



MONASH University
Accident Research Centre

**HOLLAND'S THEORY OF
PERSONALITY AND OCCUPATION IN
A ROAD SAFETY CONTEXT**

by

Nicola J. Pronk
Warren A. Harrison

December, 1998

Report No. 145

[This document has been created through Optical Character Recognition by Glenda Cairns. Every attempt has been made to correct any recognition errors, and we apologise if any have been missed.]

MONASH UNIVERSITY ACCIDENT RESEARCH CENTRE
REPORT DOCUMENTATION PAGE

Report No.	Date	ISBN	Pages
145	1998	0 7326 1444 9	36

Title and sub-title:

Holland's Theory of Personality and Occupation in a Road Safety Context

Author(s):

Pronk, N.J.

Harrison, W.A.

Sponsoring Organisation(s):

Preparation of this report was funded from Monash University Accident Research Centre funds.

Abstract:

This report details a study which aimed to confirm and extend earlier work conducted by the second author using a larger, more representative sample. A sample of 3699 drivers conducted in a telephone survey provided information about their occupations and driving record. The occupational information was used to generate personality orientation information which was then analysed in terms of its association with self-reported driving data. It was concluded that it is possible to use personality information derived this way to identify subgroups of offending drivers (confirming Harrison, 1996, 1998c), and discriminant models predicting both self-reported speeding and drink-driving included personality information derived from occupations.

Key Words:

Enforcement, police, alcohol, drink driving,
personality, occupation

Reproduction of this page is authorised

Monash University Accident Research Centre,
Building 70, Monash University, Victoria, 3800, Australia.
Telephone: +61 3 9905 4371, Fax: +61 3 9905 4363
www.monash.edu.au/muarc

Contents

INTRODUCTION	1
THE COMPLEXITY OF BEHAVIOUR	1
PSYCHOLOGICAL CHARACTERISTICS AND ROAD USER BEHAVIOUR	2
Crash Rates	2
Risky Driving Behaviour	3
Speeding	4
Drink-driving	4
IMPLICATIONS FOR THE PRESENT STUDY	5
THE HOLLAND THEORY	5
APPLICATIONS OF HOLLAND'S THEORY	7
NORMATIVE INFORMATION	7
PROJECT AIMS	8
METHOD	10
DATA	10
Data Source	10
Sampling Method	10
Sample Overview	10
Sample Comparisons with Australian Bureau of Statistics' Data	10
Holland Coding Method	11
Data Analysis	12
Examination of the Current Data	12
Comparison Between Current Sample and Lokan's (1988) Normative Sample	13
Comparison Between Current Sample and Harrison's (1996) Sample	13
Relationships Between Holland Codes and Other Variables	13
RESULTS AND DISCUSSION	14
THE CURRENT SAMPLE - NORMATIVE DATA	14
Bias in the Coding of Holland Data	14
Distribution of First-Letter Holland Codes in the Sample of Drivers	15
Comparison of Current Sample with Lokan's (1988) Norms	20
Comparisons Between This Study and Harrison (1996, 1998c)	23
The Prediction of Speeding and Drink-Driving	27
GENERAL DISCUSSION	30
SPECIFIC AIMS	30
GENERAL ISSUES	31
THE BROADER CONTEXT	32
REFERENCES	33

Figures

FIGURE 1	HOLLAND'S MODEL OF PERSONALITY ORIENTATION	7
FIGURE 2	THE DISTRIBUTION OF THE SIX PERSONALITY ORIENTATIONS FOR THE SAMPLE OF VICTORIAN DRIVERS.....	15
FIGURE 3	DISTRIBUTION OF HOLLAND FIRST-LETTER CODES FOR YOUNGER AND OLDER DRIVERS.....	16
FIGURE 4	DISTRIBUTION OF HOLLAND FIRST-LETTER CODES FOR MALE AND FEMALE DRIVERS	17
FIGURE 5	DISTRIBUTION OF HOLLAND FIRST-LETTER CODES FOR METROPOLITAN AND RURAL DRIVERS	18
FIGURE 6	HEXAGONAL REPRESENTATION OF THE CORRELATIONS BETWEEN THE SIX PERSONALITY ORIENTATIONS FOR THE PRESENT SAMPLE OF MALE DRIVERS	19
FIGURE 7	HEXAGONAL REPRESENTATION OF THE CORRELATIONS BETWEEN THE SIX PERSONALITY ORIENTATIONS FOR THE PRESENT SAMPLE OF FEMALE DRIVERS	20
FIGURES 8A AND 8B	FIRST-LETTER CODE DISTRIBUTION FOR MALE (ABOVE LEFT) AND FEMALE (ABOVE RIGHT) DRIVERS IN THE PRESENT SAMPLE COMPARED TO THOSE FROM LOKAN'S (1988) AUSTRALIAN POPULATION NORMS	21
FIGURE 9	TWO-LETTER HOLLAND CODE DISTRIBUTIONS FOR MALE DRIVERS IN THE PRESENT SAMPLE COMPARED TO THOSE FROM LOKAN'S (1988) AUSTRALIAN POPULATION NORMS	22
FIGURE 10	TWO-LETTER HOLLAND CODE DISTRIBUTIONS FOR FEMALE DRIVERS IN THE PRESENT SAMPLE COMPARED TO THOSE FROM LOKAN'S (1988) AUSTRALIAN POPULATION NORMS	23
FIGURES 11A AND 11B	FIRST-LETTER HOLLAND CODES OF METROPOLITAN (ABOVE LEFT) AND RURAL (ABOVE RIGHT) DRINK-DRIVERS (HARRISON, 1996) COMPARED TO THE PRESENT SAMPLE OF METROPOLITAN AND RURAL DRIVERS.....	24
FIGURES 12A AND 12	FIRST-LETTER HOLLAND CODES FOR MALE (ABOVE LEFT) AND FEMALE (ABOVE RIGHT) DRINK-DRIVERS (HARRISON, 1996) COMPARED TO THE PRESENT SAMPLE OF AUSTRALIAN MALE AND FEMALE DRIVERS.....	25
FIGURE 13	TWO-LETTER HOLLAND CODES OF MALE DRINK-DRIVERS (HARRISON, 1996) COMPARED TO THOSE OF THE PRESENT SAMPLE OF MALE DRIVERS.....	25
FIGURE 14	TWO-LETTER HOLLAND CODES OF FEMALE DRINK-DRIVERS (HARRISON, 1996) COMPARED TO THOSE OF THE PRESENT SAMPLE OF FEMALE DRIVERS	26

Tables

TABLE 1:	HOLLAND PERSONALITY ORIENTATIONS AND THEIR DESCRIPTIONS (FROM KELSO, 1986)	6
TABLE 2	AGE GROUP, SEX, AND LOCATION OF INTERVIEWED DRIVERS	10
TABLE 3	AGE GROUP AND SEX OF INTERVIEWED DRIVERS AND THE VICTORIAN POPULATION (COLLECTED BY THE AUSTRALIAN BUREAU OF STATISTICS (1996.....	11
TABLE 4	THE RELATIONSHIP BETWEEN INTERVIEWED DRIVERS' AGE GROUP, SEX AND LOCATION AND SUCCESS OF ASSIGNING A HOLLAND CODE	14
TABLE 7	INDEPENDENT AND DEPENDENT VARIABLES INCLUDED IN THE DISCRIMINANT FUNCTION ANALYSIS	28
TABLE 8	SUMMARY OF DISCRIMINANT FUNCTION ANALYSIS FOR THE PREDICTION OF MALES HAVING BEEN CAUGHT SPEEDING OR DRINK-DRIVING.....	29

EXECUTIVE SUMMARY

This study aimed to confirm and extend earlier work conducted by Harrison (1996, 1998c) who used a theory of the relationship between occupation and personality as the basis for an investigation of the relationship between personality and drink-driving. The current study used a larger (3,699 participants) and more representative (drawn from a telephone survey of drivers) sample to confirm Harrison's original findings and to extend them in a number of ways.

The study was based on the same theoretical approach to personality, derived from Holland (1985) and others. The Holland theory describes personality (as related to occupational choice) in terms of differing strengths in six personality orientations. Harrison had shown that some groups of drivers defined in terms of their Holland orientations were over-represented in a sample of drink-drivers.

The study had four main aims:

- To describe the distribution of Holland occupational codes in the sample of drivers interviewed in a telephone survey. It was concluded that the driver sample was generally representative of the wider population with the exception that the quota sampling used in the survey resulted in a larger number of rural participants than expected based on the population.
- The second aim was to use the present data set to investigate the concerns raised about Harrison's (1996, 1998c) study. The results suggested that the concerns raised by Harrison (1996, 1998c) were well founded. This outcome suggested that the present data set would be a more appropriate normative data set for Harrison's original analysis.
- The third aim of the present study was to compare the personality orientations of Harrison's (1996, 1998c) sample of drink drivers with the present sample used as a normative sample. The results largely confirmed Harrison's original findings. The results reported by Harrison and confirmed here are largely consistent with the literature concerning drink-driving and personality.
- The final aim was to investigate the possibility that self-reported drink-driving and speeding in the present sample were related to other information collected from each respondent at the time of the survey. This analysis suggested that speeding and drink-driving were both related to personality characteristics identified from the Holland codes, and that in the case of speeding there were a number of additional characteristics associated with the behaviour.

The results of this study confirm the potential value of the application of the Holland model to road safety research, and more importantly provide further evidence that it may be possible to target countermeasures more effectively with information about the psychological characteristics associated with unsafe driver behaviour.

INTRODUCTION

The number of traffic-related deaths and serious injuries occurring on Australian roads continues to be an issue of great concern. Road safety countermeasures have contributed to significant reductions in the road toll, however many people are still seriously injured in motor vehicle crashes. In 1996 1,970 people were killed and 21,876 were seriously injured in motor vehicle crashes on Australian roads (FORS, 1998).

In Victoria, various road safety countermeasures targeting unsafe road-use behaviours have been introduced over the past two decades. The Police have implemented enforcement campaigns targeting drink-driving (random breath test~;) and speeding (speed cameras, radar and laser-based speed detection) and the Transport Accident Commission (TAC) has conducted road safety publicity campaigns to support these enforcement strategies. Evidence suggests that these countermeasures have been effective in reducing the number and severity of crashes (Cameron, Cavallo, & Gilbert, 1992; Cameron, Cavallo, & Sullivan, 1992; Cameron, Haworth, Oxley, Newstead & Le, 1993; Newstead, Cameron, Gantzer, & Vulcan, 1995; Zaal, 1994).

Reductions in unsafe driving behaviours related to enforcement and similar activity have generally been understood in terms of the Deterrence Theory which was linked to drink-driving in Australia by Homel (1988) in the context of drink-driving enforcement. Road safety researchers and practitioners have used the Deterrence Theory to explain the behaviour changes that have resulted from Police traffic enforcement activity and many road safety countermeasures have been developed on the basis of this theory. It should be noted in this context that the applicability of this theory in the road safety context has recently been questioned by Harrison (1998a), and Harrison (1998b) has moved some distance towards developing a more appropriate theoretical account of enforcement effects.

High-intensity road safety countermeasures (such as enforcement programs in Victoria) are generally applied to the population as a whole. While this broad approach has been successful in achieving large reductions in the road toll (and changing the behaviour of many drivers) some drivers continue to offend in spite of these countermeasures. While the road fatality data indicate a lowering of the road toll in the years following the introduction of random breath testing and speed cameras, for example, they also suggest that these figures may have plateaued since 1993 (Makeham, 1997).

Harrison (1996, 1998c) has suggested that some drivers may be less responsive to the current enforcement programs. This may be because they require higher levels of enforcement (for changes in their behaviour to occur) or that perhaps for social or psychological reasons these drivers are less responsive to a negative-reinforcement based approach to behaviour change (Harrison also indicates that these possibilities are not necessarily mutually exclusive). More research is required in order to understand the mechanisms that link enforcement activity and behaviour change.

THE COMPLEXITY OF BEHAVIOUR

Driving a motor vehicle is a highly complex task that is influenced by the interaction between a range of factors that are internal (psychological) and external (environmental) to the driver. A number of researchers have examined the relationships between these factors and driving behaviours, however little is understood about the relative importance of each factor or how the factors interact to influence driving behaviour.

The present project is concerned with the psychological characteristics that may be associated with illegal driving behaviours such as speeding and drink-driving. It was anticipated that an exploration of these influences could contribute to knowledge about some of the psychological factors underlying driving behaviour and that this could in turn assist in the effective targeting of high-risk drivers who continue to engage in unsafe driving behaviours in spite of the community-wide countermeasures that have been implemented in Victoria.

PSYCHOLOGICAL CHARACTERISTICS AND ROAD USER BEHAVIOUR

The focus of research concerning the link between psychological factors and crash risk has shifted from identifying high-risk drivers to focusing on the differences between crash involved and uninvolved drivers to better understand the underlying processes associated with elevated crash risk (Elander, West, & French, 1993). Research has also examined the differences between deviant and non-deviant driving groups as a greater understanding of the underlying factors associated with unsafe driving behaviours could assist in the development of effective targeted countermeasures.

