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AN INVESTIGATION OF THE RELATIONSHIP BETWEEN TRAFFIC ENFORCEMENT AND THE PERCEIVED RISK OF DETECTION FOR DRIVING OFFENCES

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Title:

An Investigation of the Relationship Between Traffic Enforcement and the Perceived Risk of Detection for Driving Offences

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Abstract:

The report presents the results of a survey of 3,700 licensed drivers in Victoria, Australia, concerning their experiences of speed and drink-driving enforcement and their perceptions of the risk of detection for speeding and drink-driving. Exploratory analyses of the data indicate that there were five groups of correlated items. These related to the perceived risk of detection for drink driving and exposure to drink driving; exposure to drink-driving and speed enforcement in general; the perceived risk of detection for speeding; the type of driving exposure of respondents; and the recency of contact with enforcement. These factors were largely independent, with the exception of the two perceived risk factors which were moderately correlated. The factor analysis results were used to investigate similarities between drivers in a cluster analysis, where it was shown that there were six groups of respondents defined in terms of their experiences with and attitudes to enforcement activity which differed on a number of other survey measures.

EXECUTIVE SUMMARY

The nature of the relationship between the perceived risk of detection and exposure to traffic enforcement is unclear, and the processes underlying the effects of enforcement on driver behaviour are unclear.

This report details the results of a survey of 3,700 drivers in four Police Districts in Victoria. The survey was conducted as part of an evaluation of a specific enforcement program, and the present report uses the data collected in the survey to investigate the relationship between exposure to enforcement activity and the perceived risk of detection for traffic offences in the speeding and drink driving domains.

The survey questionnaire included items relating to:

- The perceived risk of detection for speeding during daylight and nighttime hours separately;
- The perceived likelihood of being checked for alcohol during daylight and nighttime hours separately;
- The perceived risk of detection for drink-driving during daylight and nighttime hours separately;
- The occupation, age group, and sex of the participant;
- The amount of driving and proportion of built-up-area and daylight driving of each participant;
- The awareness of road safety publicity; and
- The personal experience and indirect knowledge of others' experiences of traffic enforcement.

A factor analysis of the survey data indicated that there were five groups of correlated items. These were items relating to:

- The perceived risk of detection for drink driving and exposure to drink driving enforcement;
- Exposure to drink-driving and speed enforcement in general;
- The perceived risk of detection for speeding;
- The type of driving exposure of respondents; and
- The recency of contact with enforcement.

These factors were largely independent, with the exception of the two perceived risk factors which were moderately correlated.

The factor analysis results were used to investigate similarities between drivers in a cluster analysis, where it was shown that there were six groups of respondents defined in terms of their experiences with and attitudes to enforcement activity which differed on a number of other survey measures.

The final exploratory analyses investigated the nature of the relationship between survey measures and perceived risk in more detail.

The results are interpreted, in part, as having relevance to the generalisation of deterrence models to speed-choice behaviour, where it is suggested that the nature of speed-choice makes it unlikely that a deterrence model is the most appropriate way of accounting for the relationship between enforcement and behaviour.

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1   INTRODUCTION

It is generally held that traffic enforcement programs influence driver behaviour (and therefore crash involvement) through their effect on the perceived risk of detection for traffic offences. Highly visible or high-intensity traffic enforcement programs are thought to increase the perception that detection is likely to be an outcome of illegal driving behaviour.

The processes underlying this relationship are poorly understood, as is the nature of the relationship itself. This report presents the results of a survey of licensed drivers concerning their experiences of and attitudes towards enforcement. It was hoped that the results of the survey would provide additional information about the relationship between enforcement and perceptions of the risk of detection.

1.1 The Traditional View and Alternative Formulations

The enforcement program in Victoria, particularly as it relates to speeding and drink driving, is based on the deterrence model initially applied to driver behaviour in the presence of traffic enforcement by Homel (1988). This model[1], at a descriptive level, suggests that higher perceived levels of enforcement are associated with higher levels of perceived risk of detection for driving offences, which in turn lead to safer driving behaviour. At this level, then, the model restates the general observation that the threat of detection and punishment can act to change behaviour, and specifies a route by which this occurs.

The deterrence model does not, however, make sensible comment about the psychological and cognitive processes underlying this relationship between enforcement levels and behaviour. Homel (1988) drew on then-current classical or normative models of decision making to try and understand the underlying processes. These models are normative in the sense that they may be viewed as the "best" or ideal way to make decisions under conditions of uncertainty. Whether they represent the best description of the processes underlying driving behaviours in the real world is, however, less certain.

Homel (1988) used a particular form of normative decision-making models – the expected utility models – which are based on processes which require the decision maker to evaluate the likely outcomes of a number of alternative behavioural options and to behave in a way which is consistent with the relative expected utility or value to the person. These models are based on mental comparisons between outcomes, and are therefore considered to be computationally intensive (Orasanu & Connolly, 1993).

Against decision-making models such as this one is the more-recent body of evidence that behaviours and decision making are based on a number of processes which resemble short-cuts in that they avoid the need for cognitively-demanding mental computations. These processes include cognitive heuristics, levels of processing, and automatic behaviours based

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[1] It is important to clarify the distinction between the deterrence model and deterrence as an outcome of high levels of enforcement and supporting public education. The deterrence model is one possible way of accounting for the deterrence (or behaviour change) resulting from enforcement activity. Criticising the deterrence model does not negate the empirical reality that there is some psychological process which results in behavioural changes contingent on enforcement activity. The central issue is the extent to which the deterrence model is the best theoretical account of deterrence.

on recognition of environmental cues and linkages with previously-successful behaviours (Lipshitz, 1993).

The growing evidence that these non-normative processes are the core of decision making in naturalistic environments (Cohen, 1993) throws increasing doubt on the adequacy of the deterrence model as formulated by Homel (1988). It was hoped that the data collected for this study would provide additional information which might assist in the development of an alternative understanding of the processes underlying the relationship between enforcement and behaviour, although this was less important as an aim for the present study than the investigation of the strength and nature of the relationship itself. Further discussion of these issues is presented in the Discussion section of the report.

1.2 The Present Study

This report is based on data which were intitially collected as part of an evaluation funded by the Transport Accident Commission. The data were collected using telephone surveys from licensed drivers resident in four Police Districts in Victoria over three survey waves spread over a period of 4 months. For most of the analyses reported here, the data were aggregated across Districts and survey waves as data analysis for the evaluation component of the study suggested that there were few differences between them.

The survey was designed to collect information from respondents about their experiences of enforcement and their perceptions about the likelihood of detection for speeding and drink driving.

1.3 Outline Of The Report

This report presents the results of the survey in a number of sections.

The next section provides details of the sample selection process and the survey questionnaire.

Presentation of the results and discussion has been divided into specific sections. The first of these provides a short description of the data collected in the survey. The following sections present exploratory analyses of the data using a number of statistical techniques allowing an investigation of groups of items, groups of respondents, and more general comparisons between respondents. These analyses reflect the richness of the data collected during the survey. The exploratory analyses involve a large number of statistical tests, however, some of which would be expected to produce statistically significant outcomes on the basis of chance alone. In the context of an exploratory study this was not considered to present substantial difficulties.

The final section of the report attempts to draw together the results of the exploratory analyses in a way that sheds light on the factors that influence the perceived risk of detection for traffic offences.

2 METHOD

2.1 Sample

Sampling relied on the random selection of telephone numbers in each of the four Police Districts (D, Q, H, and O) from the appropriate Telstra White Pages telephone directory, using purpose-developed software to ensure no repetition of telephone numbers. Sampling of telephone numbers was expected to produce a random sample of households from which potential participants could be recruited. Recruitment of participants in this way, however, would be expected to bias the sample towards drivers at home during the early evening or on weekends (when the survey was conducted), and towards drivers with characteristics associated with having a listed telephone number. It was not possible to quantify the effect of these biases.

Households were contacted by telephone interviewers in the early evenings from Monday to Friday (between 4pm and 9pm) and on weekends (between 11am and 5pm) between July and November, 1997, and participants were recruited using the protocol in Appendix A. Quota sampling was used to equalize the number of male and female participants and the number of participants in each of the two age groups. Participants in the 18-29 year age range were difficult to recruit due to their tendency to be unavailable at the times of the interviews. One call-back was allowed for each number where there was no answer.

Information concerning refusal rates and the samples in the treatment and control Districts is presented in Table 1. Households where there were no respondents in the sampled age ranges, where English was not spoken, or where other difficulties made an interview impossible are included in Table 1 as "Not Suitable".

Table 1: Sample Information for the Treatment and Control Districts

SAMPLING DATA	
Total Number of Calls Made	0
Number of Calls Answered	0
Number Not Suitable	0
Number of Surveys	0
Number of Refusals	5,400
AGE	
18-29 years	-11
30-59 years	-29
SEX	
Female	0
Male	0

2.2 Survey Questionnaire

The survey questionnaire was developed with advice from the Transport Accident Commission and is presented in Appendix B. It was conducted by telephone using computer-assisted interviewing and direct data entry.

The survey questionnaire included items relating to:

- The perceived risk of detection for speeding during daylight and nighttime hours separately;
- The perceived likelihood of being checked for alcohol during daylight and nighttime hours separately;
- The perceived risk of detection for drink-driving during daylight and nighttime hours separately;
- The occupation, age group, and sex of the participant;
- The amount of driving and proportion of built-up-area and daylight driving of each participant;
- The awareness of road safety publicity; and
- The personal experience and indirect knowledge of others' experiences of traffic enforcement.

The items relating to the perceived risk of detection involved the use of a rating scale to estimate the likelihood of detection. The scale ranged from zero to ten (an 11-point scale) with the end points anchored such that zero was defined as meaning that there was no chance of a particular event occurring and ten defined as meaning that the event in question was certain to occur.

Occupation, age group, and sex were recorded. It needs to be emphasised that the quota sampling method sought equal numbers of respondents in four groups – males aged 18 to 29 years, females aged 18 to 29 years, males aged 30 to 59 years, and females aged 30 to 59 years.

Driving exposure was measured by asking respondents to estimate the amount of driving (in hours) that they did in the week preceding the survey, and to estimate what percentage of that time was spent driving on built-up roads and during daytime hours. The latter two items provided data concerning the type of driving exposure of each respondent.

Awareness of road safety publicity was assessed by asking respondents whether they had been exposed to any road-safety publicity or advertising in the month preceding the survey. Where they had, respondents were then asked to recall the media used for this material and the message or content of the material.

The personal and indirect experience of enforcement was assessed by having respondents indicate whether particular experiences had occurred to them or to others they knew, and if so how recently they had occurred. Events included being stopped at a breath test station, and being caught speeding or drink-driving. Respondents were also asked whether penalties were imposed in the most recent instance.

The survey took between 5 and 10 minutes to conduct.

3   DESCRIPTION OF THE DATA

This section provides an overview of responses to major items in the survey.

3.1 The Perceived Risk Of Detection For Speeding

Responses to the items concerning the perceived risk of detection for speeding offences during daylight and nighttime hours are presented in Figure 1.   The mean perceived risk rating for daytime speeding was 4.7, and for nighttime it was 4.3.
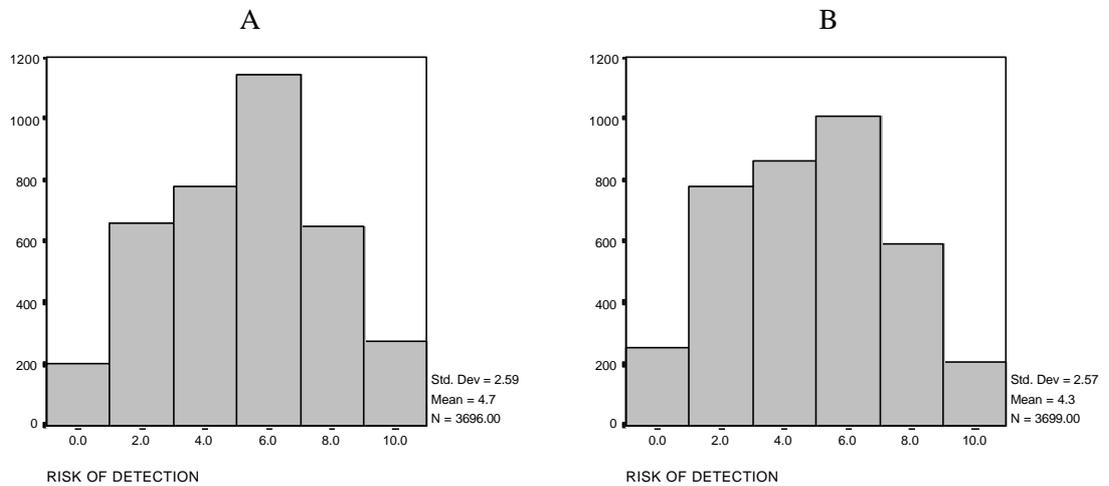
Figure 1: Perceived Risk of Detection for Speeding During Daylight (A) and Nighttime (B) hours.

