptions of the likelihood of accident severity.

The evidence from both the present study, and from previous research, on young drivers' risk perception would tend to suggest that they may take more risks when driving because they are less likely to accurately perceive and evaluate hazards, and that this may be related to their perceptions of their driving skills. Some of the findings from the present study can be seen as a contribution to the field of risk perception, by providing evidence on the perceived probability of an accident, the perceived probability of the severity of an accident, and risk-taking behaviours, with a sample of very young drivers and pre-drivers, using standard and novel methodologies. However, given the inconsistencies in the findings with 'young' and 'older' drivers from previous research (Jonah, 1986), further research is required to clarify the role of risk-perception in driver risk-taking.

The second mediator of risk-taking behaviour that has received research interest is that of risk utility. Researchers have suggested some different utilities for the risk-taking behaviours of young drivers. Researchers, such as Farley (1984) and Zuckermann (1979) have emphasised a physiological need for increased arousal in explaining the utility of risk-taking behaviours. In contrast, Hodgdon et al (1981) have suggested the following utilities for driver risk-taking behaviours: an outlet for stress, aggression, expression of independence, means of increasing arousal, to impress others, and as a means to an end. Similarly, Jessor (1984) in his Problem Behaviour Theory argued that risky driving behaviours, which are part of a larger syndrome of adolescent problem behaviour, are employed to express opposition to

authority, to gain independence and control over one's life, to cope with anxiety, fear of failure and frustration, to project the right image to peers, and to demonstrate 'maturity'. Other researchers have studied the psychosocial characteristics of young people, in an attempt to understand what factors influence the perceived utilities of risk-taking behaviour (Harrington, 1971; Mayer and Treat, 1977; Pelz and Schuman, 1973; Quimby and Watts, 1981). The relationship between accident-involvement, youth and emotion-expression has been investigated by several researchers (Harrington, 1971; Pelz and Schuman, 1968). Clement and Jonah (1984) found sensation-seeking to be correlated with self-reported speeding behaviours. The present study found that both emotion expression and risk motivation factors, along with risk-taking behaviours were related to age. Wallach and Kogan (1961) found evidence to suggest that young drivers were less likely to perceive the negative consequences of a risky action which results in failure than older drivers (e.g., being killed in a road accident). As Jonah (1986) has suggested, young people may underestimate the disutility of risk, in terms of fatal accidents, as death is a remote event for most young people.

Wilde (1976, 1982) in his 'risk homeostasis theory' made an attempt to integrate risk perception and utility. The theory states that drivers have a target level of objective risk which they find acceptable, which they try to maintain, and which is mediated by a pattern of expected costs and benefits. Wilde cites the following determining factors in a driver's target level of risk and ensuing decisions: values associated with culture, peer group pressure, gender and age-role identification and personality traits. Hence, perceived rewards for fast driving may raise the target level of risk. Wilde suggests that the route to reducing risky driving is to reduce the target level of risk by providing incentives for cautious behaviour and disincentives for risky behaviours, altering the utility of risk.

The evidence on risk utility as a mediator of risk-taking behaviour is limited as most research in the area has examined high and low accident groups among young drivers, rather than differences in risk utility as a function of age. However, there is research to suggest that risk has greater utility in young drivers in the expression of emotions, the facilitation of peer approval, feeling of power and control and the enhancement of self-esteem (Jonah, 1986). Further research on the interaction of risk perception, risk utility and driver age may prove useful in trying to understand the risk-taking behaviours of young drivers.

Similarly, stored information on previous driving experiences may play a role in the evaluation of risk utility, along with personality characteristics and motivational factors. These three particular elements of the process are those referred to by Wilde (1982) in his theory of risk homeostasis. Although not shown in their model, Mathews and Moran, in agreement with the present author, state that the processes involved in the evaluation of risk utility and risk perception are not independent: there is a bi-directional influence. While on the one hand risk utility (and the associated needs and motivations) may influence perceptual evaluation of information, the perception of risk associated with a given action is available for input to the risk utility evaluator.

An examination of the above model suggests that the route to understanding risk-taking behaviour does not lie in research which focuses on one isolated subprocess of the model. Research is also required to establish what individual/group differences exist in the magnitude of the role played by the various subcomponents. Whereas older drivers will be greatly influenced in their risk perceptions by their accident histories, younger drivers with less information on their abilities and previous outcomes of specific driving actions, are likely to underestimate the level of potential risk in certain driving actions, while at the same time having very different motivational forces from the older driver providing input to their evaluation of risk utility.