Psychological factors encompass many potential influences on driver behaviour, including cognitive skills and abilities, attitudes, social influences and personality. The present study focuses on the relationship between personality characteristics and driving behaviour.

Drivers' personality characteristics and orientations can be seen as the background against which external forces such as social influences and enforcement act. Some personality characteristics may predispose individuals to behave in certain ways (eg. take risks) or to be more easily influenced by external factors (such as social influence⁵). Other characteristics may buffer individuals against a range of external forces. Perhaps drivers who continue to exhibit risky behaviours such as speeding and drink-driving in the present climate of high traffic publicity and enforcement share some personality characteristics that render them immune from the current countermeasures.

Previous studies have identified relationships between personality characteristics, elevated crash risk and unsafe driving behaviours such as speeding and drink-driving. This section details the main conclusions drawn by a selection of relevant studies in this area.

Crash Rates

- Elander, West, & French (1993) conducted a review of the literature examining the relationship between personality and crash risk. Key aspects of their review are summarised below.
 - West, French & Elander (1991) identified an association between the dimension "thoroughness" (a dimension of decision-making) and crash rate. Their study controlled for age, sex and exposure and the results indicated that drivers who often made decisions without carefully considering the consequences had a higher risk of crashing.
 - Studies examining the association between extraversion and neuroticism are mixed and inconclusive. Fine (1963) found a significant relationship between extraversion and crash risk and traffic violations. A significant association was found between extraversion and crash rates by Craske (1968) (for males but not for females) and by Shaw and Sichel (1971) (these drivers also had higher

neuroticism scores). Several other researchers have failed to support these findings (Wilson & Greensmith, 1983; Singh, 1978; Clement & Jonah, 1984).

- Clement and Jonah (1984) found a correlation between external locus of control (a tendency to attribute causes of behaviour to external rather than internal factors) and crash involvement, however this relationship disappeared when age and exposure were controlled.
- Significant correlations have been identified between Type A personality (a tendency to rush and to be alert, competitive and ambitious as measured by clinical tests) and crash involvement (Perry, 19:96; Evans, Palsane, & Carrere, 1987). West, Elander, & French, (1992b) found an association between Type A behaviour and self-reported speeding.
- The link between psychopathology and crash involvement has been considered however many of these studies were subject to bias and used extreme samples. Finch & Smith (1971) found that 20% of fatally injured drivers were free of psychosis compared with 88% of controls.
- People with criminal records were found to be more likely to be over-involved in crashes (ranging from property damage only to fatalities) compared with the general population (Haviland & Wieman, 1974). A body of research indicates that involvement in crime and traffic crashes may share underlying causes and influences (Sivac, 1983; Whitlock, 1971).
- Associations have been identified between a range of psychological characteristics (such as hostile feelings, increased aggression, competitiveness, risk taking, emotional stability, impulsivity, stress, antisocial motivation) and crash involvement (McGuire, 1972; Tsuang, Boor, & Fleming, 1985; West, Elander & French, 1992b).
- Parker, Manstead, Stradling, & Reason (1992) found a relationship between drivers' willingness to commit traffic violations and crash involvement, suggesting that motivational factors may serve to generate objectively unsafe driving behaviour.

Risky Driving Behaviour

- Beirness (1994) found that the personality dimensions of thrill-seeking, impulsivity, hostility/anger, emotional instability, depression and locus of control were strongly and consistently associated with driving behaviour (accounting for up to 20% of the variance) and crash involvement (accounting for up to 35% of the variance). This author has suggested that high levels on these dimensions may predispose drivers to involvement in high risk-driving behaviours.
- Caspi, Begg, Dickson, Langley et al (1996) examined a range of high-risk health behaviours (including dangerous driving habits) and found that participants who engaged in these high risk behaviours were more impulsive, aggressive, alienated, and tended to respond to daily hassles with negative emotions.
- Traffic offenders were found to prefer higher levels of arousal, were greater risk takers, thrill-seekers, and were less inhibited than non-offenders (Trimpop, & Kirkcaldy, 1997).

- Labiale (1998) described a typology of drivers considering factors such as personality and driving behaviour.

Speeding

- Gabany, Plummer, Portia, & Grigg (1997) conducted a factor analysis that identified five factors that predisposed, enabled, and reinforced drivers' tendency to speed and these were Ego-gratification, Risk-taking, Time pressures, Disdain of driving, and Inattention.
- Furnham, & Saipe (1993) found that drivers convicted for speeding or reckless driving scored highly on measures of psychoticism, thrill-seeking, and boredom susceptibility compared with controls.
- West, & Hall (1997) found that driver~; who reported a more positive attitude to driving violations and who obtained a higher score on a measure of social deviance reported driving faster and having been involved in more accidents (controlling for exposure).

Drink-driving

- Adebayo (1992) found that a number of personality and situational factors were good predictors of drink-driving including standard of living, degree of loneliness, boredom and depression.
- Reynolds, Kunce, & Cope (1991) reported that first time offending drink-drivers differed from repeat offenders on a range of personality characteristics. They found that repeat offenders were significantly less expressive emotionally and less flexible in finding stimulation than first-time offenders.
- Wilson (1991) conducted a cluster analysis using a sample of drink-drivers, drivers who had been involved in a crash and high risk drivers (who had lost demerit points). Four groups of drivers were identified who differed on measures of thrill-seeking, hostility and personal adjustment as well as on a range of demographic, lifestyle and attitudes measures. Drink-drivers did not differ substantially from high-risk drivers. Wilson (1992) found that drink-drivers were more deviant on behavioural and personality measures and had more crashes and traffic convictions than controls.
- Stacy, Newcombe, & Bentler (1991) investigated three possible explanations for the effect of personality on alcohol-related problems. They found support for each of the three personality effects (particularly for the constructs sensation seeking and cognitive motivation): (1) that personality has a mediating effect, (2) that it directly effects the behaviour, (3) that alcohol consumption and personality interact. This finding could have direct relevance to those who may be at risk of drink-drive offending.
- McMillen, Pang, Wells-Parker, & Anderson (1992) found that drink-drive convicted drivers had significantly higher levels of hostility and psychopathic deviance than non-arrested impaired drivers and non-impaired drivers. Nolan, Johnson, & Pincus (1994) identified subtypes of drink-drivers based on personality differences and was able to use these to reliably predict demographic variables, drinking behaviours and driving records.

- Turrisi, Jaccard, & McDonnell (1997) found support for a model suggesting direct, indirect and moderating effects of driving aggression and indirect effects of emotional control on drink-driving.
- Biecheler-Fretel & Danech-Pajouh (1988) identified an association between driving habits, drinking habits and personality variables.

IMPLICATIONS FOR THE PRESENT STUDY

A number of converging arguments presented above led to the present interest in personality orientation and driving behaviour. These are:

- The continued occurrence of unsafe driving behaviours in the Victorian context where there are high-intensity enforcement and public education campaigns to deter behaviours such as drink-driving and speeding;
- The consistent (though sometimes weak) evidence that intra-personal factors (such as personality and other traits) may have some influence on crash involvement; and
- The increasing need to understand the factors underlying unsafe road use behaviours.

The present study was conducted in light of these arguments, and in the context of Harrison's (1996, 1998c) investigation of personality orientation and drink-driving and the availability of a larger data set. As was the case in Harrison's study (1996, 1998c), the present study sought to apply the Holland theory of personality to a sample of drivers for whom data were available concerning their driving behaviour.

THE HOLLAND THEORY

Holland's (1973, 1985b) theory of personality and occupational choice is based around the notion that people can be assessed according to the strength of their resemblance to six personality orientations.

These include orientations that are Realistic, Investigative, Artistic, Social, Enterprising and Conventional and are summarised in Table 1. The six personality orientations are empirically derived models against which people can be compared. A core feature of Holland's theory is that each personality orientation is assumed to include characteristic activities, competencies, self-concepts and vocational preferences. Holland argues that the more closely one resembles a personality orientation, the more likely one is to exhibit the behaviours that are characteristic of that group. Further, Holland argues that each (working) environment is dominated by people possessing particular personality characteristics, as different environments favour different personalities and people tend to seek out environments and people that are congruent with their own interests and competencies.

**Table 1: Holland Personality Orientations and Their Descriptions
(from Kelso, 1986)**

Holland Orientation		Personality Description
Realistic	R	Possesses mechanical or athletic ability and lacks social competence; values money, power, status; is inclined to be asocial, conforming frank, genuine, materialistic, persistent, practical, un insightful and uninvolved.
Investigative	I	Possesses mathematical and scientific ability and lacks leadership ability; values science; is inclined to be analytical, cautious, critical, complex, curious, independent, intellectual, introspective, precise, rational and unassuming.
Artistic	A	Possesses artistic or musical ability; values aesthetic qualities; is inclined to be emotional, expressive, idealistic, imaginative, impulsive, intuitive, original and sensitive.
Social	S	Possesses social competence and likes to help others; values social and ethical activities; is inclined to be cooperative, empathic, friendly, generous, helpful, idealistic, patient, sociable and tactful.
Enterprising	E	Possesses leadership and speaking skills; values political and economic achievement; is inclined to be adventurous, agreeable, ambitious, energetic, extroverted, optimistic and self-confident.
Conventional	C	Possesses clerical and numerical ability; values business and economic achievement; is inclined to be conforming, conscientious, defensive, inflexible, methodical, obedient, orderly, thrifty and unimaginative.

Holland's six-factor structure of personality orientation has been supported by a number of empirical studies (Naylor and Mount, 1986; Tracey & Rounds, 1992). The validity of the model for males has been well established, however the results for females using this model have not been as clear (Tuck & Keeling, 1986). The occupational personality orientations can be described in an hexagonal model based on their inter-correlations (Figure 1), and this has been supported by research conducted by Tracey & Rounds (1992) amongst others. Personality orientations that are more similar are placed closer together on the model than those that are less similar. For example a person whose personality is predominantly Social would be expected to have a greater congruence with those whose personalities are predominantly Artistic or Enterprising and be less similar to those whose personalities are predominantly Realistic.

In general use in occupational-counselling instruments such as the Self-Directed Search (SDS) (Holland, 1985a), the Holland approach is used to determine the relative strengths of a person's orientation in each of the six areas. These are expressed as a two- or three-letter code which indicates the person's strongest personality orientations. In a career-counselling setting this code can then be matched with the Holland codes identified as being associated with specific occupations.

It should be noted that this theory does not suggest that the personalities of individuals fall into one of the six categories, but rather are composed (to greater and lesser degrees) of each of the six personality orientations. For example, the personality of an individual (as reflected in occupational choice) with a Holland code of "ASI" would be expected to exhibit more of the qualities and characteristics associated with the Artistic, Social and Investigative personality orientations and less of the characteristics associated with the Realistic, Enterprising or Conventional personality orientations. Further, the order of the letters in the two 'Dr three-letter Holland code indicates the importance of the orientation in the make up of an individual's personality. Using the example above, the influence of

the Artistic orientation on the personality of an individual with that Holland code would be expected to be greater than that of the Investigative orientation.

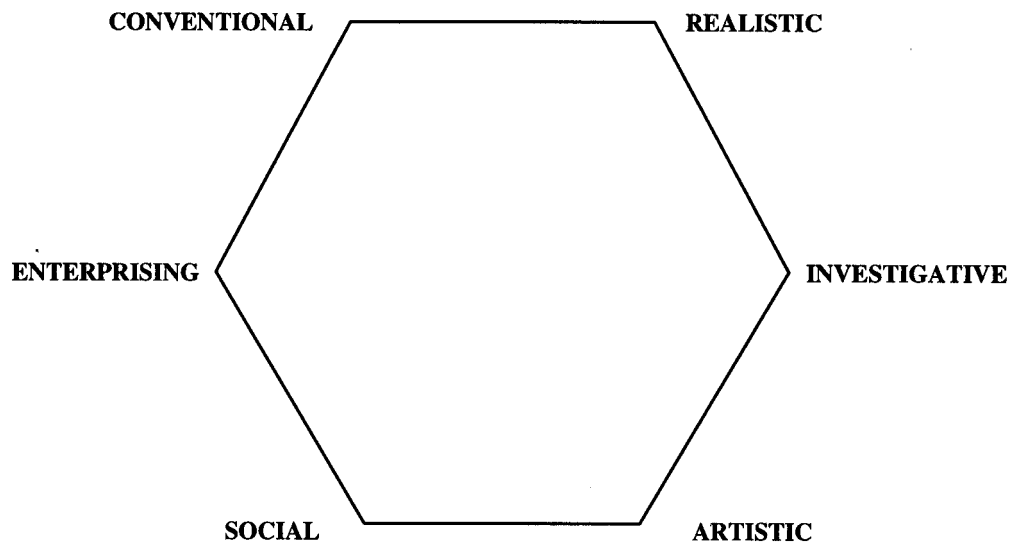


Figure 1 Holland's Model of Personality Orientation

APPLICATIONS OF HOLLAND'S THEORY

There have been many applications of Holland's theory of personality, particularly in the area of career counselling, and it has also been used as a research tool in education, business and social science (Holland, 1985a). Harrison (1996, 1998c) applied Holland's theory in a novel way, by using it as a tool to identify sub-groups of drink-drive offenders. This was done using the offenders' reported occupations to assign an appropriate Holland code using Lokan's (1988) list of occupations. Harrison was then able to draw conclusions about the personality profiles of offenders (and their associated characteristics) using Holland's theory. Thus, Harrison (1996, 1998c) was able to identify sub-groups of drivers (based on personality orientation) who were over-represented in the drink-drive offending sample (compared to the Australian norms) and he used this information to make suggestions for effective targeting strategies appropriate to these groups.