3.2 The Perceived Likelihood Of Being Checked For Alcohol

Responses to the items concerning the perceived risk of being checked for the presence of alcohol during daylight and nighttime hours are presented in Figure 2. The mean perceived risk rating for daytime was 2.1, and for nighttime it was 4.0.

A   B
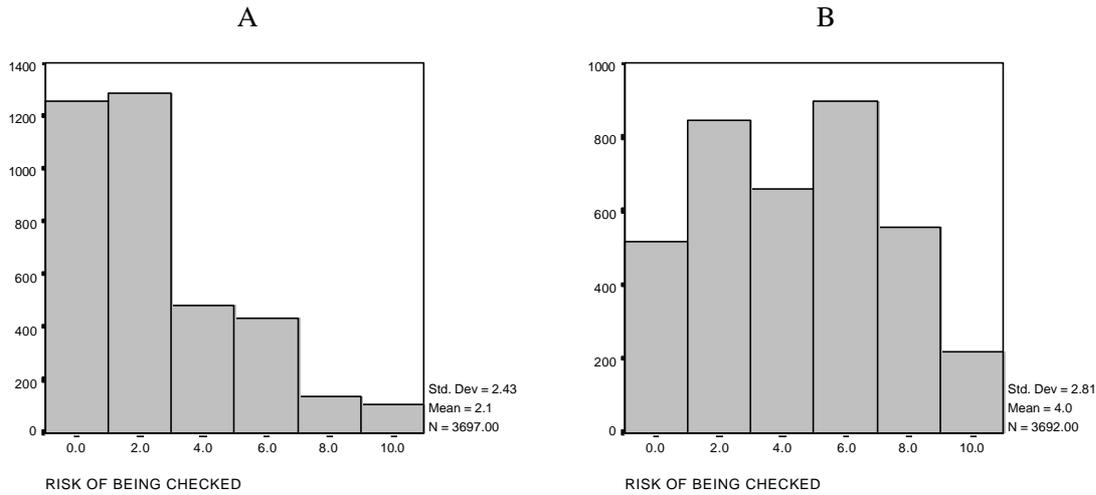
Figure 2: Perceived Risk of Being Checked for Alcohol During Daylight (A) and Nighttime (B) hours.

3.3 The Perceived Risk Of Detection For Drink-Driving

Responses to the items concerning the perceived risk of being checked for the presence of alcohol during daylight and nighttime hours are presented in Figure 3. The mean perceived risk rating for daytime was 3.6, and for nighttime it was 5.2.

A   B
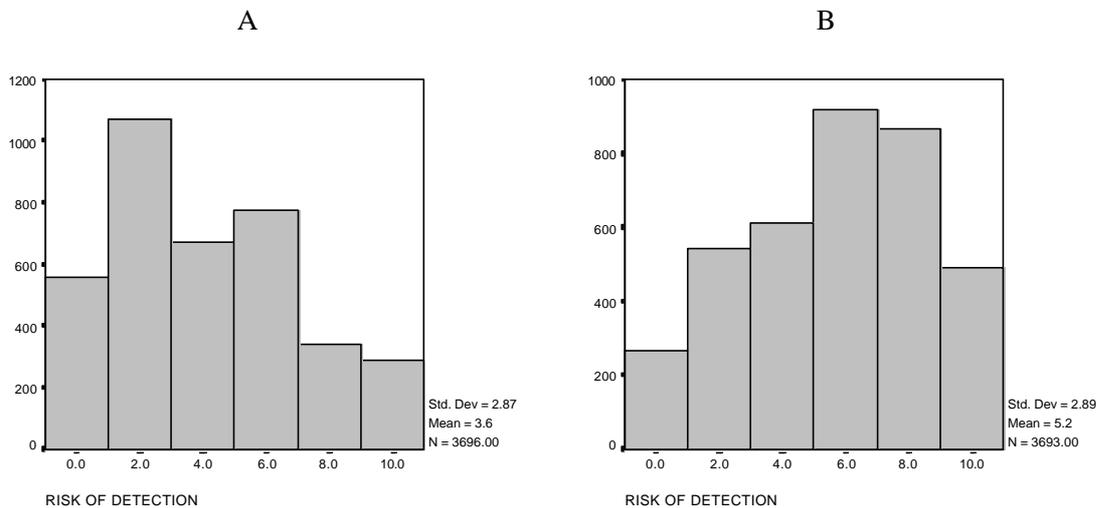
Figure 3: Perceived Risk of Detection for Drink-driving During Daylight (A) and Nighttime (B) hours.

3.4 Driving Exposure

The amount of driving reported by respondents is shown in Figure 4. In the week preceding the survey, respondents drove an average of 10.8 hours.
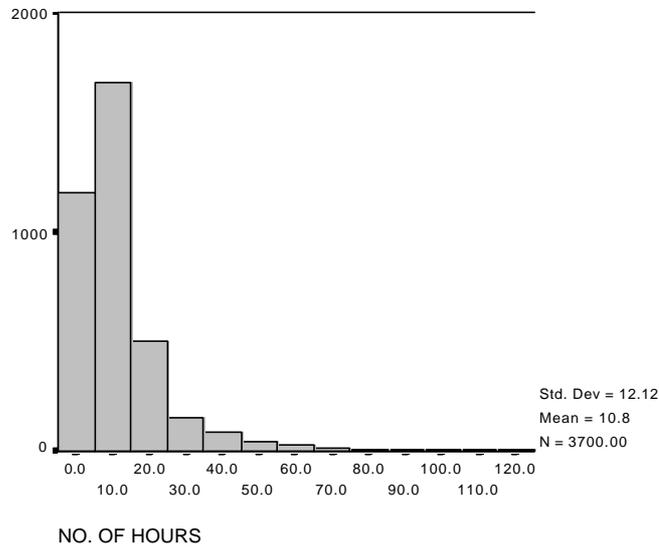
Figure 4: Number of Hours of Driving in Preceding Week

Figure 5 shows the type of driving exposure reported by respondents. Figure 5A shows the percentage driving in the preceding week which occurred in built-up areas. Respondents reported an average of 66.9% of their driving occurred in these areas. Figure 5B shows the percentage of driving occurring during daytime hours with a mean of 80%.
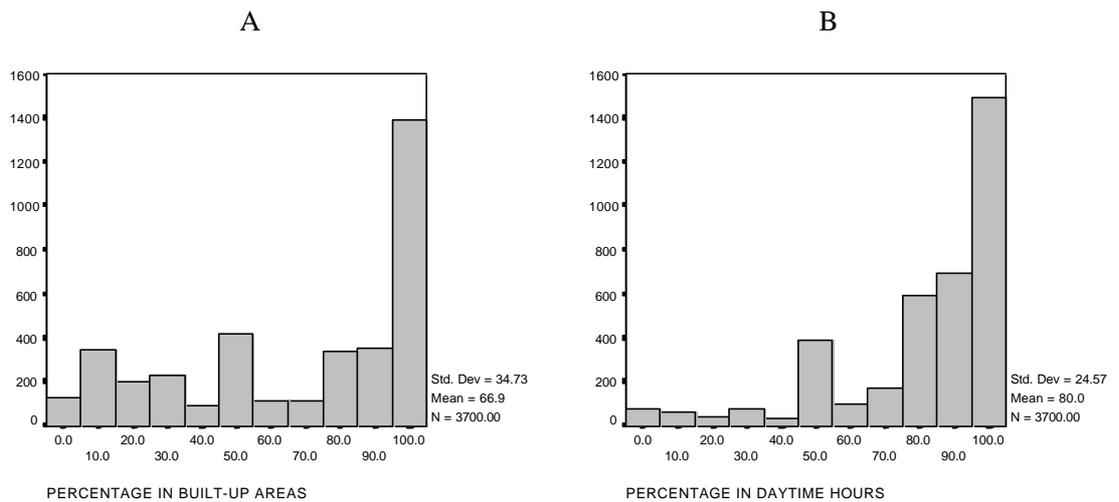
Figure 5: Amount of Driving in Built-up Areas and During the Day

3.5 The Awareness Of Road Safety Publicity

Respondents were asked to indicate whether they could recall any road-safety related material in the month prior to the survey. 86% of respondents could recall this type of material. These respondents were then asked to indicate which media they could recall being used for this publicity. 73% of respondents could recall television material, 20% radio, and 16% newspaper.

They were also asked to recall the content or message of any publicity they could recall in the preceding month. These were then recoded by the first author to reflect the inclusion of themes relating to speeding (recalled by 31% of respondents) and drink-driving or booze buses (recalled by 45% of respondents).

3.6 The Experience Of Traffic Enforcement

Respondents were asked to indicate the number of times they had seen the Police engaged in speed and drink-driving enforcement in the four weeks preceding the survey. The average number of instances of speed enforcement reported by respondents was 5.1, and the average number of times drink-driving enforcement was seen by respondents was 1.3.

Respondents were asked if they could recall having had their speed or blood alcohol concentration checked by the Police while engaged in enforcement activities. Most respondents could recall both instances (89% could recall having their speed checked, 81% their blood alcohol concentration). Figure 6 shows the time since the last instance of each of these events occurred. The mean time period since respondents last had their speed checked was 3.9 weeks, and the mean since last having their blood alcohol concentration checked was 13.8 weeks.
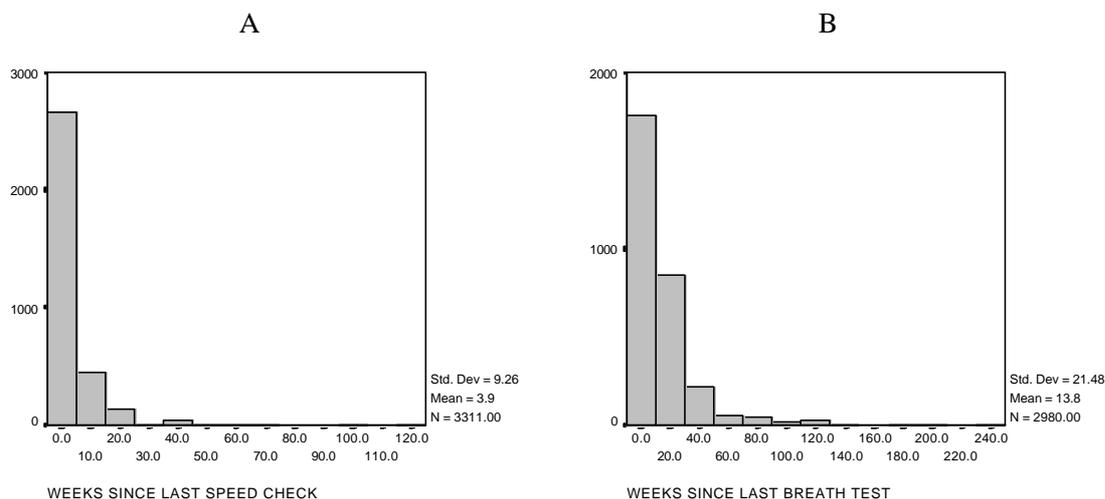
Figure 6: Time Since Last Contact with Speed and Drink-driving Enforcement

A total of 2,162 (58.4%) respondents reported having been caught for speeding, with the most recent instance being an average of 35 weeks prior to the survey. Two percent of these respondents indicated that they had avoided being fined or penalised on the most recent occasion. 3,212 respondents reported knowing someone else who had been detected speeding, with the most recent instance being an average of 10.0 weeks prior to the survey. Only 1.5% of respondents indicated that the person had avoided a penalty in that instance.

Only 235 (6.4%) of respondents had been caught drink-driving. A mean of 85.6 weeks had elapsed since the most recent time this had occurred, and 0.6% of respondents indicated that they had avoided a penalty at that time. 2,328 respondents knew of someone else who had been caught drink-driving. The most recent instance of this was a mean of 24.6 weeks prior to the survey, and 1.9% of respondents indicated that the offender had avoided a penalty at that time.