In summary, there is research to suggest that the high risk-taking behaviours of young drivers may be jointly determined by two factors: their inaccurate perceptions of the potential risk associated with certain driving behaviours, and their propensity to become involved in deliberate risk-taking activities. There is evidence to suggest that risk has greater utility in young drivers in the expression of various emotional-motivational factors.

The present study has provided a contribution to the area of risk-taking by examining various aspects of risk perception, as well as identifying general motivations and attitudes towards road user behaviour that may influence risk utility, with a novel sample of young pre-drivers/drivers. These risk perception and motivational factors held by young people have been identified and highlighted as they contribute to the differential developmental stages of youth in road user behaviour.

The implications for countermeasures on the basis of results from this study, are that educational programmes

aimed at young people require effective methods for altering risk perceptions and need to attempt to influence young drivers to make less intentional risky driving decisions. The evidence from the present study may suggest that the more interactive and pictorial modes of information presentation are more successful in assisting young people to develop more accurate mental representations of the road traffic environment with which to make their decisions.

7.9 GENERALIZATION OF THE RESULTS.

The respondents in this study were randomly selected, as far as was possible, and as such there is no reason to suppose that they are not representative of other young people in state schools and colleges across the north west of England. Some variations across large regions of the country may be expected with respect to some attitudes at different times of the year: one example may be seasonal regional differences in the scale of drink-driving campaigns. Dix and Layzell (1983) have documented variations in the style of policing adopted by regional police forces, and these differences could influence the social acceptability of certain driver behaviours and attitudes towards sanctions. Overall though, there is no strong evidence to suggest that large regional variations exist across a wide range of driving related attitudes, that are consistent over time. As such it may be assumed with reasonable confidence that subjects in this study are representative of other young people aged 11-19 years (in full-time education) in the United Kingdom. However, a note about the representativeness of the I.V.D.P. and Survey Studies samples should be reiterated here: while an attempt was made to obtain representative samples between the I.V.D.P. and Survey Studies in terms of age, sex and driving status, this was only achieved in terms of age and sex.

7.10 CONCLUSIONS.

7.10.1 IMPLICATIONS FOR PRE-/DRIVER EDUCATION.

Issues that have been raised by this study and which have important implications for the design of driver and pre-driver education programmes are summarised below.

- 1) Pre-driver education in secondary schools needs to start at the age of 11 years. This study has shown that

long before they are old enough to drive these young people hold clearly defined attitudes towards driving and road safety. Pre-driver education programmes in secondary schools can foster and attempt to maintain the socially responsible attitudes held by these very young people, which have been shown to quickly deteriorate into 'deviant' attitudes. In addition to this, pre-driver education from a very early age can help to correct any 'deviant' attitudes early on.

2) The results from both the survey and I.V.D.P. studies have revealed that there are several attitudinal and behavioural dimensions along which young people of different ages can be discriminated. The implication for driver and pre-driver education is that training material should be designed specifically to reflect the attitudinal and behavioural dimensions of the different age groups of young people at which these educational programmes are aimed. This means that one set training course would not be appropriate for secondary school pupils of all ages: training materials would have to be designed to match the attitudes and perceptions of each age group of young people. The results from this study have indicated that for training purposes young people can be usefully grouped into the following age groups: 11-14 years, 15-16 years, 17-18 years (non-drivers), 17-18 years (drivers) and 19 years (drivers).

3) Driver education and training programmes need to make a distinction in their training course content between 17/18 year old and 19 year old drivers. Results revealed that 19 year old drivers could be distinguished from their younger driving counterparts in terms of speeding, attitudes towards reckless driving, their level of aggressiveness to other drivers, and their attitudes towards the police.

4) Pre-driver education and training programmes need to make a distinction in their training course content between 11-14 year old, 15-16 year old and 17-18 year old non-drivers. Results revealed that these age groups of non-drivers could be distinguished from one another in terms of their perceptions of the likelihood of detection for driving offences, their perceived seriousness of driving offences, their attitudes associated with wanting to learn to drive, perceptions of their future driving styles, perceptions of the difficulty in mastering cognitive driving skills, and their attitudes towards drink-driving. While many attitudes and perceptions could be seen to simply increase or decrease with age, the 17-18 year old non-drivers were differentiated from their

younger counterparts on many factors. The ages 15-16 years, were also an important stage where sudden changes in the direction of attitudes and perceptions were found.