NORMATIVE INFORMATION

Harrison (1996, 1998c) noted some weaknesses in his method, including difficulties surrounding the choice of a normative sample. The present study sought, in part, to address this weakness. An effective means of calculating the relative standing of a person or group on a test or measure is to compare their results with those obtained by another person or group on the same test or measure. This is referred to as a norm-based interpretation (Murphy & Davidshofer, 1988) and is used widely. The normative group is therefore used to define the set of standards against which an individual or group can be tested and this standard is referred to as a norm.

Different populations can be used to develop norms and it is important to consider how appropriate the target population is as a comparative group given the particular use of the normative data. For example, a normative sample could represent the general population or a particular sub-section of the population, depending on the nature of the sample.

Holland (1985a) has described the "accidental" sample which he used to develop his adult norms for the Self Directed Search. He reported that this sample was composed of "participants from high schools, community colleges/universities, an evening college, a hospital, a chemical plant, a test publisher, a federal agency, a graphic design firm, a woman's center, and some samples of street people, battered women and probationers" (Holland, 1985a, p. 48). It is uncertain how appropriate this sample was as a normative sample, suggesting a need to develop more representative norms for the Holland models for use both in general occupational areas and in a research context.

Harrison (1996, 1998c) used Lokan's (1988) Australian norms for the Self Directed Search as his normative data. Although he was unable to use alternative normative data, Harrison (1996) raised concerns in his paper regarding how appropriate it was to use these norms as comparative data for his study. Harrison's (1996, 1998c) sample consisted of drink-drive offenders (identified and interviewed by the Police) ranging upwards from 18 years. Lokan's (1988) sample was composed of Australian secondary school students, selected from years 9, 10 and 11. While research suggests that occupational preferences (which can be expressed as Holland personality codes) may remain relatively stable over time and across the life of an individual (Campbell, 1966, 1971) the issue of comparability between these groups is of concern.

Harrison (1996) assigned Holland codes to the drink-drivers in his sample based on their self-reported occupation while the participants from Lokan's (1988) sample were assigned Holland codes after completing the SDS. The two samples were therefore assigned a surrogate measure of personality on different bases (one measure obtained from the completion of an assessment tool and the other by inference from reported occupation). The use of different methods to create a surrogate measure of personality raises a further concern about the comparability of the samples. An aim of the present study was to develop a set of norms using a more comparable sample and a surrogate measure of personality created using the same methodology.

PROJECT AIMS

The present project applied Holland's (1973, 1985a) theory of personality and occupational choice in a road safety context using a similar approach to that used by Harrison (1996, 1998c).

The specific aims of the present project were four-fold:

1. to examine the distribution of Holland codes (assigned according to self-reported occupation) for a large sample of Victorian drivers;
2. to compare the distribution of Holland codes obtained using this sample of Victorian drivers with the distribution of Lokan's (1988) Australian norms. This comparison was planned to evaluate the similarities and differences between these two samples and could help address the concerns raised by Harrison (1996, 1998c) relating to sample comparability;
3. to compare the distribution of Holland codes obtained by Harrison (1996, 1998c) using a drink-drive offender sample with that of the larger sample of Victorian drivers. This comparison was similar to that conducted by Harrison using Lokan's (1988) normative sample. It was expected that this comparison would allow for an evaluation of the

findings and conclusions of Harrison (1996, 1998c) (reached previously using Lokan's (1988) Australian norms) using more appropriate norms; and

4. to conduct an analysis of the relationship between Holland codes (as a surrogate measure of some personality characteristics) of Victorian drivers (assigned according to reported occupation) and their reported road safety related attitudes and behaviours. Information from this analysis could potentially be drawn upon in the targeting of road user groups who report unsafe roads safety attitudes and behaviours.

METHOD

DATA

Data Source

The data analysed in this project were collected as part of another project conducted by the Monash University Accident Research Centre (MUARC) for the Transport Accident Commission I(TAC) that evaluated the effectiveness of an enhanced speed and drink-drive enforcement program conducted by the Police in four districts of Victoria (two Police districts were largely metropolitan and two were largely rural in composition) during the second half of 1997. The data collection is described fully in Harrison and Pronk (1998).

Sampling Method

Participants were licensed drivers contacted by telephone using randomly generated telephone numbers. A quota sampling technique was used in order to obtain sufficient numbers of participants in each age group (18-29 and 30-59 years), sex, and location (metropolitan and rural) (Table 2). Participants were sampled from four Police districts (D, H, O & Q) in Victoria. A random sample of telephone numbers was extracted from the Telstra White Pages in each of the four Police districts of Victoria using purpose developed software to ensure no repetition of telephone numbers.

The telephone interviews (each of ten minutes duration) were conducted during the late afternoon and early evening and households were allowed up to one call-back.

Sample Overview

In total, 3,700 licensed drivers were interviewed. It was later discovered that one driver fell outside the required age range for the study so they were removed from the data file, leaving a total of 3,699 participants. Altogether 1,740 (47%) male drivers and 1,959 (53%) female drivers were interviewed.

The drivers ranged in age from 18 years through to 59 years, with 1,609 (43.5%) drivers in the 18-29 year age group and 2,090 (56.5%) drivers in the 30-59 year age group. It was found that 1,826 (49%) drivers were interviewed from metropolitan areas of Melbourne (D and H Police districts) and 1,873 (51%) from rural areas of Victoria (O and Q Police districts). The breakdown of drivers by age group, sex and location are shown in Table 2.

Table 2 Age Group, Sex, and Location of Interviewed Drivers

	Male Drivers		Female Drivers	
	18-29 years	30-59 years	18-29 years	30-59 years
Metropolitan	392	471	428	535
Rural	348	529	442	554
Total	740	1,000	870	1,089

Sample Comparisons with Australian Bureau of Statistics' Data

In order to ascertain how representative the present sample was of the general Victorian population, the sample was compared on a number of demographic measures with Victorian data collected by the Australian Bureau of Statistics (ABS) during the 1996

Census of Population and Housing. A summary of the survey sample data and the ABS Victorian population data is shown in Table 3.

The surveyed drivers were quota sampled from the four Police districts in order to obtain approximately equal numbers of participants in each cell (by age, sex, and location), a requirement of the original study. This sampling technique forced a bias towards rural participants compared to the number that would have been obtained using a random sampling technique or would have been expected based on the ABS data.

Following aggregation of the metropolitan and rural data, the sampled population approximates the 1996 Victorian population reported by the ABS (Table 3).

Table 3 Age Group and Sex of Interviewed Drivers and the Victorian Population (Collected by the Australian Bureau of Statistics (1996)

	Survey Data (18-59 year old drivers)	ABS (1996) (18 years and older)
<i>Males</i>		
Employed (FT/PT)	1,336 (45.8%)	1,029,231 (43.8%)
Unemployed	98 (3.4%)	110,584 (4.7%)
Studying (FT/PT)	148 (5.1%)	155,887 (6.6%)
<i>Females</i>		
Employed (FT/PT)	1,118 (38.3%)	808,334 (34.4%)
Unemployed	64 (2.2%)	75,870 (3.2%)
Studying (FT/PT)	152 (5.2%)	172,063 (7.3%)
Total	2,916	2,351,969

When assessing the above comparisons between the survey population and the Victorian population it is important to consider the sampling differences between the two samples. The survey sample was restricted to licensed car drivers between the ages of 18 and 59 years in four Police districts only, while the Victorian data collected by the ABS includes all people present in households throughout Victoria over (and including) the age of 18 years on census day (6th August, 1996).

Using data available from VicRoads and the ABS, it was estimated that approximately 930/0 of Victorians aged 18 years or older possess a licence (full or probationary) to drive a car. This suggests that it would be appropriate to use a sample of drivers (only) to approximate the larger population.

Overall, it was considered that the sample of surveyed drivers did not differ substantially from the Victorian population as reported by the ABS and therefore was representative of the Victorian population of drivers.

Holland Coding Method

Holland (1985a) and Lokan (1988) created dictionaries that listed occupations and their associated three-letter Holland codes. These data were initially collected by Holland (1966) using the Vocational Preference Inventory (V PI) (Holland, 1958), a precursor to the SDS, using samples of working adults.

In the development of the most recent American and Australian editions of these dictionaries mathematical techniques such as discriminant analysis have been employed.

These dictionaries indicate the three letter Holland codes most commonly associated with people employed in specific occupations.

Information regarding drivers' usual occupations was collected during the survey of drivers. The reported occupations of drivers were compared with those occupations listed in Lokan's (1988) Australian Dictionary (and Holland's (1985a) American dictionary if there was no listing in the Australian version). Each participant's reported occupation was matched to an occupation in the dictionary, and the corresponding three-letter Holland code (in the dictionary) was then assigned to that participant. This code could then be interpreted as a surrogate measure of the personality of the participant orientation (as expressed in their occupational choice).

It was not possible to assign a Holland code to a number of survey participants. This included seven drivers who did not report their occupation and 1,103 cases who reported being either unemployed (N=162), retired (N=68), on a pension (N=31), a homemaker (N=542) or a student (N=300). Further, a code wasn't able to be assigned to 134 drivers whose reported occupation was either vague, unclear, or couldn't be matched with an occupation in the Australian or American dictionaries. There was a total of 2,455 drivers who were assigned a Holland code on the basis of their reported occupation who have been included in the following analyses.

It should be noted that the present authors have elected to use only the first two letters of drivers' assigned Holland codes (according to their reported occupations) in the present analyses. This decision was made in order to reduce the number of personality categories (based on occupational choice) to which drivers could be assigned.

Data Analysis

A number of separate aims were identified in the Introduction and each of these is considered separately in the Results section. Multiple univariate data analyses were conducted throughout this report and it is acknowledged that this method could have the effect of inflating the overall type one error rate of the study (finding a significant result when the result is the product of chance variation in the data). However, given the exploratory nature of this study, this was not considered important enough to warrant significant concern.

Since past research has established the validity of Holland's theory when applied to males, but questioned its' validity when applied to females (Tuck & Keeling, 1986) the data were generally analysed separately for male and female participants.

The analysis of the data was completed in four stages.

Examination of the Current Data

Possible biases (according to sex, age group or location) in the assignment of Holland codes to drivers from the present sample were explored using two-way chi-square tests of independence.

Relationships between the distribution of first-letter Holland codes and drivers' group membership (sex, age group, location) were also examined using chi-square tests of independence.

Non-parametric correlations (Spearman) were conducted between the six personality orientations (as reflected by drivers occupational choice) for male and female drivers to identify whether the pattern of correlations supported the hexagonal model proposed by Holland (1985a), to help establish the validity of Holland's theory of personality and occupation using the current data.

Comparison Between Current Sample and Lokan's (1988) Normative Sample

Comparisons between the distribution of the first-letter Holland codes for the drivers in the present sample and that of the participants used by Lokan (1988) were conducted using chi-square tests of independence.

Comparison Between Current Sample and Harrison's (1996) Sample

Comparisons between the distribution of first-letter Holland codes for the drivers in the present sample and those from the drink-drive sample of Harrison (1996) were compared using chi-square tests of independence.

Relationships Between Holland Codes and Other Variables

Multivariate analyses were considered appropriate for the analysis detailed in this section of the report. Discriminant function analyses were conducted to identify whether drivers' personality or attitudes predicted their detection for speeding or drink-driving.

RESULTS AND DISCUSSION

THE CURRENT SAMPLE - NORMATIVE DATA

In light of the concerns raised in the Introduction regarding the Australian and American norms, an aim of the present project was to develop an alternative set of normative data using a sample of Victorian drivers. This section of the report explores how appropriate the data for Victorian drivers were for use as norms in the present context.

Bias in the Coding of Holland Data

As discussed above, it was not possible to assign a Holland code on the basis of reported occupation for all participants. In total, 2,457 drivers were successfully assigned a two-letter Holland code according to their reported usual occupation and 1,244 subjects (33.6%) were not assigned a code and hence not used in further analyses. In order to establish whether there was a bias in the success of assignment of Holland codes to groups of drivers, chi-square tests were used to test the relationship between the success of Holland code assignment and drivers' age group, sex and location. The results of this analysis are shown in Table 4.

Table 4 The Relationship Between Interviewed Drivers' Age Group, Sex and Location and Success of Assigning a Holland Code

Variable		Successful Holland Code	Unable to Assign Holland Code	Statistical Test Result
Sex	Male	1,336	404 (23.2%)	$\chi^2_{(1)} = 159.6, p < .05$
	Female	1,119	840 (42.9%)	
Age Group	18-29 years	1,058	551	$\chi^2_{(1)} = 0.48, n.s.$
	30-59 years	1,397	693	
Location	Metropolitan	1,207	619	$\chi^2_{(1)} = 0.11, n.s.$
	Rural	1,247	625	

Note: The percentages above indicate the percentage of male and female drivers for whom Holland codes could not be assigned.