4   THE UNDERLYING PATTERN OF RESPONSES

4.1 Background

Item responses in the survey of drivers were expected to be correlated as the items sought information concerning related perceptions – such as the perception of the probability of being detected speeding during the daytime and at night. It was considered that the pattern of relationships between responses could be used to investigate the possibility that there are psychological constructs or processes underlying perceptions of the risk of detection for traffic offences.

The underlying pattern of correlations between item responses was investigated using an exploratory factor analysis. Factor analysis capitalises on the pattern of correlations between items and uses these relationships to identify items with highly correlated responses. Factor analytic methods reduce a number of correlated, difficult to interpret variables to a smaller number of relatively independent factors which account for a significant amount of the item variance and which reflect the structure underlying the variables. Correlations between the original variables and the new factors provide information about the meaning or interpretation of each factor.

Thus, the factor analysis methods were applied to the data collected in the survey relating to the perceived risk of detection, driving exposure, and recency of contact with enforcement to investigate the structure underlying responses to these items.

4.2 Method

The factor analysis was conducted using the variables detailed in Table 2. These were items relating to the perceived risk of detection for speeding and drink-driving during daylight and nighttime hours, the amount and type of driving exposure of drivers, the amount of enforcement activity seen in the four weeks preceding the survey, the amount of elapsed time since the last time respondents had been checked for speed and alcohol, and the amount of time since someone else was known to have been detected speeding.

While it would have been useful to include other enforcement recency measures, it was considered that the increased number of cases with missing data would weaken the analysis. Demographic and publicity-related items were also not included because the factor analysis was intended to focus on enforcement in particular. These items were included in subsequent analyses involving the factors identified in this analysis.

The factor analysis was conducted using SPSS for Windows (Norusis, 1994). Factors were extracted using principal components extraction and the number of factors extracted (five) was determined using the usual criterion of eigenvalues greater than unity. Examination of the scree plot confirmed that the extraction of five factors was appropriate.

Factors were rotated using an oblique rotation. Factor rotation improves the interpretation of the factors as it maximises and minimises the correlations between items and factors. An oblique rotation reduces the independence of factors but ensures that the factors better-represent the underlying structure of the data set. In the present context, where the underlying

structure was thought to represent the psychological structure relating to perceived risk of detection it was considered important to allow factors to be correlated as psychological constructs are generally correlated.

4.3 Results

Five factors were extracted with eigenvalues greater than unity, accounting for 59.8% of the item variance. Factor loadings after the rotation of the factors are shown in Table 2. Factor loadings describe the correlations between each factor and item. Loadings less than .3 have been suppressed.

Table 2: Factor Loadings After Oblique Rotation (loadings less than .3 suppressed)

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Perceived risk of detection for drink-driving at night in the coming week	.81				
Perceived risk of being stopped and checked for drink-driving at night in the coming week	.79				
Perceived risk of detection for drink-driving during the day in the coming week	.77				
Perceived risk of being stopped and checked for drink-driving during the day in the coming week	.75				
Number of times speed enforcement seen in preceding four weeks		-.79			
Hours of driving in preceding week		-.78			
Number of times drink-driving enforcement seen in preceding four weeks	.39	-.49			
Perceived risk of detection for speeding during the day in the coming week			.81		
Perceived risk of detection for speeding at night in the coming week			.76		
Proportion of driving in last week in built-up areas				.75	
Proportion of driving in last week in daylight hours				.74	
Time elapsed since most recent recollection of having speed checked by Police					.73
Time elapsed since most recent recollection of someone else being caught speeding					.67
Time elapsed since most recent recollection of being breath-tested for alcohol by Police			.32		.44

Factor 1 appears to relate to the perceived risk of detection for drink-driving. The four items relating to the perceived risk of being checked for alcohol or being detected load most highly on this factor and do not load (with loadings greater than .3) on any other factors. The amount of drink-driving enforcement seen in the preceding four weeks also loads positively on Factor 1. High scores on this factor would represent a high perceived risk of detection for drink-driving.

Factor 2 appears to relate to the exposure of participants to enforcement activity. Both measures of the amount of enforcement activity seen in the preceding four weeks load on this factor, as does the item concerning the amount of driving in the preceding week. High scores on this factor would reflect low levels of exposure to enforcement activity as the factor loadings for the three items are negative after factor rotation.

Factor 3 relates to the perceived risk of detection for speeding, with both the daytime and nighttime perceived risk questions for speeding offences loading highly. High scores on this factor would reflect high levels of perceived risk of detection for speeding. The item concerning the amount of speed enforcement seen in the preceding four weeks did not load strongly on this factor, suggesting that the measure of exposure to speed enforcement and the measures of perceived risk of detection were uncorrelated. The item concerning the recency of personal contact with drink-driving enforcement did, however, load significantly on this factor in a way which suggests that recent contact with drink-driving enforcement may be associated with a reduced perceived risk of detection for speeding. This issue is discussed below.

Factor 4 appears to reflect the type of driving exposure, with both items concerning the percentage of driving in the preceding week in different contexts loading highly. High scores on this factor would reflect higher proportions of driving time in built-up areas and during the daytime.

Factor 5 represents the recency of contact with speed and drink-driving enforcement. High scores on this factor would reflect less recent contact with enforcement activity.

Table 3 shows the correlations between each of the factors in Table 2.

Table 3: Correlations Between Factors

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Factor 1	1.00				
Factor 2	-.13	1.00			
Factor 3	.26	-.04	1.00		
Factor 4	-.05	.11	-.01	1.00	
Factor 5	.00	.02	-.06	.05	.02

The correlations in Table 3 are generally low, with the exception of the correlation between Factors 1 and 3 (.26), suggesting that the perceived risks of detection for drink-driving and speeding (respectively) are correlated.

4.4 Discussion

The results of the factor analysis suggest a number of things about the structure underlying the responses to items in the surveys.

It is clear that the responses to items concerning the risk of detection for drink-driving at night and during the day varied together such that respondents who perceived there to be a high risk of detection for drink-driving at night were also likely to believe that the daytime risk of detection was high (Factor 1). This may reflect a general attitude or perception to drink-driving enforcement which is applied at all times of the day.

The general perception of the risk of detection for drink-driving appears to be linked to the perceived likelihood of being checked for alcohol by the Police (daytime and nighttime) and the amount of exposure to drink-driving enforcement activity in the preceding month (Factor 1). There is, therefore, an apparent link between the level of perceived risk and perceptions of enforcement activity. This linkage is consistent with the deterrence model commonly applied to drink-driving enforcement and suggests that influencing the amount of enforcement activity or the perceptions of how likely it is that respondents will be stopped for a breath test may act to increase the level of perceived risk for drink-driving. It is also consistent, however, with a decision-making approach to the enforcement-behaviour link. The link between exposure to enforcement activity and perceived risk is also consistent with evidence of the relationship between high-alcohol time crash involvement (a reflection of drink-driving behaviour) and random breath test activity noted by Newstead et al. (1995).

The results also suggest that there is a general underlying belief about the likelihood of detection for speeding such that respondents with a high perceived risk of detection for speeding during the day time are also likely to have an elevated belief in the risk of detection at night (Factor 3).

The correlation between the perceived risk of detection for drink-driving (Factor 1) and for speeding (Factor 3) suggests that there may be a general attitude or belief about the risk of detection for traffic offences which (in part) contributes to the specific perceived risks for the two offences. This is not surprising as an experience-based mental model of the driving environment would include some information about the general level of enforcement which would in turn influence the perceived risk of detection for all offences. For respondents where this internal mental model includes information about high levels of enforcement, a generalised elevated perceived risk of detection would be likely.

The perceived risk of detection for speeding (Factor 3) does not appear to be related to either the recent level of enforcement activity seen by respondents (Factor 2) or to recent experiences of speed enforcement (Factor 5). Rather, there is some evidence that recent experience with drink-driving enforcement may act to reduce the perceived risk of detection for speeding. This is an unexpected finding and will require additional consideration. In spite of this, it is of considerable interest that recent experience of speed enforcement is unrelated to the perceived risk of detection for speeding. This is clearly inconsistent with the deterrence model sometimes applied to speed enforcement and which was originally applied to drink-driving enforcement. This issue is discussed in the General Discussion.

5   FOCUSING ON GROUPS OF DRIVERS

There is considerable potential benefit for the development of road safety measures in an increased understanding of the characteristics of drivers who might be higher-risk road users. This section reports an exploratory cluster analysis designed to investigate the possibility that there are defined groups of road users in the sample who have attitudes or perceptions that might place them at risk.

Cluster analysis is a statistical technique which allows the similarity between respondents on a number of measures to be used to place similar respondents into groups. In the present situation, a cluster analysis would allow respondents with similar perceptions or attitudes to be grouped. The characteristics of these groups would then provide potentially valuable information for future targeting of countermeasures.

The large number of variables available for the cluster analysis and the likely difficulties involved in interpreting clusters based on many variables led to a decision to base the cluster analysis on the factor scores derived from the factor analysis reported in the preceding section. Thus, the perceived-risk, exposure, and enforcement experience items were used to generate five factor scores for each respondent. The factor scores represented the respondent's position on each factor, and so summarise the perceptions and behaviours of the respondent in terms of the five factors interpreted in the preceding section.

The clusters derived from the cluster analysis were then compared in terms of other information collected in the survey to describe each cluster's characteristics.

5.1 Method

An initial analysis of the data was conducted to determine the appropriate number of clusters of respondents. This involved taking a random sample of about 25% of respondents and using their factor scores (derived in the factor analysis) in a hierarchical cluster analysis using Ward's method of clustering and Mojena's method (Blashfield & Aldenderfer, 1988) to specify the appropriate number of clusters. This method was repeated using another random sample of 25% of the respondents to ensure stability of the results of the analysis. Both analyses indicated that 6 clusters should be drawn from the sample.

The factor scores of the complete sample were then entered into a k-means cluster analysis (Norusis, 1994) specifying 6 clusters as the outcome.

The clusters were then compared using analysis of variance techniques to describe the clusters in terms of the enforcement factors extracted in the factor analysis, and were compared on other survey items to provide a more detailed description of the clusters.

5.2 Results

Six cluster were identified. Results from the cluster analysis are presented in Table 4.

Table 4: Results of the Cluster Analysis

CLUSTER	NUMBER IN CLUSTER	MEAN FACTOR SCORES (CLUSTER CENTRES)				
		I Risk for Drink-driving	II Exposure to Enforcement [2]	III Risk for Speeding	IV City & Daytime Driving	V Time Since Enforcement
1	627	-0.08	-0.21	-0.16	-1.48	-0.16
2	619	-0.59	-0.33	0.94	0.40	0.38
3	293	0.45	2.57	0.10	-0.16	-0.40
4	1152	-0.55	-0.23	-0.82	0.35	-0.18
5	900	1.05	-0.12	0.47	0.34	-0.29
6	109	-0.22	-0.37	0.16	0.16	4.10

Differences between clusters on each factor were investigated using Analysis of Variance with post-hoc pairwise comparisons and the Bonferroni correction for elevated type one error rates resulting from multiple significance tests. The results are presented in Table 5.

Table 5: Differences Between Clusters on Each of the Five Factors

FACTORS	SIGNIFICANT DIFFERENCES BETWEEN CLUSTERS
I Risk for Drink-driving	C5 > C3 > C1 C6 > C4 C2
II Exposure to Enforcement	C3 > C5 C1 > C4 C2 C6
III Risk for Speeding	C2 > C5 > C6 C3 > C1 > C4
IV City and Daytime Driving	C2 C4 C5 C6 > C3 > C1
V Time Since Enforcement	C6 > C2 > C1 C4 > C5 C3

The results presented in Tables 4 and 5 indicate:

- Cluster 1 respondents (17% of the sample) were less likely to drive during the day and in built-up areas than other respondents and were likely to have relatively low perceived risks of detection for both speeding and drink-driving.

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[2] Factor scores on the Exposure to Enforcement factor (Factor II) are reversed in future discussion to ensure clear interpretation of the factor. High scores on the reversed factor mean high levels of exposure to enforcement.