5) Pre-driver and driver education and training programmes need to make a distinction in their training course content between 17-18 year old drivers and 17-18 year old non-drivers. Results revealed that 17-18 year old drivers could be distinguished from their same age non-drivers in terms of the perceived seriousness of drink-driving and driving without a licence, the perceived dangerousness of potential hazards, preferred driving speeds and rate of deceleration, the relative perceptions of 'self' and 'others' driving skill, overtaking frequencies and road environment awareness.

6) The results from both the survey and I.V.D.P. studies have revealed that there are very few attitudinal and behavioural dimensions along which young male and female non-drivers can be discriminated, but several along which male and female drivers can be. The implications for pre-driver education and the associated training content are minimal, due to the very limited dimensions along which these non-drivers can be discriminated (males rate the acceptability of driving offences, and the desirability of having a saloon or sports car, higher than do females). While the results indicated that male and female drivers aged between 17 and 19 years could be discriminated along several attitudinal and behavioural dimensions (driving speeds, risk motivation, risk perception and perceived importance of car safety features), two factors in the design of driver education courses need to be considered. Firstly, many differences between the young male and female drivers were reduced when assessed using interactive video techniques (e.g., perceived likelihood of accident-involvement, and overtaking behaviours). Secondly, when considering the implementation of school-based driver education programmes, it would be difficult to justify in socio-political terms, the development of different education programmes for males and females.

7) The present study indicated that sex differences between young drivers were more apparent when using survey instruments as a measuring technique, than when using interactive video. While the I.V.D.P. results indicated that there were no sex differences within the driver and non-driver samples in terms of driving speeds, evaluation and response to hazards, perceptions of skill for 'self' and the 'average' driver, perceived likelihood of an accident and the associated severity, differences were

only apparent on two overtaking behaviours and one road environment awareness factor. These results may suggest that the use of interactive video technology reduces the perceptual and behavioural differences between young males and females. The disparate identification of sex differences with use of different measurement techniques was highlighted in terms of perceptions of the likelihood of accident involvement. Sex differences were apparent on this issue on the Driver Questionnaire, but not on the I.V.D.P. Previous research which has employed pictorial assessment techniques in risk perception, has also failed to identify sex differences (Sivak et al, 1989). It may be suggested that sex differences in risk perception are more apparent in passive, non-pictorial, assessment environments. These results suggest that it may be easier to expose young males and females to the same driver education programmes, if visual aids, such as video or interactive video, are employed (rather than traditional classroom lecturing techniques) as a method of reducing these sex differences. This is particularly important in training programmes for young male and female drivers, where sex differences become more apparent.

8) This study revealed that while young people of all age groups only perceived most driving offences to be moderately serious, these perceptions did vary with age somewhat. Educational programmes need to focus some attention on the seriousness of driving offences, in terms of both sanctions and related accident statistics, in an attempt to have a positive impact upon these perceptions.

9) It was indicated in this study that young people of all ages generally had socially responsible attitudes towards drink-driving. It may be possible to use these positive attitudes in education and training programmes as a reference point against which to discuss other risk-taking behaviours on the road. Classroom discussions with young people about drink-driving in terms of the perceived likelihood of detection, likelihood of accident-involvement, sanctions and possible severity of consequences, along with perceived societal attitudes towards the offence, may be used as a focal point for a comparison with other risk-taking behaviours on the road (such as speeding). It may be possible to produce some element of cognitive dissonance in young people by presenting them with the issue that while they do not sanction one form of dangerous driving behaviour (drink-driving), they sanction other equally dangerous ones.