No significant relationship was found between drivers' age group ($X^2_{(1)} = 0.48, p > .05$) or their location ($X^2_{(1)} = 0.48, p > .05$) and success of Holland code assignment. However, a significant relationship was found between drivers' sex and the success of Holland code assignment ($X^2_{(1)} = 159.6, p < .05$). It was more likely that Holland codes could be assigned for male drivers than for females.

One of the aims of the present study was to compare the results obtained using a general sample of Victorian drivers with those obtained by Harrison (1996) using a sample of drink-driving offenders. Harrison (1996) did find a significant relationship between drivers' age group and location and the success of Holland code assignment, a finding that wasn't confirmed with the current data set. This difference (between the two studies) could partially be explained by the omission of older drivers from the present study (the maximum age was 59 years) and the presence of fewer younger male drivers in the present study. Harrison (1996) used a convenience sample, limited specifically to drink-drive offenders whereas the sample used here was obtained using quota sampling and more accurately reflects the general population. Both this study and Harrison (1996) found a significant relationship between drivers' sex and success of Holland code assignment. This is most likely due to the large number of female respondents reporting

"housewife/homemaker" as their main occupation (in this study 542 participants, or approximately 15%).

The assignment of Holland codes to those who report "housewife/homemaker" as their occupation is a difficult issue. Holland (1985a) has suggested that a code of "SAE" be assigned to those with this occupation, however the current authors were reluctant to use this code. People (particularly women) can find themselves in this occupation for a number of practical and family reasons that do not necessarily reflect their occupational preference but rather practical issues of their family situation"

Distribution of First-Letter Holland Codes in the Sample of Drivers

The first-letter of a Holland code indicates the personality orientation that has the greatest influence on the behaviour of an individual. Holland (1985a) states that "... the first letter of the occupational code is the most important, most descriptive, and most reliable" (p. 15). An examination of the distribution of the first-letter Holland codes can give an indication of the relative distribution of the six orientations within the sample and help identify dominant personality differences (in terms of characteristics and tendencies) between groups.

The distribution of personality orientations (as related to occupational choice) for the sample of Victorian drivers (based on first-letter Holland code) is shown in Figure 2. The greatest proportion of drivers reported occupations that received a Realistic first-letter Holland code (38%) while the smallest proportion reported occupations that were assigned an Artistic first-letter Holland code (3%).

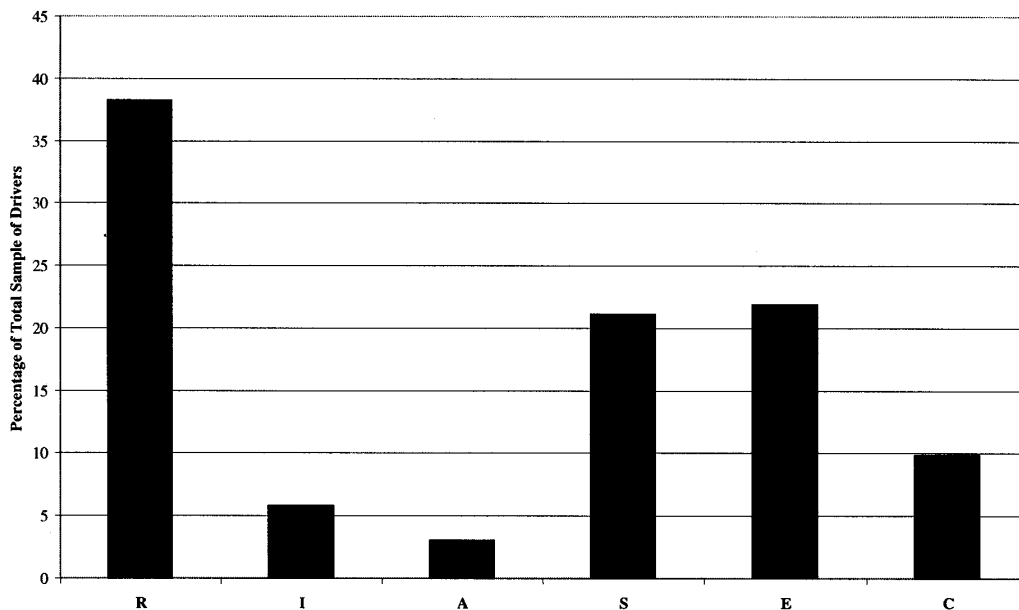


Figure 2 The distribution of the Six Personality Orientations for the Sample of Victorian Drivers

The distribution of first-letter Holland codes for younger and older drivers was found to differ significantly ($X^2_{(5)} = 14.7, p < .05$), and this relationship is illustrated in Figure 3. Younger drivers were more likely to report occupations coded as Realistic or Conventional

while older drivers were more likely to report occupations coded a~; Social or Enterprising (based on first-letter codes).

It is important to note that students were not assigned Holland codes and were excluded from the present analysis. A consequence of this is that the proportion of younger drivers in the analysis in less skilled occupations (manual or office positions) and apprenticeships would be greater than the proportion of older drivers in the analysis in the same types of occupations. These types of occupations tend to fall into the Realistic and Conventional categories while the more senior managerial and professional positions (which for this and other reasons would more likely be filled by older people) tend to fall into the Enterprising or Social categories. This may partly explain the significant difference identified between the younger and older drivers in the current sample. Further, Holland (1985a) noted age differences between younger and older participants that he felt could partially be explained by differences in interests. For example, he suggested that older people tend to be less interested in adventurous activities and occupations and this would be reflected in their personality orientation distribution.

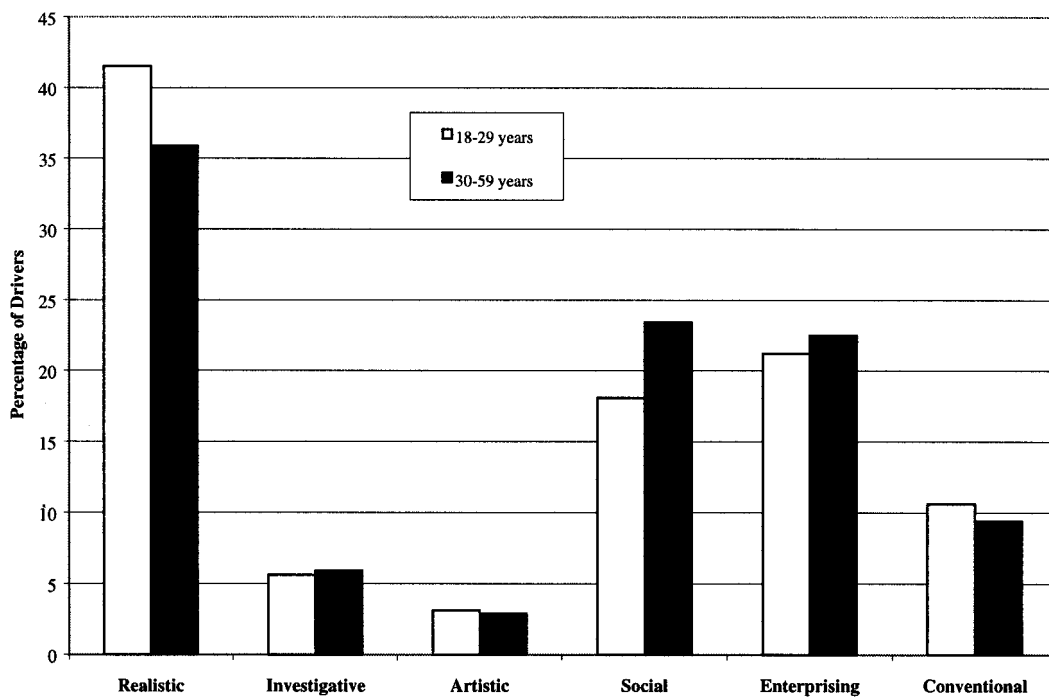


Figure 3 Distribution of Holland First-Letter Codes for Younger and Older Drivers

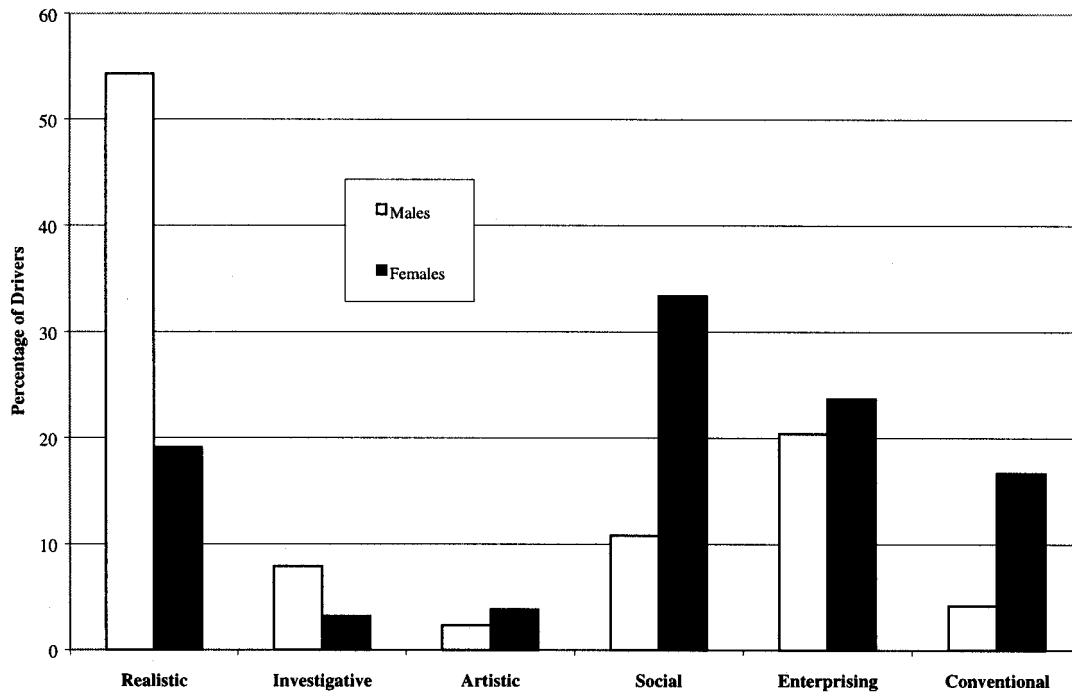


Figure 4 Distribution of Holland First-Letter Codes for Male and Female Drivers

Figure 4 shows the distribution of first-letter Holland codes for male and female drivers. A significant relationship was identified between sex and first-letter occupation code ($X^2_{(5)} = 472.7, p < .05$). Male drivers were more likely to report occupations that were coded as Realistic or (to a lesser extent) Investigative while female drivers were more likely to report occupations coded as either Social, Enterprising, Conventional or (to a lesser degree) Artistic.

Harrison (1996, 1998c) found a similar significant difference between the distribution of Holland codes for male and female participants in his study of drink-drivers. This finding could suggest that males and females differ in some aspects of their personality orientations (and characteristics) at a group level, with important implications for the development and targeting of effective countermeasures. Past research has identified similar sex differences in the high-point codes obtained for males and females (Martin, 1978), and Holland (1985a) states that on average males are more likely to obtain R, I, and E codes and that females are more likely to obtain S, A, and C codes.

A significant relationship was found between drivers' location (metropolitan or rural) and the first-letter Holland code of their reported occupation ($X^2_{(5)} = 18.3, p < .05$). This relationship is shown in Figure 5 and indicates that drivers from metropolitan areas were more likely to report occupations that were coded as Investigative or Conventional while drivers from rural areas were more likely to report occupations that were coded as Realistic and slightly more likely (than metropolitan drivers) to report occupations coded as Social or Enterprising.