- Cluster 2 respondents (17%) had the lowest average perceived risk of detection for drink-driving (with cluster 4) and the highest perceived risk of detection for speeding. They reported the lowest levels of exposure to enforcement activity and were relatively more likely to be involved in driving in daytime and in built-up areas.

- Cluster 3 respondents (8%) had a high level of exposure to enforcement and reported the most recent direct experience of enforcement. They had moderate perceptions of the risk of detection for speeding and relatively high perceptions of the risk of detection for drink-driving. They were relatively likely to drive at night and in rural areas.

- Cluster 4 was the largest cluster (31% of respondents). Respondents in this cluster had relatively low perceptions of the risk of detection for both speeding and drink-driving and report low levels of exposure to enforcement activity. They were likely to drive during the daytime and in built-up areas.

- Cluster 5 (24%) had the highest perceived risk of detection for drink-driving and a relatively high perceived risk of detection for speeding. They reported relatively high levels of exposure to enforcement activity and recent direct experience of enforcement.

- Cluster 6 respondents (3%) reported the lowest levels of exposure to enforcement activity and the longest time since direct contact with enforcement. They were likely to engage in driving in daytime and in built-up areas and had moderate perceptions of the risk of detection for speeding and drink-driving.

Additional analyses were conducted comparing the clusters on other measures obtained in the survey. It needs to be emphasised here that the following analyses relate to variables or survey items that were not used in either the factor analysis or the cluster analysis reported above, and so contribute additional information about cluster members independent of the information obtained from the earlier analyses.

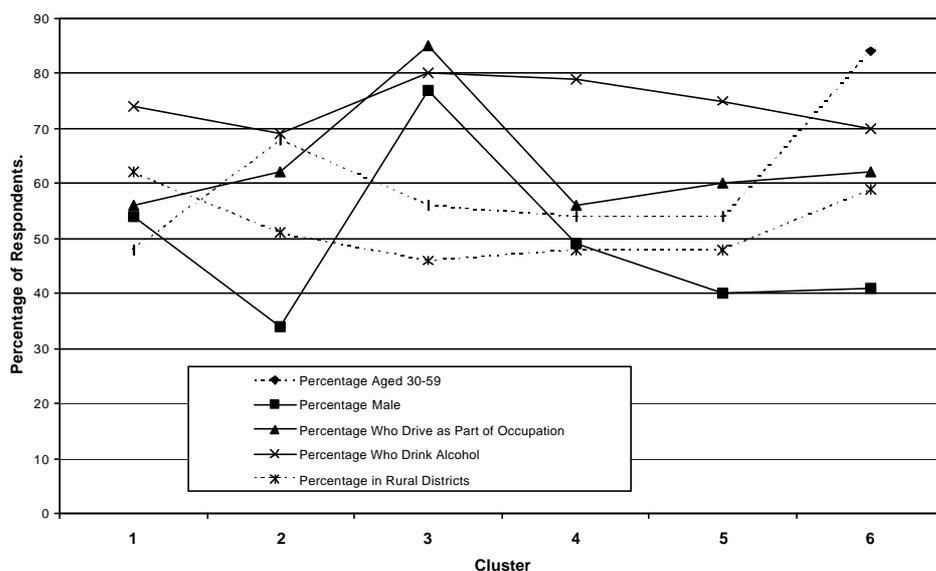Figure 7 shows the pattern of results across clusters for the demographic variables.

Figure 7: Demographic Survey Items by Cluster

For each of the demographic variables in Figure 7, the relationship between the variable and cluster membership was statistically significant at the .05 level. Post-hoc statistical tests were carried out for each variable for all possible comparisons between pairs of clusters using 2x2 chi-squared tests of association and a Bonferroni-type correction to reduce the potential impact of multiple statistical tests on the type one error rate for comparisons on each variable. This resulted in the setting of a relatively conservative type one error rate for each comparison of .0033.

Table 6 shows the pattern of differences between clusters for each variable.

Table 6: Differences Between Clusters on Demographic Variables

VARIABLES	SIGNIFICANT DIFFERENCES BETWEEN CLUSTERS
Percentage of respondents aged 30-59 years	C6 > C2 > C3 C4 C5 C1
Percentage of respondents who were male	C3 > C1 C4 > C6 C5 C2
Percentage of respondents who drive as part of their occupation	C3 > C6 C2 C5 C4 C1
Percentage of respondents who drink alcohol	C3 C4 C5 C1 C6 > C2
Percentage of respondents living in rural Districts	C1 C6 > C2 C4 C5 C3

The results in Table 6 provide some additional information about each of the clusters:

- Cluster 1 respondents tended to be younger and less likely to drive as part of their occupation compared to other respondents. They were also more likely to live in one of the two rural Police Districts included in the evaluation.

- Cluster 2 respondents were the least likely to drink alcohol and were less likely than respondents in some other clusters to be male. They were relatively likely to live in the metropolitan Police Districts.

- Cluster 3 respondents were the most likely to be male, to drive as part of their occupation, and to drink alcohol. They were relatively likely to live in a metropolitan Police District.

- Cluster 4 respondents were relatively likely to drink alcohol and were unlikely to drive as part of their occupation. They were more likely to be in the younger age group.

- Cluster 5 respondents were likely to be in the younger age group and to be female compared to respondents in other clusters. They were more likely to live in the metropolitan Police Districts.

- Cluster 6 respondents were the most likely to be in the older age group, and were relatively likely to be female and to live in the rural Police Districts.

Figures 8, 9, and 10 show some additional survey variables by cluster membership. Figure 8 shows cluster differences in responses to items relating to speeding and speed enforcement, Figure 9 shows cluster differences in drink-driving related measures, and Figure 10 shows cluster differences in items relating to recall of specific advertising media as it was considered that this information might be useful for targeting public education materials.
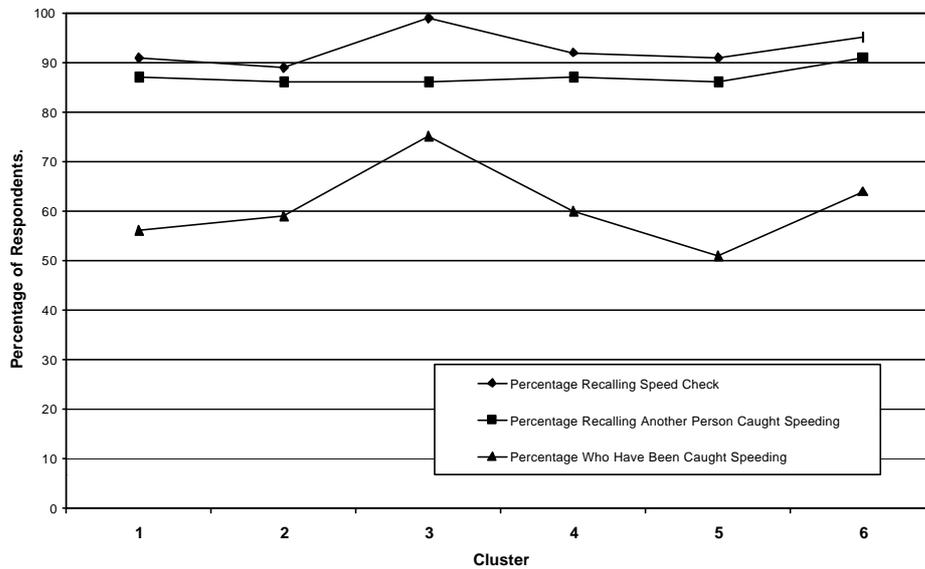
Figure 8: Speeding and Cluster Membership
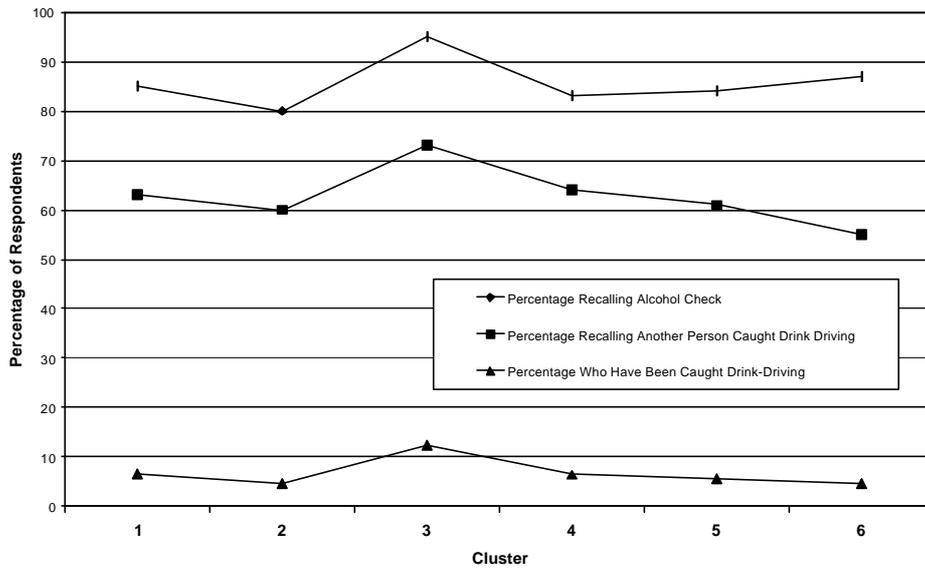
Figure 9: Drink-driving and Cluster Membership
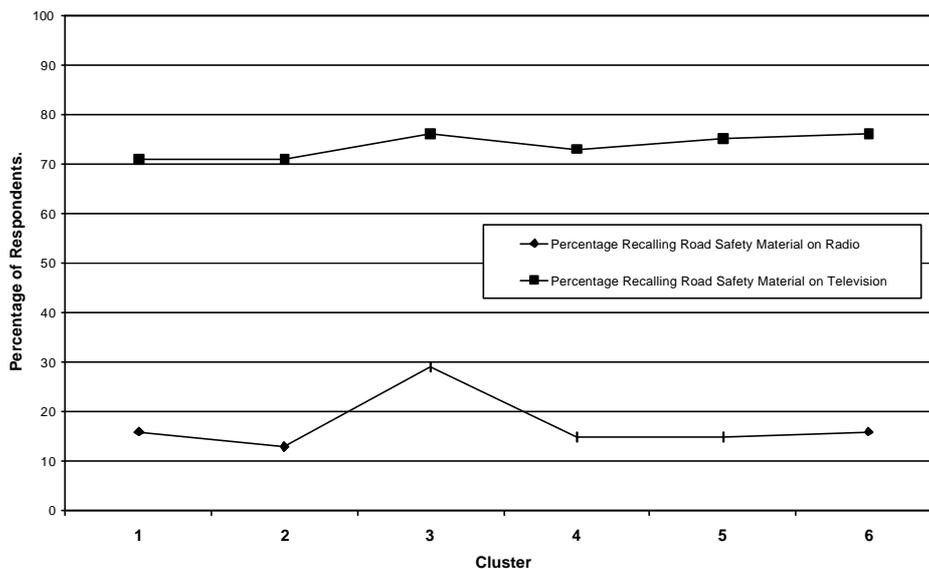
Figure 10: Recall of Road Safety Material in Specific Media by Cluster Membership

With the exception of the items relating to the recall of other drivers caught speeding and the recall of advertising material on television, responses to all the items shown in Figures 8, 9, and 10 were significantly related to cluster membership.

Post hoc analyses of pairwise comparisons between clusters were conducted for each of the items that were significantly related to cluster membership using the same correction for elevation of the type one error rate noted above. The results of these comparisons are presented in Table 7.

Table 7: Differences Between Clusters on Behavioural Variables

VARIABLES	SIGNIFICANT DIFFERENCES BETWEEN CLUSTERS						
Percentage recalling speed check	C3	>	C6 C4 C5 C1 C2				
Percentage recalling being caught for speeding	C3	>	C6 C4 C2 C1	>	C5		
Percentage recalling alcohol check	C3	>	C6 C1 C5 C4 C2				
Percentage recalling another driver caught drink-driving	C3	>	C4 C1 C5 C3 C6				
Percentage recalling being caught for drink-driving	C3	>	C1 C4 C5 C6 C2				
Percentage recalling road safety material on radio	C3	>	C1 C6 C5 C4 C2				

The results in Figures 8, 9, and 10, and Table 7 suggest that respondents in cluster 3 were significantly more likely than respondents in other clusters to have been caught speeding and drink-driving, and were more likely to recall having had their speed and alcohol levels checked at some time in the past. They were also more likely to know of another driver who had been caught drink-driving. Respondents in cluster 5 were less likely than other respondents to have been caught speeding.