- 10) Education programmes need to include information on the social, legal and health issues associated with alcohol consumption. This study indicated that the reported social consumption of alcohol increased with age.
- 11) An important area to which driver and pre-driver education must address itself is risk utility, as some findings from the present study found 'deviant' attitudes towards risk-taking behaviours on the road. Results indicated that not only did a positive attitude towards reckless driving and a high risk motivation increase as age increased, but also that young people's perceptions of themselves as drivers (or their future driving styles) are more 'deviant' than either their reported or simulated driving behaviours. An attempt to correct these 'deviant' perceptions would be wise to pre-empt any future correlation between these 'deviant' perceptions and actual on-the-road driving behaviours.
- 12) The issue of the perception of one's driving skills in relation to the skills of other drivers needs to be addressed early on in driver and pre-driver education programmes. This study, like others, indicated that young people of all ages rated themselves as more skilful than the 'average' driver. A comparison of the results from the survey and interactive video studies, suggests that the use of interactive video in driver and pre-driver training in the concept of self skill, may be more profitable than traditional lecturing techniques. The use of interactive video in measuring skill for 'self' and the 'average' driver produced a decrease between these two ratings as age and driving experience increased, whereas assessment using survey techniques did not. It may be that interactive video techniques assist young people in developing a more accurate perception of the road traffic environment, and helps them to develop more accurate relative perceptions of their skills. If an accurate awareness of one's own skill in relation to others can be produced in the classroom using interactive video techniques, then these perceptions may transfer with young people as drivers on the road. However, as this study only employed interactive video as an assessment technique, further work and evaluation of this method as a training tool is required before its benefits as a training tool can be assured.
- 13) Previous research has indicated that the presentation of fear-arousing material during driver training does (at least in the short-term) increase fear of an accident and its consequences (e.g., Griffeth and Rigers, 1976). The results from the present study into the perceived

likelihood of an accident and accident seriousness, would suggest that such a fear-arousal technique would not be appropriate. Although the perceived severity of the consequences of one's actions is one element in the risk equation, one needs to consider the cognitive processes of the driver one stage prior to this: results from the Driver Questionnaire revealed that although drivers had moderate perceptions of the likelihood of an accident being serious when engaging in certain behaviours, they also had lower perceptions that an accident would occur in the first place. It would not be very effective to increase young people's perceptions of the severity of accidents, without first increasing their perceived likelihood of accident-involvement. The study showed that young drivers held particularly low perceptions of the likelihood of an accident through speeding or close-following.

14) Along with an attempt to increase the perceived likelihood of accident-involvement resulting from risk-taking behaviours, should be an attempt to increase young people's perceived likelihood of detection to reduce deliberate risk-taking behaviours. Research in the area of drink-driving has shown the perceived likelihood of detection to be related to the offence (Guppy, 1986). Increasing the perceived likelihood of detection may have greater impact upon drivers' perceptions of the risks associated with dangerous driving behaviours.

15) The results from this study have presented evidence which allows one to tentatively suggest that video technology may be an effective training tool to make young people aware of the critical safety factors that drivers must pay attention to in the road traffic environment: however, evaluation of video technology as a training tool is required in order to substantiate this. An awareness of these road safety factors will also help young people in their early roles as pedestrians and cyclists. As all young people were shown to perform poorly on a task that required verbal reports of awareness of road environment factors, some trial testing of young people on these factors, may be a useful preliminary to discussions on driver skill, as young people do not hold all the information about road traffic situations necessary to make accurate judgments about their skills and behaviour. An understanding of drivers' perception of the road environment at different developmental stages has implications for driver and pre-driver education as it is important to know which aspects of the road environment cause young people perceptual awareness problems, in order to focus the correct level of training on the correct issues at different developmental stages.

16) In the implementation of any driver or pre-driver education programme, some consideration needs to be given to the background of the trainers. This point has particular relevance to the role of the police as trainers, as the present study has indicated that while overall young people had a fairly neutral attitude towards the police, this attitude became increasingly negative as age increased. Research by Spear, Singh and Nicholas (1988) has shown that police officers are involved in a large percentage of secondary school road safety education programmes in the United Kingdom. Their study also indicated that police officers in nearly 50% of the 263 divisions studied, had received no training for their road safety education duties. The fact that police officers are often involved with local schools in road safety education programmes, and that these police officers often have no specific training, makes young people's attitudes towards the police of crucial importance. The early and continued contact of very young secondary school pupils with the police, will provide an opportunity to foster a positive relationship rather than a negative one in the latter teenage years. However, 17-19 year olds who have not had previously positive contact with the police, may not develop a respectful relationship during road safety education lessons. Road Safety Officers and other external visitors may be able to develop a more positive relationship in which to teach road safety education, than police officers, or indeed teachers who may be entrenched in the existing ethos of the school.