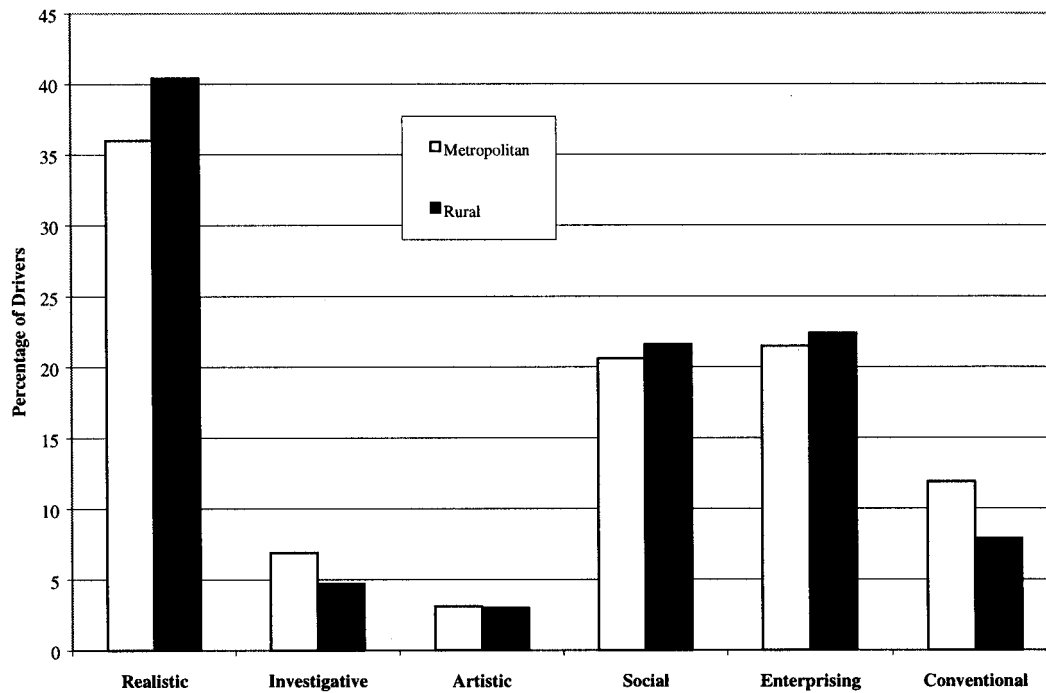


Figure 5 Distribution of Holland First-Letter Codes for Metropolitan and Rural Drivers

This finding suggests some variability in the geographic distribution of personality orientation, possibly related to the distribution of different types of occupations. For example, a greater number of office/clerical type positions (assigned a C coding) would be expected to be located in metropolitan areas and hence could help explain the higher percentage of drivers in metropolitan areas reporting occupations that were assigned this type of code.

Summary

Following the above analysis of the demographic composition of the sample, it was concluded that the current sample of drivers is an appropriately representative group of the Victorian population. While a bias was identified that suggested Holland codes were less likely to be assigned to female drivers, it was believed that this was largely the result of the high numbers of female participants reporting "homemaker" as their main occupation combined with the reluctance of the authors to allocate a Holland code for this occupation. This is an issue that could be addressed in future research.

The analysis of the distribution of Holland codes identified some differences between groups. It was found that young drivers were more likely to report occupations assigned a Realistic or Conventional code, whilst older drivers were more likely to report occupations that were assigned Social or Enterprising codes. Male drivers were more likely to report occupations with Realistic or Investigative codes and female drivers were likely to report occupations that were assigned an Artistic, Social, Enterprising or Conventional code. Drivers from metropolitan areas were more likely to report occupations assigned Investigative or Conventional codes while rural drivers were more likely to report occupations assigned Realistic and to a lesser extent, Social and Enterprising codes.

Structure of the Data in Terms of Holland's Theory and Model

It was noted above that it is possible to describe Holland's theory using an hexagonal model, based on the intercorrelations between the six orientation factors (Tracey & Rounds, 1992). Some doubts have been expressed concerning the model's structure (eg. Lunneborg & Lunneborg, 1975) and its validity for females (Holland, 1973). One aim of this project was to consider the strength of the relationships between the six orientations using the current data set and to examine how consistent they are with those predicted by Holland's model.

Holland's theory does not assign people into types or categories but rather identifies their relative strength of association with each of the six orientations. This strength of association is reflected by the ordering of the orientations within the assigned Holland code, with the first named orientation being expected to exert the strongest influence (on characteristics and behaviours) and the subsequent orientations being expected to exert a lesser influence on the characteristics and behaviours of the person. For example, an individual with a Holland code of ASI would be expected to have the greatest strength of association with the Artistic orientation's characteristics, and a weaker association with the Social and Investigative orientations' characteristics. For this analysis, each participant was assigned a score on each of the six Holland orientations reflecting the strength of association with that orientation based on the two-letter codes. For each driver, the first-letter code was assigned a score of 2, the second-letter code was assigned a score of 1, and the remaining orientations were assigned a score of 0. These scores therefore reflected the relative strength of each Holland orientation for each driver.

Using this method to assign points to reflect the participant's strength of association to each personality orientation, correlations between these orientations (RIASEC) in the present data were examined for male and female participants separately and the Spearman correlation coefficients between the six orientations for males and females are shown in Figures 6 and 7 respectively.

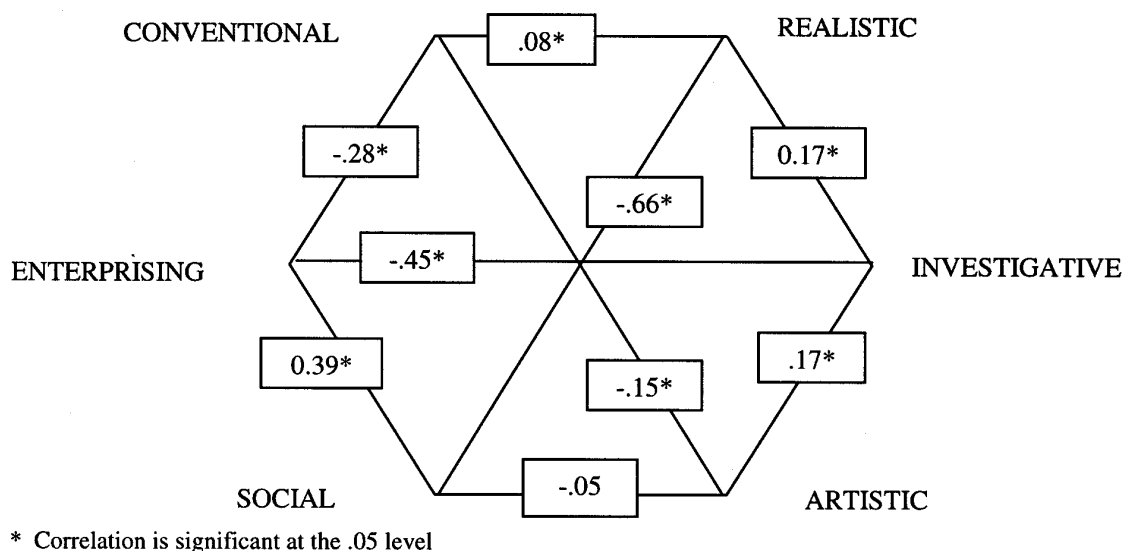


Figure 6 Hexagonal Representation of the Correlations Between the Six Personality Orientations for the Present Sample of Male Drivers

Figure 6 illustrates the correlation coefficients for male drivers from the present study between the six orientations. Significant relationships were identified between the six

factors. The pattern of these correlations is generally consistent with the hexagonal structure proposed for the Holland model, with strongly negative correlations between orientations on opposite sides of the hexagon and less negative or positive correlations between more-closely located orientations. The only significant variation from this general result was the significant negative correlation between the Conventional and Enterprising orientations.

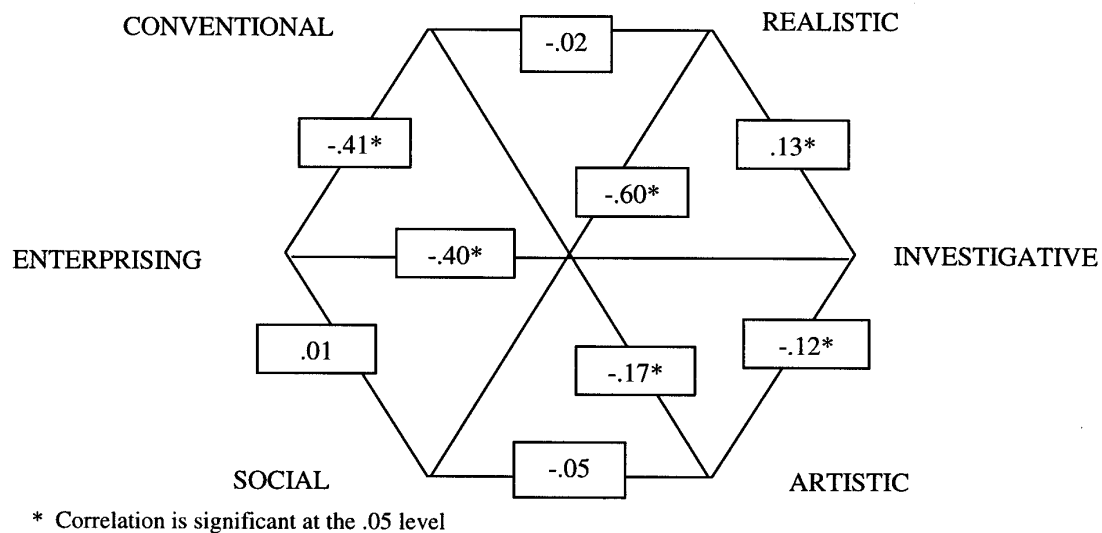


Figure 7 Hexagonal Representation of the Correlations Between the Six Personality Orientations for the Present Sample of Female Drivers

Figure 7 shows the Spearman correlation coefficients for the female drivers in the present study (between the six orientations) and shows a pattern of results that are less clear than those obtained for the male drivers. The pattern of results for the female drivers show some similarities with those predicted by Holland's model, however there are a number of deviations from the expected pattern, including significant negative correlations between the Enterprising and Conventional, and Investigative and Artistic orientations. This suggests that some caution needs to be exercised when applying structure (and perhaps the Holland model) to this sample of female drivers.

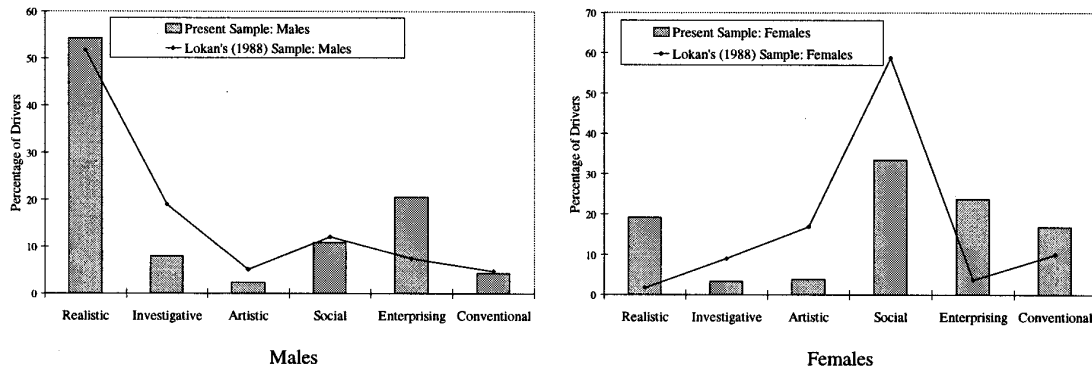
Comparison of Current Sample with Lokan's (1988) Norms

As discussed in the Introduction there were concerns regarding how appropriate Lokan's (1988) Australian norms were as a comparison group against which to measure Harrison's (1996, 1998c) drink-drive offenders. The aim of this section is to compare the distribution of the first-letter and two-letter Holland codes of male and female participants from Lokan's (1988) sample with the distributions of the present sample of Victorian adult drivers.

Figures 8a and 8b show the first-letter code distribution for male and female drivers (respectively) in the present sample compared to the Australian normative distribution reported by Lokan (1988). Significant differences were identified between the two data sets for both male ($X^2_{(5)} = 415.5, p < .05$) and female ($X^2_{(5)} = 3535.4, p < .05$) participants.

Males in the present sample were more likely to be assigned Enterprising and (less so) Realistic first-letter codes (for their reported occupations) than were the adolescents in Lokan's (1988) normative sample (who completed the SDS) and were less likely to be

assigned first-letter codes of Investigative and (less so) Artistic orientations than those in Lokan's (1988) sample. The female participants in the present sample were more likely to be assigned Realistic, Enterprising and Conventional first-letter codes than the females from Lokan's (1988) sample (on the basis of completing SDS), and were less likely to be assigned Investigative, Artistic and Social first-letter codes than those female members of Lokan's (1988) sample.



Figures 8a and 8b First-Letter Code Distribution for Male (above left) and Female (above right) Drivers in the Present Sample Compared to those from Lokan's (1988) Australian Population Norms

The large number of two-letter Holland codes made it impractical to conduct any test of statistical significance, but it is clear that there are some substantial differences between the present sample and Lokan's (1988) normative sample. In particular, males in the present sample were more likely to be assigned two-letter Holland codes of RI, RC, SE and ES than were those in Lokan's (1988) sample and were less likely to be assigned two-letter codes of SR and RS and in most Investigative occupational areas than those from the adolescent sample (Figure 9).