Cluster 3 respondents were more likely than other respondents to recall road safety material on the radio.

5.3 Discussion

The cluster analysis reported above was based on the results of the factor analysis using items relating to the perceived risk of detection, exposure to enforcement, and recency of experience with enforcement. It suggested that there are six clusters of respondents to this survey, with respondents in each having similar attitudes in the areas defined by the items included in the factor analysis.

Further analysis suggested that there are some additional differences between the clusters of respondents which help to identify them more completely. The analyses reported in this section suggest that the sample of respondents may be segmented into the following groups:

- Cluster 1: Comprising 17% of the sample, these respondents tend to be younger than other respondents and to live in rural areas. They perceive relatively low risks of detection in relation both to speeding and to drink-driving. Their direct experience of speeding and drink-driving enforcement and their offence history do not differ significantly from those of the majority of other respondents. This cluster may represent a

problem as their relatively low perceived risk of detection for the two offences is present in the context of an average level of exposure to traffic enforcement. The bias towards rural respondents in this cluster may explain this in part, however, as the density of enforcement in rural areas is likely to be lower than might be the case in metropolitan areas.

- Cluster 2: These respondents comprise 17% of the sample. They were the most likely respondents to drive during the daytime and in built-up areas and were relatively more likely than some respondents to live in the metropolitan area. They have a low level of exposure to enforcement activity and the lowest perceived risk of detection for drink-driving but the highest perceived risk of detection for speeding. They were the least likely to consume alcoholic drinks and the least likely to be male. This cluster is less likely to represent a serious road safety problem in spite of their low perceived risk of detection for drink-driving as this most probably derives from a lack of exposure to drink-driving enforcement. Their relatively low level of alcohol use suggests that the low perceived risk of detection is unlikely to represent a problem.

- Cluster 3: These respondents comprise 8% of the sample and represent a potential road safety problem. Respondents in this cluster have high levels of exposure to enforcement, most likely as a result of having to drive as part of their occupation. They were more likely to be male and to drink alcohol than were respondents in other clusters, and tended to live in the metropolitan area (although they were more likely than other respondents to drive at night or in rural areas). They have moderate perceptions of the risk of detection for speeding and relatively high perceptions of the risk for drink-driving, but were significantly more likely than all other respondents to have been caught for both speeding and for drink-driving. They were also more likely than other respondents to know of another person who had been caught for drink-driving. The tendency to offend in spite of high levels of awareness of enforcement activity and moderate to high perceptions of the risk of detection is cause for some concern. Of some interest, and most likely the result of driving as part of their occupation, these respondents were significantly more likely than others to recall road safety material on radio. Radio may be an appropriate medium for the placement of publicity targeting this group.

- Cluster 4: This cluster comprised 31% of the sample. These respondents reported low levels of exposure to enforcement activity and relatively low perceptions of the risk of detection for both traffic offences. They were relatively likely to consume alcoholic drinks and were more likely than others to be in the younger age group, and were likely to drive in built-up areas and in daytime. Although they did not differ significantly from other respondents in terms of their actual enforcement experience or their offence history, this group may constitute a potential road safety risk due to the combination of alcohol use and relatively low perceived risks of detection for drink-driving and speeding.

- Cluster 5: This cluster comprised 24% of the sample and had high levels of exposure to enforcement activity as well as high levels of perceived risk of detection for speeding and (particularly) drink-driving. Respondents in this group were more likely than others to be female, to live in the metropolitan area, and to be in the younger age group. They were also the least likely group to recall being caught for speeding. This group is less likely to represent a concern in road safety terms.

- Cluster 6: Comprising only 3% of the sample, this cluster reported the lowest levels of exposure to enforcement and held average perceptions of the risk of detection for speeding and drink-driving. They were more likely than others to drive during the daytime and in built-up areas. They were more likely to be female, in the older age group, and to live in rural areas. This group is unlikely to represent a problem for road safety as their exposure

to crash risk is most likely small. The bias towards older, low exposure drivers and driving in rural built-up areas suggests that the risk level of this cluster is quite low.

Clusters 3 and 4 may be potential targets for enforcement and public education programs. Cluster 3 in particular is a high-exposure group with a substantially greater likelihood of having offended in the past. Cluster 3 respondents had some particular characteristics that may aid in the targeting of this group. Compared to other respondents, they:

- Drive more often as part of their occupation and have a higher level of exposure to driving risk and to enforcement activity;
- Are much more likely to be male;
- Are more likely to drink alcohol and have been caught speeding and drink-driving more often; and
- Appear to listen to the radio more often.

The last point may be important as it could be combined with other factors in a public-education program addressing the perceived risk of detection and other consequences for this group. Basing a program targeting this group on radio publicity may increase the chances of the message being heard. The importance of work-related driving for this group might also be useful as a message stressing the potential work-related consequences of licence loss might be expected to have more of an impact than other types of messages.

6   EXPLORATORY ANALYSIS OF DIFFERENCES (PERCEIVED RISK)

The preceding exploratory analyses (the factor analysis and the cluster analysis) were concerned with investigating similarities between responses to the survey items as a way of understanding the underlying structure of the survey and the underlying groups of respondents.   The exploratory analysis presented here sought to   investigate the differences between groups of respondents on the perceived risk measures.

It was considered that a between-groups analysis of differences in the perceived risk of detection would contribute further to an understanding of the factors which may have an impact on this psychological construct.   While it is already clear from earlier analysis that the level of exposure to enforcement is correlated with perceived risk as it relates to drink-driving but not speeding, it is not possible at this stage to draw conclusions about differences between subgroups of the population from which the sample was drawn or about differences between different types of perceived risk ratings relating to different times.

6.1 Method

The complexity of the data and the need to ensure both that important interactions between factors were investigated and that complex, difficult to interpret interactions were ignored resulted in a decision to use factorial analysis of variance (ANOVA) as the basic data-analysis tool.   ANOVA allows differences between a number of factors to be investigated on a dependent or measurement variable.   The analysis was further complicated in this case by the need to consider some factors as between-groups factors and some as within-groups factors. Within-groups factors are those where the measurements at different levels of the factor are taken from all participants, and between-groups factors are those where measurements at different levels are taken from independent groups of participants.   ANOVA techniques treat these types of factors differently.

The basic analysis design used in the ANOVA is shown in Table 8 (next page).   The between group factors are self-explanatory.   The survey collected information concerning age group and sex, and was conducted in particular locations at particular times.   These factors were included in the analysis as recorded.   The within groups factors were included to allow comparison of the four measures of perceived risk included in the survey – namely the perceived risk for speeding and for drink-driving, each for daytime and nighttime driving.   As all respondents were asked these questions, the two factors (Offence Type and Time of Day) were treated as within groups factors in the analysis of variance.

Analysis of variance partitions the between and within groups variance into variance due to the effect of each of the factors and their interactions and residual or error variance which cannot be accounted for by the factors used in the analysis.   The complexity of interaction terms can be predefined, and given the likely poor explanatory power of complex interactions and the difficulties associated with their interpretation it was decided to limit the complexity of interaction terms in the analysis to 2-way between and within groups interactions and 4-way interactions for mixed (within x between) analyses.

It should also be noted that the use of a factorial analysis of variance involves the generation of many tests of significance which, as noted above, have the potential to result in an experiment-wise error rate somewhat larger than the .05 normally specified on a test-by-test

basis. Given the exploratory nature of the present analysis no steps were taken to reduce the impact of this potential problem.

Table 8: Design of Multivariate Data Analysis

TYPE OF FACTOR	FACTORS	LEVELS
Between Groups – comparisons between groups of participants	Group	Treatment[3] Districts Control Districts
	Sex	Female Male
	Age	18-29 Years of Age 30-59 Years of Age
	Survey	Number 1[3] Number 2 Number 3
Within Groups – comparisons between perceived risk items in the survey	Offence Type	Speeding Drink-driving
	Time of Day of Offence	Daytime Nighttime

6.2 Results

Perceived Risk Averaged Across Time of Day and Offence Type

There was a significant effect of Sex ($F_{(1,3672)}$ = 35.7, p < .001) such that females perceived there to be a higher general risk of detection for traffic offences ($\bar{x}$ = 4.6) than males ($\bar{x}$ = 4.2).

Perceived Risk Averaged Across Offence Type

The perceived risk for offences committed during nighttime hours ($\bar{x}$ = 4.7) was significantly higher than for those committed during the day ($\bar{x}$ = 4.2) ($F_{(2, 3672)}$ = 513.9, p < .001). The effect of Time of Day on perceived risk interacted with the effects of Age ($F_{(2, 3672)}$ = 62.7, p <

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[3] The location and survey-wave variables used in the evaluation for which these data were originally collected were included in the analysis for completeness. The evaluation divided the Districts into treatment and control districts on the basis of the level of enforcement activity which occurred in the survey periods. The treatment Districts had slightly elevated levels of speeding enforcement between the first two surveys, and of drink-driving enforcement between the second and third surveys.   The ANOVA technique partitioned the variance due to these variables and their interactions with other variables, but any effects and interactions involving these variables are not discussed here.

.001), and Sex ($F_{(2, 3659)} = 5.3$, $p = .02$). These interaction effects are shown in Figures 11, and 12.
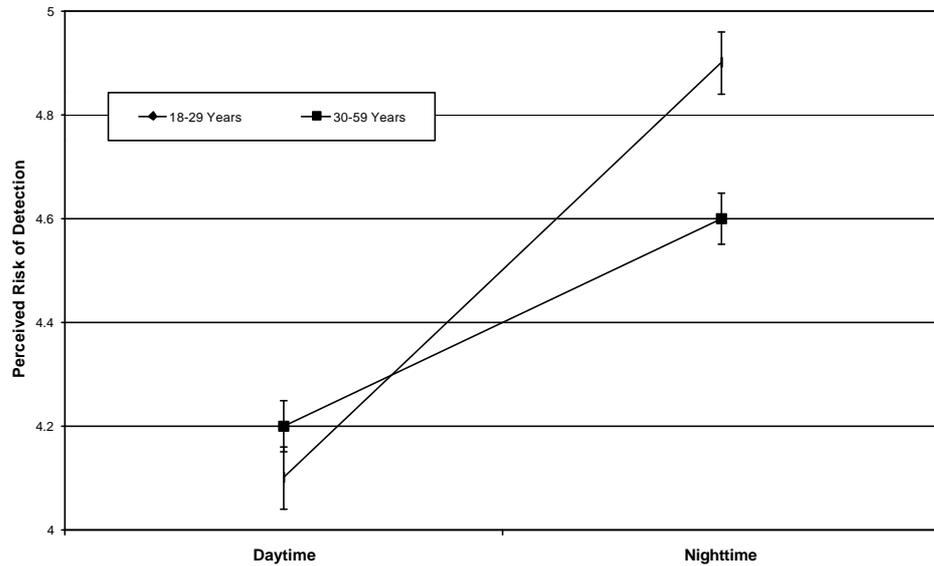
Figure 11: Perceived Risk of Detection by Time of Day and Age (Means and Standard Errors)

Figure 11 indicates that the elevation in perceived risk for nighttime offences compared to daytime offences is greater for respondents in the younger age group.
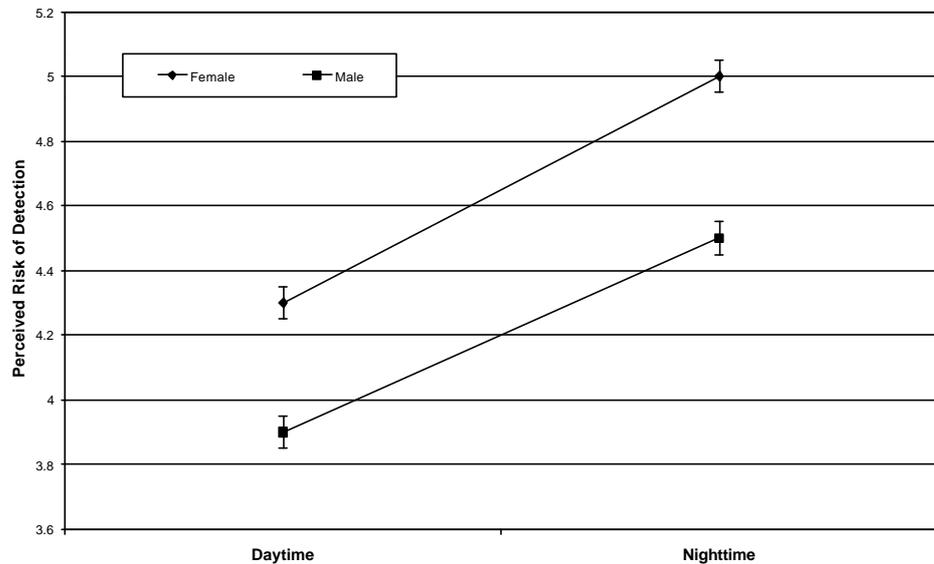
Figure 12: Perceived Risk of Detection by Time of Day and Sex (Means and Standard Errors)

Figure 12 shows that the difference between nighttime and daytime perceived risks of detection was slightly larger for females than it was for males.