17) The use of the I.V.D.P. system revealed that young people find interactive video interesting and novel, and as such it holds their interest. The use of interactive video as a training tool, lies in its facilities to present realistic representations of the road traffic environment to the user, which the user can then interact with. The use of this technology in a training environment may assist in stimulating interest in the topic of road safety in schools. Indeed, the use of interactive video was implemented by Road Safety Officers in the north west of England in 1989-90, as a training tool aimed at 16-18 year olds. A further advantage of interactive video technology is that it can be used as a very simple, but effective, means of data collection and evaluation.

7.10.2 IMPLICATIONS FOR FUTURE RESEARCH.

Areas which this study has highlighted as in need of further research are summarised below.

- 1) A comparison of simulated driving behaviours (produced from an interactive video system) with on-the-road observed behaviours would allow a more direct assessment of the validity of the use of interactive video as a measuring technique. This study made indirect comparisons between the I.V.D.P. simulated driving behaviours with the observed on-the-road behaviours reported in previous studies, and found a reasonable degree of similarity.
- 2) An examination is required of the cognitive processes that produce age-related differences in the evaluation of potential hazards, but no differences in the actual response to hazards. This area could be further examined by making a comparison between hazard evaluation and style of response to hazards, as previous research has indicated the latter to be related to driving performance (Pelz and Krupat, 1974).
- 3) As the present study found that the perceived seriousness of some offences decreases with age, it may be informative to examine the correlation of the perceived seriousness of individual offences, with the reported contravention of these offences, to see how well attitudes towards offences actually predict transgression.
- 4) An examination of the means for the transgression of speed limits within the present study indicated that transgression became less likely as the speed limit increased. Research is needed to determine whether this is due to young drivers' lack of experience on roads with higher speed limits, or because young drivers feel it is more dangerous to break these higher speed limits.
- 5) Future research could extend the examination of the relationship between driving offence-related behaviours and the perceived likelihood of accident-involvement, by including the perceived likelihood of detection into the equation. The present study suggested that the reported low likelihood of engaging in dangerous overtaking behaviours, did not appear to be motivated by the perception of accident-likelihood and severity: one explanation which could usefully be explored in future research is the role of the perceived likelihood of detection. Research in the field of drink-driving has

indicated that offenders have lower perceptions of the likelihood of detection for the offence (Guppy, 1986): it would be useful in the design of driver education programmes and other countermeasures, to see whether this perception-behaviour relationship is generic.

6) Research is needed to clearly identify which task elements, and which cognitive processes, are responsible for the reduction of age and sex differences in perceptions and behaviours, when performance is measured using interactive video technology as opposed to survey techniques. Further research evidence is required to determine whether the use of interactive video techniques results in an increase or decrease in perceptions and performance, when compared to survey assessment techniques.

7) Future research needs to assess the use of interactive video as a *training tool*, as opposed to more traditional methods, in driver and pre-driver education programmes.

8) The selection of a wider age range of driving subjects (e.g., 17-25 years) would allow greater potential for an examination of the effect of driving experience and exposure upon attitudes, perceptions and behaviours as part of a developmental process. It may be expected that experience will play a significant role in explaining group differences within a sample with a larger age range than employed in the present study.

9) A methodological improvement in future work could be made by increasing the age range of the non-driver sample to 19 years, to match that of the driver sample: this would allow for a more detailed examination of the effect of driving status upon attitudes, behaviours and perceptions, at each of three consecutive ages (17, 18 and 19 years).

10) In order to provide some assessment of the verbal commentary results, further work could be undertaken to address the issues of the effect of training upon performance, and the validity of performance measures. Firstly, work could be undertaken which compares the performance of subjects with pre-task training, with those without training on the interactive video verbal commentary task. Secondly, subjects could be presented with an 'importance' rating task of a series of environmental awareness factors (such as the technique employed by Spicer, 1964), in order to provide some

measure of the validity of the verbal commentary task results. From the results of the present study it is unclear whether subjects did not report certain aspects of the road traffic environment because they did not notice them (e.g., road traffic signs), or because they were already including them *within* their consideration of other factors (such as the reporting of required actions/behaviours). A follow-up task involving the rating of a pre-determined list of factors may help to disentangle these results.

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