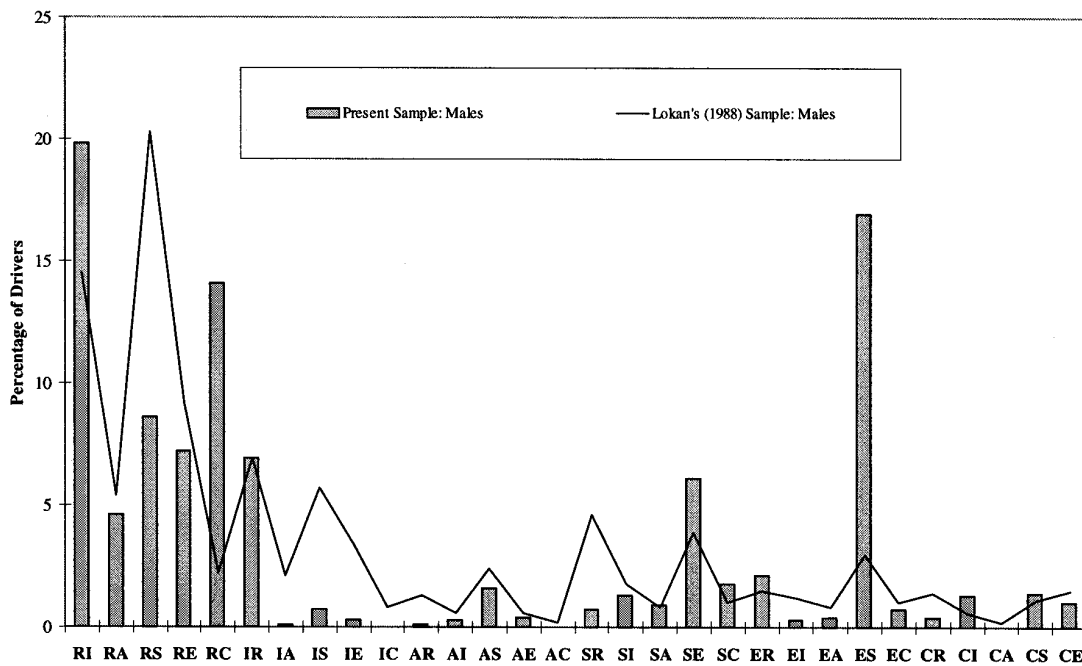


Figure 9 Two-Letter Holland Code Distributions for Male Drivers in the Present Sample Compared to those from Lokan's (1988) Australian Population Norms

The distribution of two-letter Holland codes for female participants is illustrated in Figure 10. The females in the present sample were more likely than the female participants in Lokan's (1988) sample to be assigned two-letter Holland codes of RI, RS, RC, ES and CS, and were less likely to be assigned IS, AS and SA than the participants from Lokan's (1988) sample.

These results indicate clear differences in Holland code distributions (first-letter and two-letter codes) between the present sample and Lokan's (1988) adolescent sample. Hence the personality orientations of the drivers from the present sample using the surrogate measure of their reported occupation differ from those of Lokan's (1988) adolescent sample obtained by completion of the SDS (a different surrogate measure). In light of the issues raised in the Introduction regarding the selection of an appropriate comparison (or normative) group, the present findings illustrate the differences that can (and do) exist between two different samples. This adds support to the concerns raised by Harrison (1996), questioning how appropriate the comparison group was that he utilised in his study.

Therefore, given the above differences in Holland code distributions and the use of different methods for developing a surrogate measure of personality distribution (by Lokan and Harrison, as discussed in the Introduction) it is suggested that the present sample of adult drivers may be a more appropriate comparison group against which to compare the Holland code distributions identified by Harrison (1996) in a sample of drink-drive offenders.

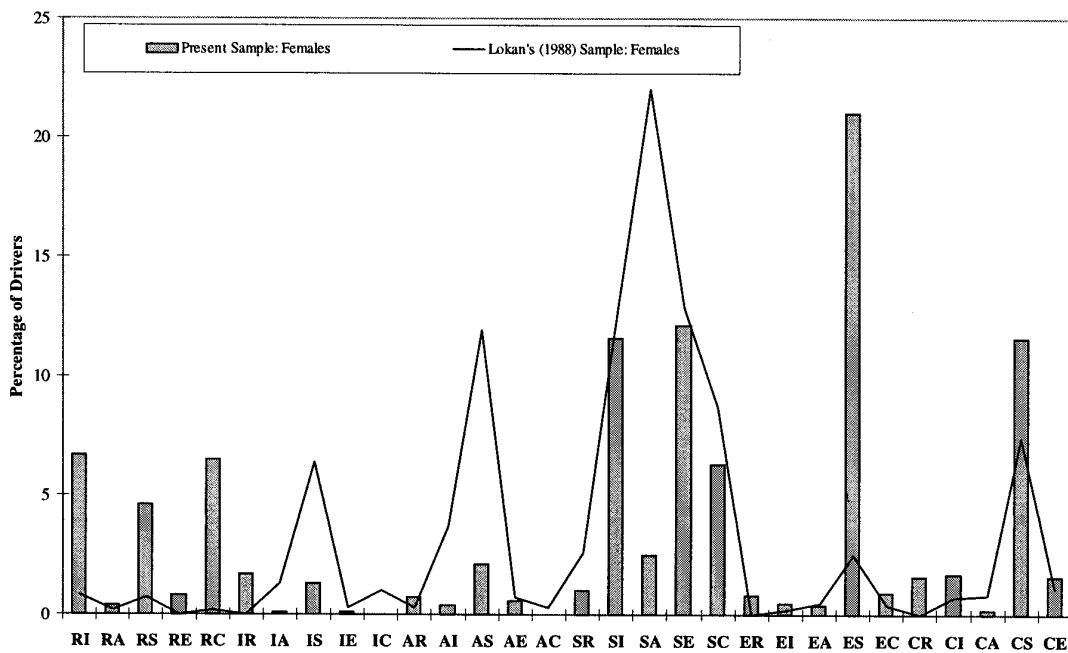


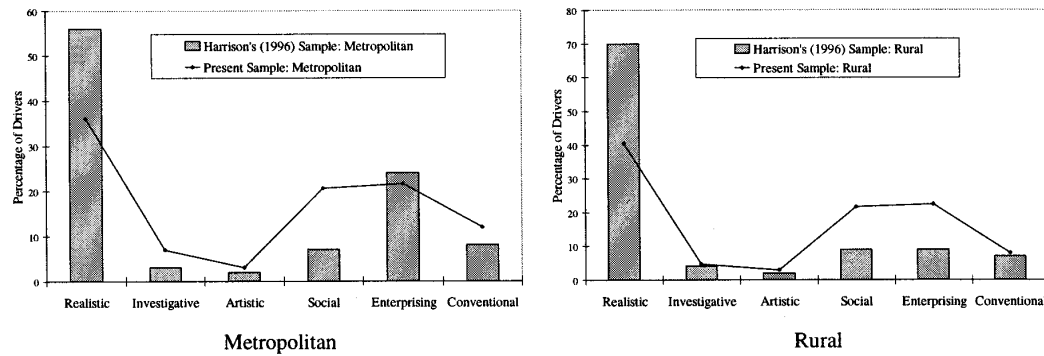
Figure 10 Two-Letter Holland Code Distributions for Female Drivers in the Present Sample Compared to Those From Lokan's (1988) Australian Population Norms

Comparisons Between This Study and Harrison (1996, 1998c)

Harrison's (1996, 1998c) application of Holland's theory of personality and occupation to a road safety problem was innovative, and he emphasised the exploratory nature of his work and called for further research to validate his results. An aim of the present study was to compare the Holland code distribution obtained by Harrison (1996, 1998c) using a sample of drink-drive offenders with that of a normative sample of Victorian drivers. In light of the results of the previous section of the report it was considered that a comparison using the present sample as a normative sample was appropriate.

The analyses conducted by Harrison (1996, 1998c) are repeated in this section, substituting the present sample as a normative group in place of Lokan's norms.

The distributions of metropolitan and rural drink-drive offenders from Harrison's (1996, 1998c) sample and those from the current sample of drivers are shown in Figures 11a and 11b respectively. A significant difference was identified between the distribution of Harrison's (1996, 1998c) metropolitan drink-drive sample and that of the metropolitan drivers from the present sample ($X^2_{(5)} = 224.9, p < .05$) and between the rural drink-drive offenders and the current sample of rural drivers ($X^2_{(5)} = 158.2, p < .05$).

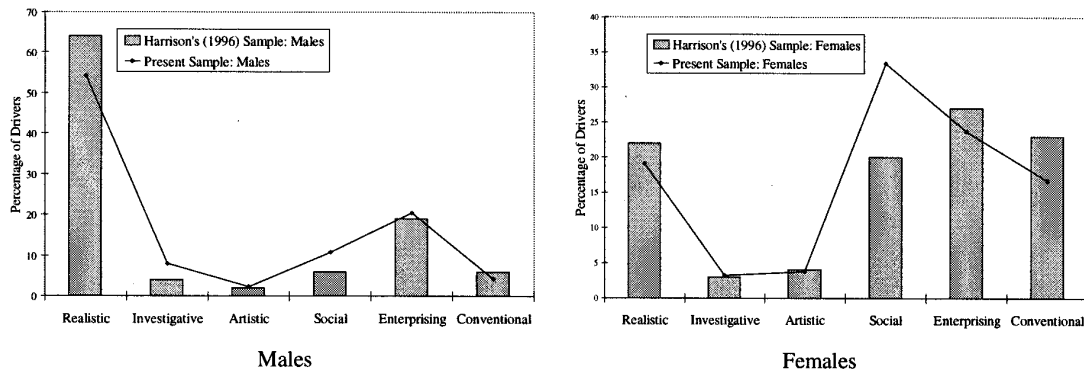


Figures 11a and 11b First-Letter Holland Codes of Metropolitan (above left) and Rural (above right) Drink-Drivers (Harrison, 1996) Compared to the Present Sample of Metropolitan and Rural Drivers

As shown in Figure 11a, Harrison's (1996, 1998c) drink-drive offenders from metropolitan areas were more likely than the metropolitan drivers from the present sample to report occupations assigned a Realistic first-letter Holland code and less likely to report occupations assigned an Investigative, Social or Conventional first-letter Holland code. The rural drink-drive offenders from Harrison's (1996) sample were more likely to report occupations assigned a Realistic first-letter Holland code and were less likely (than those from the present sample) to report occupations assigned Social or Enterprising first-letter Holland codes (Figure 11b). These results suggest an over-representation of the Realistic personality orientation in both metropolitan and rural drink-drivers compared to more appropriate normative data drawn from the wider driving community.

Figures 12a and 12b illustrate the distribution of Holland codes for Harrison's (1996, 1998c) sample of male and female drink-drivers (respectively) and the distribution of the present normative sample of male and female drivers. A significant difference was identified between the distributions of Harrison's (1996, 1998c) male drink-drive offenders and the male drivers of the present study ($X^2_{(5)} = 94.4, p < .05$).

Harrison's (1996, 1998c) drink-drive offending males were more likely than the male drivers of the present sample to be assigned a Realistic first-letter Holland code for their reported occupation and were less likely to be assigned a first-letter Holland code of Investigative or Social for their reported occupation (Figure 12a). The distribution of first-letter codes did not differ significantly for female participants from the two samples ($X^2_{(5)} = 11.3, p > .05$) (Figure 12b).



Figures 12a and 12b First-Letter Holland Codes for Male (above left) and Female (above right) Drink-Drivers (Harrison, 1996) Compared to the Present Sample of Australian Male and Female Drivers

These results suggest that there may be an over-representation of Realistic orientations amongst male drink-drivers, but not amongst female drink-drivers.

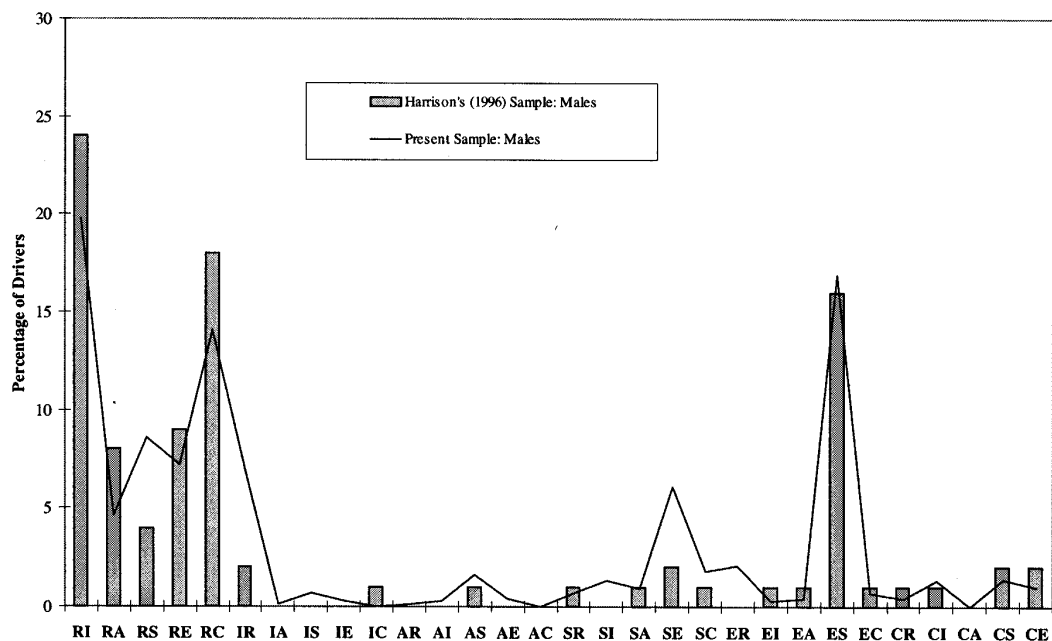


Figure 13 Two-Letter Holland Codes of Male Drink-Drivers (Harrison, 1996) Compared to those of the Present Sample of Male Drivers

The comparison between the two-letter Holland codes for the male drink-drivers and the present sample of male drivers is shown in Figure 13. The RI and RC two-letter Holland codes were found to be over-represented amongst the male drink-drive offenders compared to the present normative sample of male drivers. This finding is consistent with that of Harrison (1996, 1998c), although the differences between the drink-drive sample and the present sample aren't as large as those found in the earlier study using the adolescent sample norms. Further, the present comparison did not identify the over-representation of male drink-drivers assigned an ES Holland code reported by Harrison (1996,1998c).