<u>Perceived Risk Averaged Across Time of Day</u>

There was a significant difference between ratings of the perceived risk of detection for speeding ($\bar{x}$ = 4.5) and drink-driving ($\bar{x}$ = 4.4) ($F_{(2, 3672)}$ = 4.4, p = .04). This effect interacted with the effects of Age ($F_{(2, 3672)}$ = 11.9, p = .001), and Sex ($F_{(2, 3672)}$ = 11.1, p = .001). These interactions are shown in Figures 13 and 14.
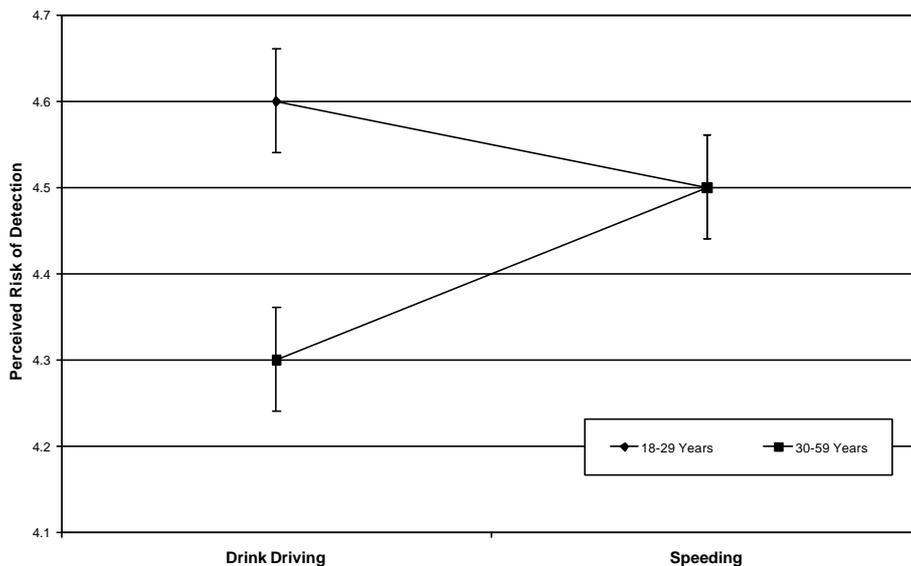
Figure 13: Perceived Risk of Detection by Offence Type and Age (Means and Standard Errors)

Figure 13 shows that the perceived risk of detection for speeding was the same for both age groups, but that younger respondents had a higher perceived risk of detection for drink-driving than did the older respondents.
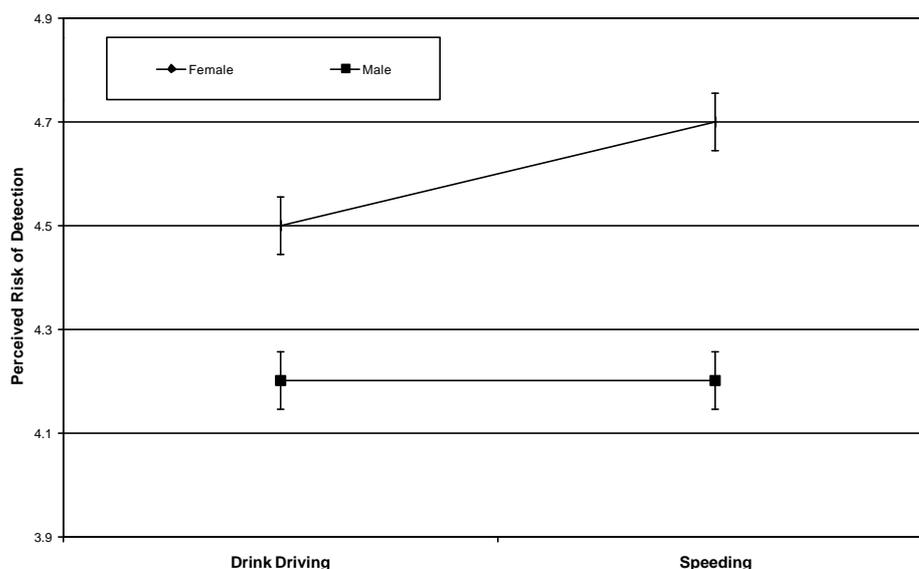
Figure 14: Perceived Risk of Detection by Offence Type and Sex (Means and Standard Errors)

The data in Figure 14 show that the perceived risk of detection for drink-driving and speeding did not differ for male respondents, but that the ratings for these two offences differed for females. Female respondents rated the perceived risk of detection for speeding as greater than the perceived risk of detection for drink-driving.

Perceived Risk Including Offence Type and Time of Day Effects

The perceived risk of detection for both speeding and drink-driving was dependent on the time of day of the offence ($F_{(2, 3672)}$ = 1,740.1, p < .001). This Offence Type by Time of Day interaction is shown in Figure 15 where it is clear that the perceived risk of detection for speeding offences is higher than that for drink-driving offences during the day time and is lower during the nighttime. This most likely reflects the relative levels of each type of enforcement in the daytime and nighttime.
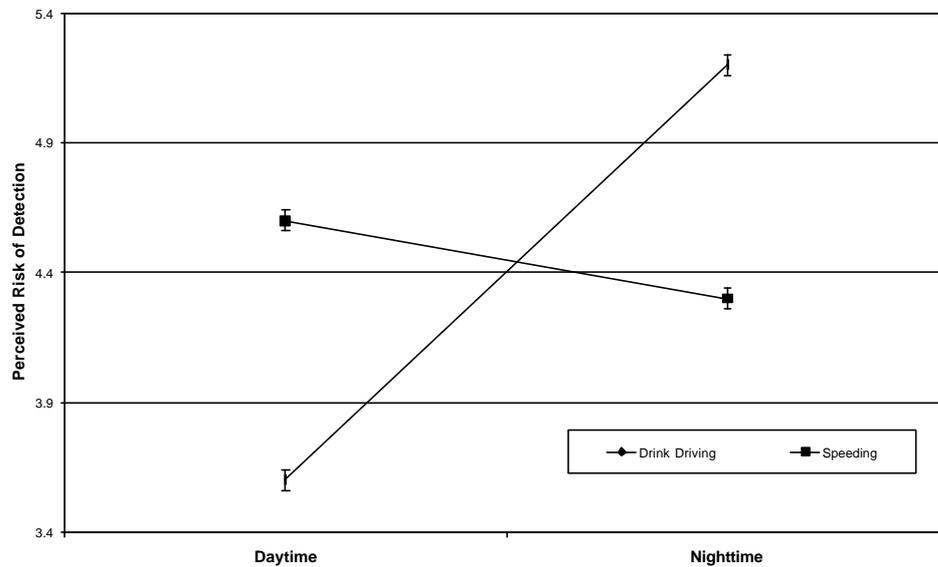
Figure 15: Perceived Risk of Detection by Time of Day and Offence Type (Means and Standard Errors)

The Time of Day by Offence Type was further complicated by small but significant higher-order interactions with Sex ($F_{(2, 3672)}$ = 5.8, p = .02), and Age and Sex together ($F_{(2, 3672)}$ = 9.4, p = .002). The four way interaction is shown in Figure 16.
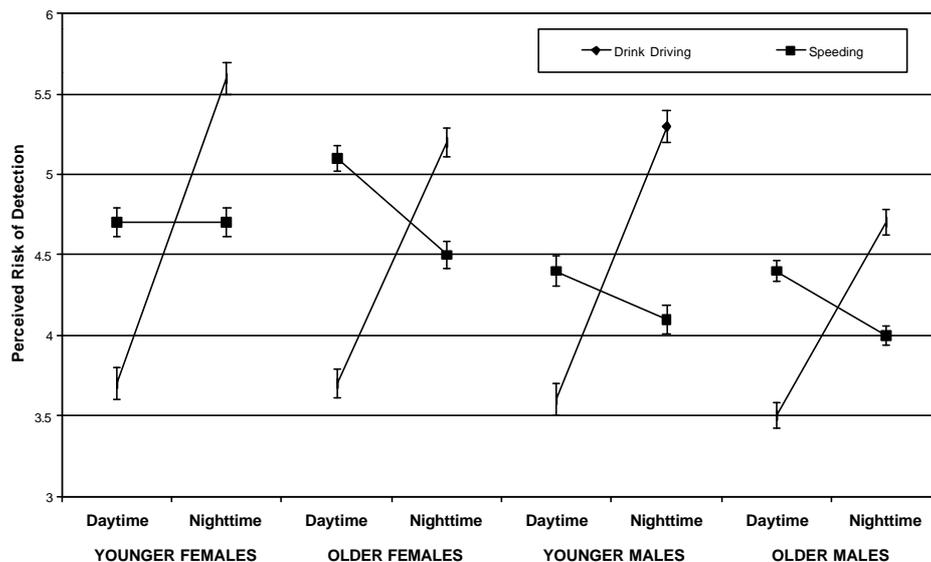
Figure 16: Perceived Risk of Detection by Time of Day, Offence Type, Sex, and Age (Means and Standard Errors)

Figure 16 suggests that while all age by sex groups of respondents rated the risk of detection for drink-driving as higher at night than during the day, only three groups rated the risk of detection for speeding as higher during the day than at night. Ratings provided by females aged 18-29 years suggested that their perceptions of the risk of detection for speeding were not influenced by the time of day of the offence.

6.3 Discussion

This exploratory analysis revealed a number of differences between groups of respondents and types of ratings of perceived risk.

While there were no main effects of age, there were some interactions involving this variable. Respondents in the younger group (18-29 years) reported higher perceived risks of detection for drink-driving than respondents in the older group, but the same perceived risk of detection for speeding. Consistent with this, younger respondents also reported higher perceived risks of detection for traffic offences committed at night than did older drivers, but were no different from older drivers in their perceptions of the risk of detection for offences committed during the day.

The potential implication of this is that the road use of young drivers (as discussed in the next section, 25% of road use for younger drivers was at night compared to 16% for older drivers) leads to greater exposure to drink-driving enforcement for younger drivers and therefore an increased perceived risk of detection for drink-driving. It is also worth noting in this context that results reported in the next section also show that younger drivers were more likely to report seeing drink-driving enforcement activity than were older drivers. The bias away from daytime driving for younger drivers would not, however, lead to a lower perceived risk of detection for speeding as the earlier analysis suggested that the link between exposure to

enforcement activity and the perceived risk of detection may only apply for drink driving and not for speeding.

The finding that females have a higher perceived risk of detection in general and for speeding in particular underscores the lack of relationship between exposure to enforcement and perceived risk for speeding given the result also reported in the next section that males were more likely than females to report seeing speed enforcement occurring.

7 EXPLORATORY ANALYSIS OF DIFFERENCES (OTHER VARIABLES)

The preceding analysis using ANOVA investigated the differences between groups on a measure of the perceived risk of detection for traffic offences. This (final) exploratory analysis was also concerned with differences between groups of subjects but using other survey items as dependent measures. It was considered important to examine the way in which these measures vary between groups of respondents as the information would complement the analysis in the previous section.

It again needs to be stressed that the analysis presented here is exploratory in nature and that although some effort has been made to reduce the likely impact of many statistical tests on the type one error rate for the study as a whole, it is still likely that the significance tests reported here are liberal rather than conservative.