The comparison between the two-letter Holland codes for the female drink-drivers from Harrison's (1996, 1998c) sample and the present sample of female drivers is shown in Figure 14. The pattern of results for male participants differed from that for female participants. The RC/CR, ES and CS two-letter Holland codes were found to be over-represented amongst the female drink-drive offenders compared to the present sample of female drivers. Once again this finding is consistent with that of Harrison (1996, 1998c), offering further support for his preliminary findings.

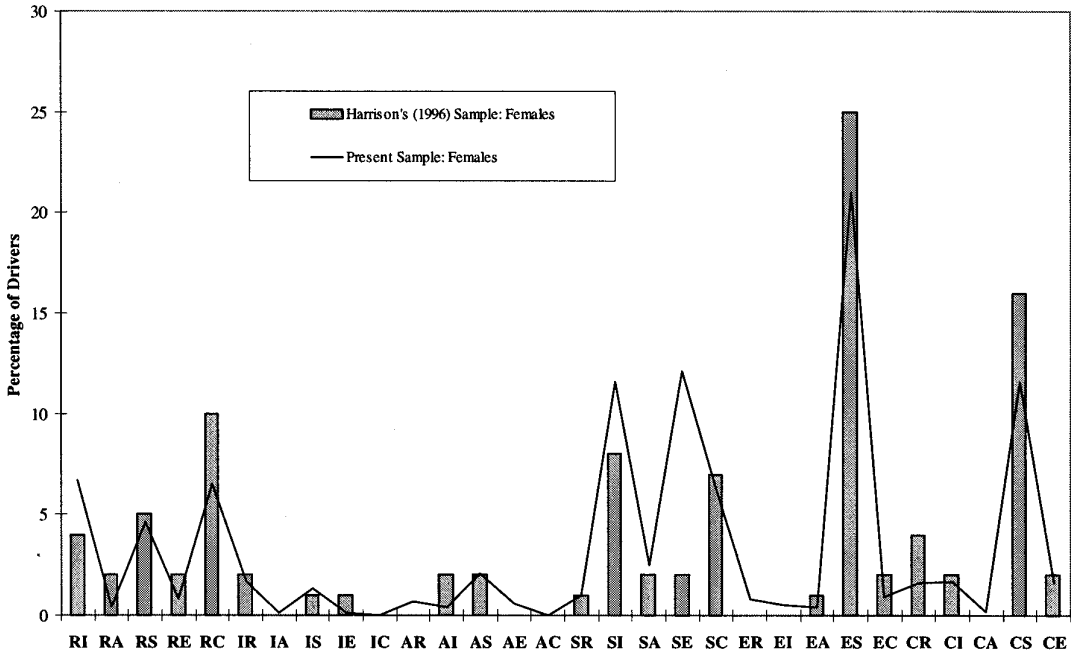


Figure 14 Two-Letter Holland Codes of Female Drink-Drivers (Harrison, 1996) Compared to those of the Present Sample of Female Drivers

The above comparisons between the distributions from Harrison's (1996, 1998c) sample and the present sample indicate a similar pattern of results to those obtained by Harrison in his earlier study using Lokan's (1988) adolescent sample, however some differences in the results were noted.

For the male drivers it was only those with a Realistic personality orientation (as reflected by occupational choice) that were found to be over-represented in the drink-drive offending sample compared to the current sample, while Harrison (1996, 1998c) also found those with an Enterprising personality orientation to be over-represented (when using single-letter Holland codes and Lokan's (1988) adolescent sample). Further, the present study identified that the male drivers with an RI or RC two-letter Holland code were over-represented in the drink-drive offending sample (consistent with Harrison's (1996, 1998c) findings), but Harrison also identified the ES group as being over-represented.

Harrison (1996, 1998c) found that the female drink-drivers with Realistic, Enterprising and Conventional personality orientations were over-represented compared to Lokan's (1988) norms using an adolescent sample and single-letter Holland codes, a finding that wasn't confirmed using the present sample of drivers. The drink-drive offending females with ES, CS, CR and RC two-letter Holland codes were identified by Harrison (1996, 1998c) to be over-represented compared to Lokan's (1988) norms and this was confirmed here.

These findings support Harrison's suggestion (1996, 1998c) that particular groups of drivers (based on personality orientation as reflected in occupational choice) may be over-represented in the drink-drive sample. Not all of Harrison's (1996, 1998c) significant results were confirmed in the present study, but the majority were. The greatest difference between the findings of the present study and those of Harrison (1996, 1998c) were for the female group. As suggested earlier, the validity of applying Holland's theory to females has been questioned by previous research (Tuck & Keeling, 1986). This suggests that the results for the female participants should be interpreted with great caution and this comparison could reflect the poorer validity of this theory when applied to female participants.

The present study aimed to confirm the comparisons made by Harrison (1996, 1998c) and readers are referred to this paper for a full explanation of the identified "problem" sub-groups of drink-drive offenders, based on personality.

The Prediction of Speeding and Drink-Driving

The data used in the present project were collected in a study conducted by MUARC that examined drivers' attitudes towards Police traffic enforcement. The project collected a range of data relating to drivers' attitudes towards traffic enforcement and their road use behaviour.

In light of the consistent association that has been identified between personality and driver behaviour (as discussed in the Introduction), an analysis of the relationship between drivers' personality orientation (as reflected by their occupational choice) and a variety of road safety attitudes and behaviours was considered important. Potentially, data from this type of analysis could be used to assist the strategic targeting of enforcement and educational/publicity countermeasures.

In particular, the relationships between having been detected by the Police for speeding or drink-driving and personality (and some driving-related attitudes and behaviours) were considered important. One aim of this study was to investigate such relationships.

Past research has indicated relatively poor validity of Holland's theory and model when applied to females (Tuck & Keeling, 1986). The results obtained in earlier sections of this report for female participants indicate,

- A bias in the assignment of Holland codes for female participants, believed to be driven largely by the number reporting "homemaker" as their occupation and the reluctance of the authors to assign a code to this occupation.
- The correlations between the six personality orientations (for females) were not clearly consistent with those predicted by Holland's (198:5a) theory and model.
- While the results obtained by Harrison (1996) relating to problem male drivers were confirmed by this study, the results were less clear for female participants.

For these reasons, further analyses were conducted using only male participants in this study (see the Discussion for further recommendations relating to this issue).

Discriminant function analyses (stepwise) were performed (for males only) in SPSS for Windows (Norusis, 1994), using 17 variables as predictors of membership in two groups

(have been/haven't been caught) for both speeding and drink-driving. The variables included in these analyses are shown in Table 7.

Table 7 Independent and Dependent Variables Included in the Discriminant Function Analysis

Variables Employed in Discriminant Function Analysis		Type of Variable
Independent Variables		
	Realistic Personality Orientation	Rating (0, 1, or 2)
	Investigative Personality Orientation	Rating (0, 1, or 2)
	Artistic Personality Orientation	Rating (0, 1, or 2)
	Social Personality Orientation	Rating (0, 1, or 2)
	Enterprising Personality Orientation	Rating (0, 1, or 2)
	Conventional Personality Orientation	Rating (0, 1, or 2)
	Percentage Driving in Daylight	Percentage
	Percentage Driving in Built Up Areas	Percentage
	Seen Road Safety Publicity/Advertising	Yes/No (1 or 0)
	Risk of Detection for Speeding (Day)	Rating (0 – 10)
	Risk of Detection for Speeding (Night)	Rating (0 – 10)
	Chance of Breath Test (Day)	Rating (0 – 10)
	Chance of Breath Test (Night)	Rating (0 – 10)
	Risk of Detection for Drink-Driving (Day)	Rating (0 – 10)
	Risk of Detection for Drink-Driving (Night)	Rating (0 – 10)
	No. Times Sighted Speed Enforcement	Number (≥ 0)
	No. Times Sighted Drink-Drive Enforcement	Number (≥ 0)
Dependent Variables		
(Separate analyses for each)	Have Been Caught Speeding	Yes/No (1 or 0)
	Have Been Caught Drink-Driving	Yes/No (1 or 0)

A summary of the results obtained for the male drivers is shown in Table 8. The discriminant function predicting whether or not drivers had been caught speeding was statistically significant ($X^2_{(4)} = 54.2$ $p < .01$). The correlations in Table 9 suggest that the males who had been caught speeding were more likely to have an Enterprising personality orientation, to have spent more time driving (over the previous week), to perceive a fairly low risk of detection for drink-driving during the daytime and to have seen relatively more speed enforcement (over the past month). This discriminant function was found to have 56.2% accuracy in the prediction of male drivers who have been caught speeding by the Police.

This result suggests that for male drivers, it is a combination of their personality orientation (Enterprising), their driving behaviours (have spent more time driving, have seen more speed enforcement) and road safety attitudes (low perceived risk of detection for drink-driving during the daytime) rather than a single factor that best predicts whether they have been caught speeding by the Police. People with an Enterprising personality orientation tend to be acquisitive, ambitious and excitement seeking and tend to work in occupations such as sales, marketing and promotions. They tend to have good leadership and speaking abilities and lack scientific abilities.

The discriminant function predicting whether or not drivers had been caught drink-driving was also statistically significant ($X^2_{(2)} = 12.5$, $p < .01$). The correlations in Table 8 suggest that males who had been caught drink-driving were more likely to have Realistic personality orientations and less likely to have Investigative personality orientations. This function was found to have 62.7% accuracy in the prediction of male drivers who have been caught for drink-driving by the Police.

Table 8 Summary of Discriminant Function Analysis for the Prediction of Males Having Been Caught Speeding or Drink-Driving

Variables	Correlation of variables with discriminant functions	F (Significance)
Prediction of Speeding Detection		
Enterprising Personality Orientation	.61	23.17 (p<.01)
Risk Alcohol Detection (Day)	-.55	18.37 (p<.01)
No. of Hours Driving (Past Week)	.40	17.11 (p<.01)
Sighting of Speed Enforcement (Past Month)	.30	13.83 (p<.01)
Prediction of Drink-Driving Detection		
Realistic Personality Orientation	.83	6.85 (p<.01)
Investigative Personality orientation	-.68	6.26 (p<.01)

This result suggests that male drink-drivers tend to have a Realistic personality orientation and tend not to have an Investigative personality orientation. People with a Realistic personality orientation tend to be asocial, materialistic and un insightful and to work in occupations such as the trades, as mechanics or as farmers; they possess mechanical abilities but tend to lack social skills (Holland, 1985b). People possessing Investigative personality orientations tend to be analytical, cautious, intellectual and rational and to work in occupations in the sciences; they tend to have mathematical or scientific abilities and tend to lack leadership ability (Holland, 1985b). It is interesting to note that the Realistic and Investigative personality orientations are situated beside one another on the hexagonal model (see Figure 1 in Introduction) and the correlations between these two orientations using the current sample of males further support this (see Figure 6). This indicates that these two groups share a number of similar characteristics. However it also suggests that examination of the differences between these groups may help identify some of the critical characteristics associated with drink-driving behaviour. Individuals with a Realistic personality orientation tend to be inflexible and aren't receptive to education while individuals with an Investigative personality orientation tend to be rational, intellectual and value education. These differences may at least partially explain the driving behaviour differences between these two groups. Perhaps the characteristic tendencies of the drivers with a Realistic personality orientation render them impervious to the current education-based and punishment-based road safety initiatives (see the general discussion for a further exploration of this issue).

GENERAL DISCUSSION

SPECIFIC AIMS

This study had four main aims. The first of these was to describe the distribution of Holland occupational codes in a general sample of drivers who took part in telephone surveys for another project. Comparison of the sample with population statistics derived from the ABS census data suggested that the driver sample was generally representative of the wider population with the exception that the quota sampling used in the original project resulted in a larger number of rural participants than expected in the population. The high level of licensing in the wider community further suggests that the sample used here was generally representative within the usual constraints imposed by a telephone-survey methodology. The analysis of the distribution data suggested that there were some age and location differences in the distributions of Holland codes which were consistent with other research in this area.

The Holland code data presented in this study may be useful beyond the immediate needs of road safety research as they provide estimates of the prevalence of different occupational types across the wider community. The potential use of these data as normative data in other contexts should be investigated.

The proposed hexagonal structure of Holland's model was also investigated, with the correlations between the six orientations being largely consistent with the structure for males but less so for females.