7.1 Method

The analyses reported here involved a multivariate ANOVA technique using the same between group factors as were used in the analysis reported in the preceding section (see Table 8). A multivariate analysis of variance method was used to reduce the number of individual univariate tests that needed to be considered, using a number of variables as dependent measures. The dependent measures included in the analysis were:

- The perceived likelihood of having to undertake a breathtest in the following week in the daytime and nighttime;
- The perceived likelihood of being fined once detected for drink driving and for speeding;
- The recency of enforcement contact measured as the number of weeks since the last time the respondent was breathtested, had their speed checked, or knew of someone else detected speeding;
- The number of instances of enforcement activity (drink-driving and speed) seen in the preceding 4 weeks; and
- The amount and type of driving.

Interactions were again limited to two-way interactions to simplify interpretation of the results. Multivariate statistical tests were conducted for each main effect and interaction using the Hotellings test statistic. Where this was significant at the .05 level, followup tests were conducted using univariate ANOVA methods for each of the items and a moderately conservative significance level of .01.

7.2 Results

The results of the multivariate analysis of variance used here are reported for each between groups effect or interaction found to be significant in the overall multivariate test.

<u>Sex</u>

The effect of Sex was statistically significant in the multivariate test ($F_{(12,2312)}$ = 19.0, p < .001). Univariate tests indicated that there were the following significant differences between males and females:

- The number of times speed enforcement had been seen in the preceding four weeks ($F_{(1,2323)}$ = 55.2, p < .001) with male respondents reporting having seen more speed enforcement ($\bar{x}$ = 6.3) than females ($\bar{x}$ = 4.1).

- The number of times drink-driving enforcement had been seen in the preceding four weeks ($F_{(1,2323)}$ = 9.4, p = .002) with male respondents reporting having seen more drink-driving enforcement ($\bar{x}$ = 1.5) than females ($\bar{x}$ = 1.1).

- The recency of contact with enforcement as measured by the number of weeks since the last time respondents were aware that their speed had been measured ($F_{(1,2323)}$ = 9.6, p = .002, $\bar{x}_{male}$ = 3.4 weeks, $\bar{x}_{female}$ = 4.3 weeks); the number of weeks since respondents had last been breathtested ($F_{(1,2323)}$ = 14.4, p < .001, $\bar{x}_{male}$ = 12.4 weeks, $\bar{x}_{female}$ = 15.2 weeks); and the last time someone known to the respondent had been caught speeding ($F_{(1,2323)}$ = 21.1, p < .001, $\bar{x}_{male}$ = 8.3 weeks, $\bar{x}_{female}$ = 11.6 weeks).

- Driving exposure and type of exposure as measured by the amount of driving in the preceding week ($F_{(1,2323)}$ = 120.4, p < .001, $\bar{x}_{male}$ = 14.0 hours, $\bar{x}_{female}$ = 8.1 hours); the percentage of that driving undertaken in daytime hours ($F_{(1,2323)}$ = 13.2, p < .001, $\bar{x}_{male}$ = 77%, $\bar{x}_{female}$ = 83%); and the percentage in built-up areas ($F_{(1,2323)}$ = 47.5, p < .001, $\bar{x}_{male}$ = 62%, $\bar{x}_{female}$ = 71%).

<u>Age Group</u>

The effect of Age Group was statistically significant in the multivariate test ($F_{(12,2312)}$ = 16.2, p < .001). Univariate tests indicated that there were the following significant differences between younger (18-29 years of age) and older (30-59 years of age) respondents:

- The number of times drink-driving enforcement had been seen in the preceding four weeks ($F_{(1,2323)}$ = 14.0, p < .001) with younger respondents reporting having seen more drink-driving enforcement ($\bar{x}$ = 1.6) than older respondents ($\bar{x}$ = 1.1).

- The recency of contact with enforcement as measured by the number of weeks since the last time respondents were aware that their speed had been measured ($F_{(1,2323)}$ = 17.5, p< .001, $\bar{x}_{older}$ = 4.5 weeks, $\bar{x}_{younger}$ = 3.1 weeks); the number of weeks since respondents had last been breathtested ($F_{(1,2323)}$ = 51.8, p < .001, $\bar{x}_{older}$ = 16.4 weeks, $\bar{x}_{younger}$ = 10.2 weeks); and the last time someone known to the respondent had been caught speeding ($F_{(1,2323)}$ = 30.4, p < .001, $\bar{x}_{older}$ = 11.9 weeks, $\bar{x}_{younger}$ = 7.8 weeks).

- The percentage of the preceding week's driving undertaken in daytime hours ($F_{(1,2323)}$ = 68.2, p < .001, $\bar{x}_{older}$ = 84%, $\bar{x}_{younger}$ = 75%).

- The perceived likelihood of having to undergo a breathtest in the following week if driving at night ($F_{(1,2323)}$ = 17.0, p < .001, $\bar{x}_{older}$ = 3.8, $\bar{x}_{younger}$ = 4.2).

- The perceived likelihood that a driver who is caught speeding will be fined ($F_{(1,2323)} = 21.7$, $p < .001$, $\bar{x}_{older} = 9.4$, $\bar{x}_{younger} = 9.1$).

Age by Sex

The interaction between Age and Sex was significant in the multivariate test ($F_{(12,2312)} = 2.6$, $p < .001$). Univariate tests indicated that there was only one significant interaction between these variables, which is shown in Figure 17.
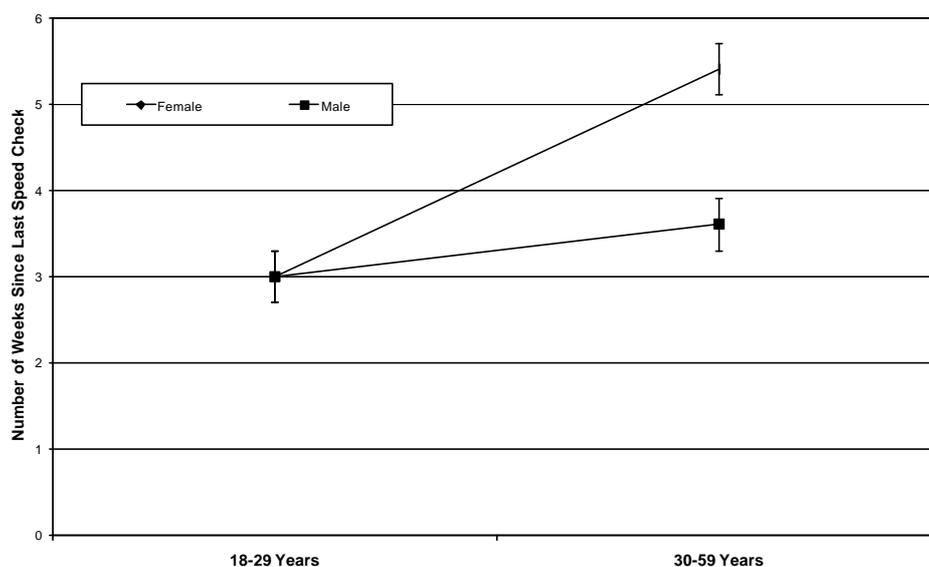
Figure 17: Amount of Time Since Last Experience of Having Speed Measured by Police by Age and Sex (Means and Standard Errors)

The number of weeks since the last time respondents could recall having their speed checked by the Police varied according to both age and sex ($F_{(1,2323)} = 11.0$, $p = .001$), where the sex difference noted above occurred only for respondents in the older group. There was no sex difference in the elapsed time since the last experience of speed enforcement in the younger age group, while in the older age group males reported more recent instances of this.

7.3 Discussion

The results of the analyses reported in this section are summarised in Table 9. A number of patterns emerge from these results. The first is that males and younger respondents reported more-recent contact with both speed enforcement and drink-driving enforcement and had more-recent knowledge of others being detected for speeding. Males also reported more instances of drink-driving enforcement and speed enforcement than females, and younger respondents reported more drink-driving enforcement than older respondents.

The differences in awareness of enforcement activity would be (in part) due to differences in the amount and type of driving. Males tended to drive more than females but females were more likely to report driving during the daytime and in built-up areas. Younger respondents were more likely to drive at night than were older respondents.

The relationship between the results reported in this section and those reported earlier is of some interest and will be dealt with more fully in the general discussion.

Table 9: Summary of Results of Analysis of Other Variables

MEASURE	RESULT
Perceived likelihood of having to undergo a breathtest in the following week	• Younger respondents higher perceived likelihood than older respondents
Perceived likelihood of being fined if detected offending	• For speeding – older respondents higher than younger

Recency of contact with enforcement	• For breathtesting:
	  ♦ More recent contact for males
	  ♦ More recent contact for younger respondents
	• For having speed checked:
	  ♦ More recent contact for males
	  ♦ More recent contact for younger respondents
	  ♦ More recent contact for older males compared to older females, but less of a sex difference for younger respondents
	• For others known to be caught speeding:
	  ♦ More recent for males
	  ♦ More recent for younger respondents

Number of times enforcement seen	• For speed enforcement:
	  ♦ Males reported more than females
	• For drink-driving enforcement:
	  ♦ Males reported more than females
	  ♦ Younger respondents reported more than older respondents

Driving exposure	• For the amount of driving:
	  ♦ Males drove more than females
	• For the percentage of driving in built-up areas:
	  ♦ Females more than males
	• For the percentage of driving in daytime:
	  ♦ Females more than males
	  ♦ Older respondents more than younger respondents

8 GENERAL DISCUSSION

The results of the factor analysis which investigated the underlying pattern of responses suggested that the survey responses relating to the perceived risk of detection, driving exposure, and recency of contact with enforcement were best summarised with five factors or groups of items which accounted for almost 60% of the item variance. The first factor combined the drink-driving items (suggesting that the responses to these were highly correlated) and the item relating to the amount of exposure to drink-driving enforcement. This suggests that the perceived risk of detection for drink-driving is related to the amount of exposure to drink-driving enforcement in the preceding four weeks.

The correlation between exposure to enforcement and perceived risk of detection in the drink-driving domain was not repeated in the speeding domain, however. The third factor combined the perceived risk of detection for speeding at night and during the day but did not include the speed-enforcement exposure responses. There was only a very small correlation between the exposure to enforcement factor (Factor 2) and the perceived risk for speeding factor, underscoring the lack of relationship (noted above) between changes in exposure to enforcement and the perceived risk of detection for this offence. The results of the factor analysis, however, suggest more strongly that the perceived risk of detection for speeding may not be related to the amount of contact with speed enforcement in general. That is, that the lack of effect of changes in speed enforcement noted above might extend to the general relationship between speed enforcement and perceived risk.

The factor analysis results indicated that the amount of speed enforcement seen by respondents was unrelated to the perceived risk of detection for this offence. Thus, drivers who had seen high levels of speed enforcement were not more likely to report a high perceived risk of detection for speeding, and drivers with low levels of exposure to speed enforcement were not more likely to report low levels of perceived risk. This result suggests that the way in which drink-driving enforcement is generally thought to influence driver behaviour via general deterrence may not apply as well to driver behaviour in the speeding domain.

This is an important result. It is not possible to argue that the lack of relationship between exposure to speed enforcement and the perceived risk of detection was a result of low levels of exposure to speed enforcement. Respondents reported seeing an average of 5.1 instances of speed enforcement in the preceding four weeks compared to only 1.3 instances of drink-drive enforcement where there was a relationship between enforcement and perceived risk. This result suggests, therefore, that there is a difference between the type of relationship between enforcement and perceived risk of detection for speeding and drink driving.

This may not be surprising given the nature of the two offences. Drink-driving is the result of a small number of decisions made at key points in time regarding consuming alcohol and driving rather than using other forms of transport. Speeding is the result of a continuous decision-making process while the driver is in the vehicle, resulting in continuous adjustments to vehicle speed, based on a large number of factors. The mechanisms by which the two behaviours are influenced by enforcement activity are unlikely to be similar.

The difference reported here between the relationship between enforcement and perceived risk in the drink-driving and speeding domains argues strongly for additional research in this area. It is unlikely that the effectiveness of speed enforcement programs relying on a combination of specific- and general-deterrent effects will be maximised unless the mechanisms by which enforcement affects behaviour are more-fully understood.

The factor analysis results were used as the basis for grouping survey respondents with similar responses to the items used in the factor analysis. The results of this analysis suggested that there were two groups of drivers who were potential road safety problems. One group in particular (Cluster 3) were high-exposure, male drivers with a number of specific characteristics. Their recollection of material on the radio and their high level of car use suggested that radio publicity might be a useful tool to target this group of drivers.

The exploratory analyses of the perceived risk data and the data from other survey items provide some additional information about the factors that influence the perceived risk of detection.

In general there were a number of differences between male and female respondents. Males (probably as a result of the amount of driving they reported) were generally more likely to have contact with and recent experiences of both speeding and drink-driving activity. It is of some interest, therefore, that females had higher levels of perceived risk of detection for both offences and, in particular, for speeding. This suggests that the link between awareness of enforcement activity and perceptions of the risk of detection may not be as strong as generally thought, or that other factors not addressed in this analysis act to modulate the perceived risk of detection in addition to the impact of the level of contact with enforcement. Awareness of publicity is one possible additional factor, but analysis indicates that there were no sex differences in the level of recall of publicity.

Younger respondents tended to report more enforcement and more-recent experience of enforcement activity than older respondents, particularly for drink-driving. In the case of drink-driving, the age differences in the perceived risk of detection (and the perceived likelihood of having to undertake a breath test) were consistent with differences in the level of exposure to enforcement. Younger respondents rated both risks higher than older respondents.

The picture which emerges from this analysis is a complex one, especially for perceived risk in the speeding domain. There are clearly a number of factors other than the amount of enforcement which influence ratings of the perceived risk of detection, and in some instances there are suggestions that higher levels of exposure to enforcement may act to reduce the perceived risk of detection. This is consistent with findings in recent investigations of drink-driving in rural areas (e.g. Harrison, 1996) which suggest that exposure to enforcement activity can act to reduce the perceived uncertainty (in location and time) of enforcement operations associated with high levels of perceived risk. It is clear that relatively small increases in enforcement levels are unlikely to provide easily identified road safety benefits unless other factors are taken into account and the mechanisms by which enforcement influences driver behaviour are more-fully understood.

The implications of the present research for the deterrence model of the relationship between enforcement and behaviour are relatively unclear. While the results for drink driving are not inconsistent with this model, they are also consistent with a number of alternative accounts of the effect of negative consequences on behaviour. There is nothing in the results here which might be taken to support the deterrence model over other psychological models of behaviour or decision making.

The results in relation to speeding are less supportive of the application of the deterrence model, however. There was no correlation between exposure to speed enforcement and the perceived risk of detection for speeding, a result which is clearly inconsistent with the main tenet of the deterrence model. As noted above, this may reflect a basic difference between speed-choice and drink driving. As a result of the time-pressured and workload-intensive nature of driving and vehicle control, speed-choice processes may be more likely to utilise a

range of heuristic or recognition-based processes rather than the rational, computationally intensive processes required under classical deterrence models. Under these conditions, speeding may be less susceptible to the effects of behaviour-change programs relying on rational decision-making processes. These issues are discussed by Harrison (in press) and in considerably more detail by Harrison and Fitzharris (in preparation), where the potential for alternative accounts of the effects of enforcement is explored in the context of psychological models of decision-making in naturalistic environments.

In addition to recommendations concerning the clear need for further research in this area, one conclusion which does flow from this analysis of the difference between speeding and drink-driving is that speeding countermeasures may need to be designed in a way which taps more basic, affective or learning processes rather than higher-level, rational processes. Speeding countermeasures may need to draw more on widespread negative reinforcement (through high levels of detection such as those which are currently available through the speed camera program in Victoria) and carefully designed public education material.

9 REFERENCES

Blashfield, R., & Aldenderfer, M. (1988) The methods and problems of cluster analysis. In J. Nesselroade & R. Cattell (Eds) *Handbook of Multivariate Experimental Psychology (2nd Edn.)* New York: Plenum Press

Cameron, M.H., Haworth, N., Oxley, J., Newstead, S., Le, T. (1993) *Evaluation of Transport Accident Commission Road Safety Television Advertising. Report 52*. Clayton, Vic: Monash University Accident Research Centre

Cohen, M.S. (1993) Three paradigms for viewing decision biases. In Klein, G.A., Orasanu, J., Calderwood, R., & Zsdambok, C.E. (Eds) *Decision Making in Action: Models and Methods.* Norwood, NJ: Ablex.

Gergersen, N.P. (1996) *Young Car Drivers. Report 409A* Sweden: VTI

Harrison, W.A. (1996) *An Exploratory Investigation of Aspects of Drink Driving in Rural Areas of Victoria. Report 93*. Clayton, Vic: Monash University Accident Research Centre

Harrison, W.A. (in press) Applying Psychology to a reluctant road safety: A comment on South (1998). *Australian Psychologist*.

Harrison, W.A., & Fitzharris, M. (in preparation) *Drinking and Driving in Rural Victoria: Deterrence Revisited*. Monash University Accident Research Centre.

Homel, R. (1988) *Policing and Punishing the Drinking Driver: A Study of General and Specific Deterrence*. New York: Springer-Verlag.

Hays, W.L. (1981) *Statistics* New York:: Holt-Saunders

Lipshitz, R. (1993) Converging themes in the study of decision making in realistic settings. In Klein, G.A., Orasanu, J., Calderwood, R., & Zsdambok, C.E. (Eds) *Decision Making in Action: Models and Methods.* Norwood, NJ: Ablex.

Newstead, S., Cameron, M., Gantzer, S., & Vulcan, P. (1995) *Modelling of Some Major Factors Influencing Road Trauma Trends in Victoria 1989-1993 Report 74*. Clayton, Vic: Monash University Accident Research Centre

Norusis, M.J. (1994) *SPSS Advanced Statistics 6.1* Chicago, Ill.: SPSS Inc.

Orasanu, J. & Connolly, T. (1993) The reinvention of decision making. In Klein, G.A., Orasanu, J., Calderwood, R., & Zsdambok, C.E. (Eds) *Decision Making in Action: Models and Methods.* Norwood, NJ: Ablex.

10 APPENDIX A: PROTOCOL FOR RECRUITMENT OF PARTICIPANTS

RECRUITMENT OF PARTICIPANTS

Dial Number

IF NO ANSWER/FAX/ETC

IF ANSWERED

**Good Afternoon/Evening. My name is XXXXXX.
I am calling from the Accident Research Centre to conduct a survey
of car drivers in your area concerning some road safety issues.
The survey is completely confidential and will about five minutes.**

IF NOT 1ST PERSON IN HOUSE

IF 1ST PERSON IN HOUSE

Thanks for that.

Speak to identified
person

**I am interested in talking to a car driver
between the ages of 18 and 59.**

**Would you or someone in your home be
willing to take part in the survey?**

**Would you be willing to take
part in the survey?**

IF HANDED TO NEW PERSON

IF PERSON AGREES

IF NO

IF NO

IF PERSON AGREES

**Before we start – if possible we are trying to
talk to drivers under the age of 30. Would
you or anyone there be in that age group?**

IF NO

Continue with
Survey

**That's OK, we are interested in
getting as many people as we can.**
Continue with Survey

FINISHED

Record type of result
If no answer or invitation to call back, mark for call back

APPENDIX B: SURVEY QUESTIONNAIRE


```
SURVEY OF PERCEPTIONS OF ENFORCEMENT
====================================


Enter


        Phone Number:            ########
        Police District:         <A>




My name is XXXXXXXX.  I am calling from the Accident
Research Centre to conduct a survey of car drivers in your area
concerning some road safety issues.  The survey is completely
confidential and will only take ten minutes.




RECRUIT PARTICIPANT




next page...  <A>




Before we start we would like to collect a little information about you.




Can you tell me what age group do you fall in to?
Are you between 18 and 29 or are you between 30 and 59?


     Age Group:               #       Code    (18-29) 1    (30-59) 2


And your gender is....


     Sex:                     <A>     Code   M  F




Could you tell me what your occupation is please:


  ·   Occupation:        <A                                    >




Do you need to drive as part of this occupation?


     DrivOcc                  <Y>    Code  (Y)es  (N)o
```

The first questions are about how much driving you have done
in the last week.

Could you tell me roughly how much time you have spent driving in the
last week?

        Driving Hours: ### hours

What percentage of that time do you think would have been spent driving
during daylight hours?

        Daylight percentage: ### %

What percentage of your driving would have been spent driving on roads
in built-up areas?

        Built-up percentage: ### %

The next questions are about how much traffic enforcement you think is
being performed by the police.

There are no right or wrong answers here, we are interested in your opinion.

I will describe some situations. For each one could you please answer with a
number between 0 and 10 which describes how certain you think that situation
is. "0" means that you think there is no chance at all of something
like that happening, and "10" means that you think it is certain that it will
happen. Remember that there are no right or wrong answers
here, we are interested in your opinion.

Using a scale from 0 to 10...

We know that most people do not speed, but
if you were to drive over the speed limit in the next week
during daylight hours, how certain do you feel that the Police would
detect you.

        SpDetDay: ##

If you were to drive over the speed limit in the next week
during night-time hours, how certain do you feel that the Police would
detect you.

        SpDetNight: ##

Using the same scale from 0 to 10...

If you were caught by the Police for speeding, how certain do you feel that you would be fined?

     SpFine: ##

How many times have you seen Police doing speed enforcement in the last four weeks?

     SpEnfSeen: ##

The next questions are like the ones you just answered except they relate to drink-driving rather than speeding. They use the same scale from 0 to 10 where "0" means that you think there is no chance at all of something like that happening, and "10" means that you think it is certain that it will happen.

Using this scale...

How certain do you feel that the Police will stop you for a breath test at some time in the coming week when you are driving during daylight hours?

     AlcChDay: ##

How certain do you feel that the Police will stop you for a breath test at some time in the coming week when you are driving during night-time hours?

     AlcChNight: ##

Using the same scale from 0 to 10...

We know that most people do not drink and drive, but if you were to drink-drive next week during daylight hours, how certain do you feel that the Police would detect you.

     AlcDetDay: ##

Again, if you were to drink-drive in the next week during night-time hours, how certain do you feel that the Police would detect you.

     AlcDetNight: ##

Using the same scale from 0 to 10...

If you were caught by the Police for drink-driving, how certain
do you feel that you would be punished with a fine or some other
penalty?

     AlcFine: ##

How many times have you seen the Police doing breath tests in the
last four weeks?

     AlcEnfSeen: ##

Could you tell me if you drink alcoholic drinks?

     DrinkAlc   <Y>   Code (Y)es (N)o

The next questions are about road safety publicity.

In the last month, have you seen, heard, or read any road safety
publicity or advertising?

     Publicity: <Y>   Code (Y)es (N)o

        IF YES: Can you recall the main message of that publicity?

        Type main message recalled: <A   >
                                  <A   >

        Can you recall where you have seen, heard, or read this
        type of material?

        DO NOT PROMPT, ACCEPT MULTIPLE RESPONSES AND ENTER Y OR N:

           Television: <Y>   Radio: <Y>
           Newspaper: <Y>   Magazines: <Y>
           Billboard: <Y>   Other: <Y>

We are also interested in knowing about your own experiences with Police traffic enforcement.

Do you think you have ever had your speed measured or monitored by the Police using either radar, lasers, or speed cameras?

    RecSpCheck: <Y>   Code (Y)es   (N)o

        IF YES: How long ago was the last time this happened?

                  LSpCheck: ###.# months

Have you ever been caught speeding?

    RecSpCaught: <Y>   Code (Y)es (N)o

        IF YES: How long ago was the last time this happened?

                  LSpCaught: ###.# months
                  LSpFined?   <Y> Code (Y)es (N)o

Do you know anyone else who has been caught for speeding?

    RecOthSpeed: <Y>   Code (Y)es (N)o

        IF YES: How long ago was the last time this happened?

                  LOthSpeed: ###.# months
                  LOthSpFine?   <Y> Code (Y)es (N)o

Have you ever been stopped for a breath test?

    RecAlcCheck: <Y>   Code (Y)es (N)o

        IF YES: How long ago was the last time this happened?

                  LAlcCheck: ###.# months

Have you ever been caught for drink-driving?

    RecDD: <Y>   Code (Y)es (N)o

IF YES: How long ago was the last time this happened?

                    LDD   ###.# months
                    LDDFine   <Y>   Code (Y)es   (N)o

Do you know anyone else who has been caught for drink-driving?

      RecOthDD: <Y>   Code (Y)es   (N)o

           IF YES: How long ago was the last time this happened?

                    LOthDD: ###.# months
                    LOthDDFine?   <Y>   Code (Y)es   (N)o

That's the end of the survey. You've been very helpful.

Thank you very much for your assistance.

STOP   <A>