The second aim was to use the present data set to investigate the concerns raised about Harrison's (1996, 1998c) use of adolescent normative data. It will be recalled that Harrison used Lokan's (1988) normative data for the Self Directed Search as comparison data for his adult sample of drink drivers.

There were two concerns here. The possibility that occupational and personality changes might occur between adolescence and adulthood was not accounted for, and the normative data from Lokan used the SDS as a measure of personality under the Holland model while Harrison's approach used occupation as a surrogate measure. The use of two different approaches to assessing personality in the drink-drive and normative samples was of some concern.

The comparison between the Holland code distributions of Lokan's sample and the present sample suggested that the concerns raised by Harrison (1996, 1998c) were well founded. There were a number of differences between Lokan's adolescent normative data and the present sample for both first-letter and two-letter Holland codes. The extent to which these differences reflect maturational changes in occupation-related personality or differences resulting from the use of two approaches to assessing Holland personality orientations is uncertain, however, and may profitably be an area of further research.

The third aim of the present study was to compare the personality orientations of Harrison's (1996, 1998c) sample of drink drivers with the present sample used as a normative sample. The results largely confirmed Harrison's original findings, suggesting that the recommendations for development and targeting of countermeasures for drink-driving made by Harrison may be appropriate in spite of the methodological issues raised by him and confirmed here. The results reported by Harrison and confirmed here are largely consistent with the literature concerning drink-driving and personality.

The final aim was to investigate the possibility that self-reported drink-driving and speeding in the present sample was related to other information collected from each respondent at the time of the survey. This analysis suggested that speeding and drink-driving were both related to personality characteristics identified from the Holland codes, and that in the case of speeding there were a number of additional characteristics associated with the behaviour.

The results of this analysis underscored the difference between speeding and drink-driving, where drink-driving was closely related only to the presence or absence of two personality orientations while speeding was related to one personality orientation and a number of additional factors. The interplay between attitudinal, motivational, social, and personality factors in behaviour is complex, but it may be the case that there is a need to understand the relationships between these factors and road use behaviour in order to develop and target new countermeasures. The difference between the two discriminant analyses serves to remind researchers in this area that these relationships are complex and, more importantly, potentially different for different behaviours. It may be the case, for example, that countermeasures to target drink-driving more effectively will have different characteristics to those that target speeding. The current reliance on general enforcement programs (under the Deterrence Model approach) and on general public education campaigns largely ignores the additional complexity suggested by the results reported here.

GENERAL ISSUES

The approach used here and by Harrison (1996, 1998c) assumes that the surrogate measure of personality based on occupational choice is reliable and general enough to ensure meaningful results. The confirmation of earlier results in the present study argues at least in part for the reliability of the method, but the issue of the generality of the personality measure is of some concern. It is strongly recommended that there is a need to investigate the issues raised here in the context of high levels of enforcement and publicity with standardised personality instruments.

The failure to include two substantial groups of drivers in the present analysis is also of some concern. The use of occupational choice as the basis of the surrogate measure of personality resulted in the exclusion of unemployed people and homemakers. It is not unreasonable to assume that there may be an association between employment status and alcohol use resulting from the psychological consequences of unemployment, so the exclusion of unemployed people from the present investigation is a problem. The concerns relating to the exclusion of both unemployed people and homemakers (and other excluded groups) would be met in a study using standardised personality assessment instruments as the basis for the personality measure.

The confirmation of Harrison's earlier results provide additional support for ongoing research efforts in this area, suggesting that there is some stability in the relationship between unsafe road use behaviour and personality. The confirmation of the earlier results also underscores the potential for this area of research in the development and targeting of drink-driving and speeding countermeasures. The identification of stable personality characteristics that underlie unsafe road use behaviour leads to suggestions about how best to target those who continue to offend in spite of the current road safety program. The reader is referred to Harrison (1996) for an example of how this might occur.

THE BROADER CONTEXT

This study and the work reported by Harrison (1996, 1998c) were conducted in the context of highly intense enforcement and public education programs that have been in place for over a decade. The enforcement and publicity programs have been shown to be effective in reducing the crash rate amongst Victorian road users, and logically must be assumed to have had an impact on the psychological processes underlying driving and other road use behaviours.

REFERENCES

- Adebayo, A. (1992). Factors antecedent to impaired driving in a Canadian urban sample. *International Journal of the Addictions*, 26, 8, 897-909.
- Beirness, D. (1994). Do we really drive as we live? The role of personality factors in road crashes. *Alcohol, Drugs & Driving*, 9, 3-4, 129-143.
- Biecheler-Fretel, M., & Danech-Pajouh, M. (1988). Alcohol, mobility and basic driving behaviour in T. Rothengatter, & R. de Bfilin (Eds), *Road User Behaviour: Theory and Research*. Assen, Netherlands: Van Gorcum & Co.
- Cameron, M., Cavallo, A. & Gilbert, A. (1992). *Crash-Based Evaluation of the Speed Camera Program In Victoria 1990-1991. Phase 1: General Effects. Phase 2: Effects of Program Mechanisms*. Report No.42, Clayton, Vic., Australia: Monash University Accident Research Centre.
- Cameron, M., Cavallo, A., & Sullivan, G. (1992). Evaluation of the random breath testing initiative in Victoria 1989-1991: *Multivariate time series approach*. Report No: 38, Clayton, Vic., Australia: Monash University Accident Research Centre.
- Cameron, M., Haworth, N., Oxley, J., Newstead, S., & Le, T. (1993). *Evaluation of the Transport Accident Commission Road safety Television Advertising*. Report No.52, Clayton, Vic., Australia: Monash University Accident Research Centre.
- Campbell, D. (1966). The stability of vocational interests within occupations over long time spans. *Personnel and Guidance Journal*, 44 1012-1019.
- Campbell, D. (1971). *Handbook for the Strong Vocational Interest Blank*. Stanford, California. Stanford University Press.
- Caspi, A., Begg, D., Dickson, N., Langley, J. (1996). Identification of personality types at risk for poor health and injury in late adolescence. *Criminal Behaviour & Mental Health*, 5, 4, 330-350.
- Elander, J., West, R., & French, D. (1993). Behavioural correlates of individual differences in road-traffic crash risk: An examination of methods and findings. *Psychological Bulletin*, 113, 2, 279-294.
- Federal Office of Road Safety. (1998). Road fatalities - Time series statistics. <http://www.dot.gov.au/programs/fors/stats/timeser0.htm>
- Fildes, B., & Lee, S. (1993). *The Speed Review: Road Environment, Behaviour, Speed Limits, Enforcement and Crashes*. CR 127. Canberra, ACT., Australia: Federal Office of Road Safety.
- Furnham, A., & Saipe, J. (1993). Personality correlates of convicted drivers. *Personality and Individual Differences*, 14, 2, 329-336.
- Gabany, S., Plummer, P., & Grigg, P. (1997). Why drivers speed: The Speeding Perception Inventory. *Journal of Safety Research*, 28, 1, 29-36.

- Harrison, W. (1996). *The Potential for the Use of Psychological and Situational Factors in the Targeting of Drink-Drive Countermeasures* Report No.108, Clayton, Vic., Australia: Monash University Accident Research Centre.
- Harrison, W.A. (1998a). Applying psychology to a reluctant road safety: A comment on South (1998). *Australian Psychologist*, 33,
- Harrison, W .A. (1998b). Deterrence may not result from deterrence: Challenges to a deterrence account of the effects of enforcement on behaviour. Paper presented to the Road Safety Research and Enforcement Conference, Wellington, New Zealand. November 1998.
- Harrison, W.A. (1998c). The occupations of drink-drivers: Using occupational information to identify targetable characteristics of offenders. *Accident Analysis and Prevention*, 30, 119-132.
- Harrison, W.A., & Pronk, N. (1998). *An Investigation of the Relationship Between Traffic Enforcement and the Perceived Risk of Detection for Driving Offences*. Report No.134, Clayton, Vic., Australia: Monash University Accident Research Centre.
- Holland, J. (1958). A personality inventory employing occupational titles. *Journal of Applied Psychology*, 42, 336-342.
- Holland, J. (1973). *Making Vocational Choices*. Englewood Cliffs, N.J.: Prentice Hall.
- Holland, J. (1985a). *The Self-Directed Search: Professional Manual* - 1985 Edition. Odessa, Florida: Psychological Assessment Resources.
- Holland, J. (1985b). *Making Vocational Choices. A Theory of Vocational Personalities and Work Environments*. Englewood Cliffs, NJ. Prentice-Hall.
- Homel, R. (1988). *Policing and Punishing the Drinking Driver: A Study of General and Specific Deterrence*. New York, Springer- Verlag.
- Ke1so, G. (1986). An orientation to Holland's Theory. in J.J. Lokan & K.F. Taylor (Eds) *Holland in Australia: A Vocational Choice Theory in Research and Practice*. Melbourne, Vic., Australia: Australian Council for Educational Research.
- Labiale, G. (1988). Survey on driver behaviour, in T. Rothgatter, & R. de Bruin (Eds), *Road User Behaviour: Theory and Research*. Assen, Netherlands: Van Gorcum & Co.
- Lokan, J. (1988). *The Self-Directed Search: Professional Manual Australian Supplement*. Melbourne, Vic., Australian Council for Educational Research.
- Lunneborg, C., & Lunneborg, P. (1975). Factor structure of the vocational interest models of Roe and Holland. *Journal of Vocational Behaviour*, 7,313-316.
- Makeham, P. (1997). How many deaths and injuries will we choose to accept? *Proceedings from the 1997 Road Safety Research and Enforcement Conference*, Hobart, Australia: Tasmanian Department of Transport.
- Martin, C. (1978). Sex differences in the patterning of occupational interests, in J. Lokan & K. Taylor (eds) *Holland in Australia: A Vocational Choice Theory in Research and Practice*. Melbourne, Vic.: Australian Council for Educational Research.

McMillen, D., Pang, M., Wells-Parker, E., & Anderson, B. (1992). Behaviour and personality traits among DUI arrestees, non-arrested impaired drivers, and non-impaired drivers. *International Journal of the Addictions*, 26, 2, 227-235.

Murphy, K., & Davidshofer, C. (1988). *Psychological Testing. Principles and Applications*. Englewood, New Jersey. Prentice-Hall.

Naylor, F. & Mount, T. (1986). Issues in the generality of Holland's hexagonal model. in J. Lokan & K. Taylor (eds) *Holland in Australia: A Vocational Choice Theory in Research and Practice*. Melbourne, Vic.: Australian Council for Educational Research.

Newstead, S., Cameron, M., Gantzer, S., & Vulcan, P. (1995). *Modelling of Some Major Factors Influencing Road Trauma Trends In Victoria 1989-1993*. Report No.74, Clayton, Vic., Australia: Monash University Accident Research Centre.

Nolan, Y., Johnson, J., & Pincus, A. (1994). Personality and drunk driving: Identification of DUI types using the Hogan Personality Inventory. *Psychological Assessment*, 6, 1, 33-40.

Norusis, M. (1994). *SPSS Advanced Statistics 6.1* Chicago, I11: SPSS Inc.

Tracey, T. & Rounds, J. (1992). Evaluating the RIASEC circumplex using high-point codes. *Journal of Vocational Behaviour*, 41,295-311.

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

Reynolds, J., Kunce, J., & Cope, S. (1991). Personality differences of first-time and repeat offenders arrested for driving while intoxicated. *Journal of Counselling Psychology*, 38, 3, 289-295.

Roper Organisation. (1991). Roper Survey: Drunk driving intolerable, speeding acceptable. *Highway and Vehicle Safety Report*, 18, 6, 4-5.

Stacy, A., Newcomb, M., & Bentler, P. (1991). Personality, problem drinking and drunk driving: Mediating, moderating, and direct-effect models. *Journal of Personality & Social Psychology*, 60, 5, 795-811.

Tracey, T., & Rounds, J. (1992). Evaluating the RIASEC circumplex using high-point codes. *Journal of Vocational Behaviour*, 41,295-311.

Trimpop, R., & Kirkcaldy, B. (1997). *Personality predictors of driving accidents*. *Personality and Individual Differences*, 23, 1, 147-152.

Tuck, B., & Keeling, B. (1986). Sex and cultural differences in the factorial structure of the Self-Directed Search. in J. Lokan & K. Taylor (eds) *Holland in Australia: A Vocational Choice Theory in Research and Practice*. Melbourne, Vic.: Australian Council for Educational Research.

Turrisi, R., Jaccard, J., & McDonnell, D. (1997). An examination of the relationships between personality, attitudes, and cognitions relevant to alcohol-impaired driving tendencies. *Journal of Applied Social Psychology*, 27, 15, 1367-1394.

West, R., & Hall, J. (1997). The role personality and attitudes in traffic accident risk. *Applied Psychology: An International Review*, 46, 3, 253-264.

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

Wilson, J. (1992). Convicted impaired drivers and high-risk drivers: How similar are they? *Journal of Studies on Alcohol*, 53, 4, 335-344.

Zaal, D. (1994). *Traffic Law Enforcement: A Review of the Literature*. Report 53, Clayton, Vic., Australia: Monash University Accident Research Centre