In The Applied Psychologist (2nd edition). J. Hartley, A. Branthwaite (Eds) Buckingham: Open University Press, 2000.

Chapter 8 Are women better drivers than men?

Michelle Meadows and Stephen Stradling

Introduction

Are women better drivers than men? As applied social psychologists working in the area of driver behaviour this is a question we often get asked. How should we go about answering it? What - at first sight - appears a straightforward question turns out to require a range of different research tools (Meadows & Stradling, 1995). These include:

- analyses of accident statistics
- questionnaire/survey studies of drivers
- performance studies using driving simulators, instrumented vehicles, videotaped driving behaviour or on-road observation
- statistical procedures for summarising data, and exploring interactions between different variables
- deriving models for organising concepts and findings and subsequently suggesting directions for future research.

In this chapter we shall present information derived from using a number of these tools, mostly analyses of data from accident statistics, surveys and questionnaires, and conclude with a summary model of factors influencing the behaviour of drivers.

So - are women better drivers than men? Well, that depends what you mean by 'better'. The first thing is to decide what counts as being a 'good' driver? Should it be:

- Passing the driving test first time?
- Setting a lap record in a Formula 1 racing car?
- Least penalty points over forest tracks in a prepared rally car?
- Passing, with distinction, a police Class 1 driving course?
- Achieving the maximum 'no claims bonus' on your insurance premium?
- 60 years on the road and never had an accident?
- Getting to the airport through rush hour traffic without losing your temper or missing your flight?
- Ferrying the children safely to and from school, yourself safely to and from work, and the shopping safely home without unduly inconveniencing any other road user?
- Being able to drive home drunk without attracting the attention of the police?

As bases for comparison each of these has advantages and disadvantages, so let's look at just the first.

Since a practical driving test was introduced in the UK in 1935, the overall first-time pass rate has varied between 45% and 55% with that for women some 10% below that for men throughout this period (Cameron, 1998). But does this tell of permanent and pervasive differences in driving competence between males and females, differences in the proportions of males and females properly prepared and ready for the test, or even bias on the part of the (largely male) examiners? And, as the test involves a brief, daytime drive on urban roads, is it an ecologically valid assessment of the competence currently needed, given the amount of motorway, night-time and long distance driving the modern motorist undertakes (though female drivers tend to do less of each of these)? Answering our question, as we shall see, is one of attempting to tease apart a host of interacting or what we technically called 'confounded' variables.

What do accident statistics tell us, and how should we interpret them?

Driving is a skill-based, rule-governed, expressive activity. Becoming a driver involves:

- mastering the technical skills of vehicle handling and positioning;
- learning the rules (both formal and informal) in order to 'read the road' and anticipate hazards; and
- resisting self-serving impulses that bring immediate gratification but might place others at risk.

Perhaps the most important single indicator of the extent to which drivers manage to master each of these skills is the extent to which they remain crash-free. Keeping clear of accidents benefits both the individual driver and the society which has to meet the costs of crashes (which in fiscal terms alone is currently estimated at around £1million per fatality in the UK).

The basic facts about accident frequency and accident severity seem, initially, fairly straightforward:

1. Overall there are more serious crashes involving male than female car drivers. The most recent figures are shown in Table 8.1. In 1996, more male car drivers were killed, seriously injured, or injured than female car drivers. Dividing the figures in column four of Table 8.1 by 365 gives the average number of female and male car drivers killed each day on the roads in Great Britain (column five).
2. Male drivers have a higher fatality rate. The fatality rate also varies substantially with driver age, but this sex difference remains relatively stable right across the age range (McKenna et al, 1998).
3. In identical impacts a female driver will likely be more severely injured than a male (though this difference in anatomical vulnerability is not as large as that between older and younger drivers).

Table 8.1

But if we refocus our question as ‘Who are the least dangerous drivers - men or women?’, this will require more than examining aggregate crash statistics. We must consider a number of other variables.

Proportions of men and women drivers in accidents
As noted above, there are more accidents involving men than women drivers on UK roads. But there are also a number of other documented differences between men and women drivers that may contribute to this, and these differences may act as ‘confounding variables’.

First, there are more male than female drivers on the roads and thus more males are exposed to the risk of being crash-involved. Table 8.2 gives the figures for the numbers and proportions of female and male full licence holders in Great Britain during 1993/95 and, in the final column, we have calculated for each age band the number of females as a percentage of the number of males.

Table 8.2

At present, around 80% of eligible males in the UK population are registered drivers, compared to around 55% of eligible females. The proportion for males now appears to have reached a peak and seems unlikely to get much higher, whereas that for females is continuing to rise. Of the 30 million registered drivers in the UK in 1993/95, 42% were female and 58% were male, but these overall figures mask large age-related differences as shown in Table 8.2. Amongst drivers aged 17-49 there were 5 males for every 4 females (or 1.25 males for every female). At the top of the age range, though, amongst the over 70s, there were 2 registered male drivers for every female driver.

The proportion of female to male drivers thus varies historically - the number and hence the proportion of female drivers on UK roads is inexorably increasing. It also varies geographically - for example, the proportions of female drivers are much higher in northern than in southern European countries.

Mileage differences
An important further part of the gender difference in crash involvement - and a further confounding variable - is that the average male driver drives a higher annual mileage than the average female driver. This increases the males’ level of exposure to crash risk. In the UK the average annual mileage is around 12000 miles per year (c19000 kilometres) for males and 8000 miles (c13000 kilometres) for females, although this difference is continually reducing. Furthermore, not only do male drivers have a higher annual mileage than female drivers, but the size of this ‘exposure differential’ increases with increasing age. The number and proportion of ‘dormant drivers’ - those who hold a full driving licence but rarely venture behind the wheel - is highest amongst elderly females.

Journey differences

There are further differences in the types - and hence times, places and purposes - of journeys made by male and female drivers. For example, more 'school runs' on urban roads in the latter part of the morning rush hour and in the mid-afternoon are made by female drivers; and more male drivers are sales representatives, service engineers and delivery drivers who hurry from call to call, on motorways or through city centres. Thus gender differences are confounded not only with the distance covered but also with the types of journeys made.

Road differences

Where you drive is important in accounting for the extent of crash involvement. As Maycock notes (1997, p.166)

> 'To take an extreme example, speeds are higher on motorways than on urban roads, but despite the higher speeds, accident rates [*accidents per mile*] are much lower on the former than on the latter. Unless the two road types are considered separately, therefore, an overall [*system wide*] speed-accident relation would show a strong negative relation - lower speeds, higher accident rates'.

And this would clearly mis-represent the well-documented finding (e.g., Horswill & McKenna, 1997; Maycock, 1997) that speed is positively related to crashes, both their frequency (by reducing safety margins) and their severity (at higher speeds the laws of physics dictate that there is greater energy to be absorbed at impact).

National differences

These patterns of social change outlined above have been reported for the US as well as for the UK:

> 'Over the last two decades, there have been major changes in life style for women, with corresponding changes in their driving behaviour. Women are increasing in both their rate of licensure and in the amount of driving that they do. They are also driving at times and places where they previously did not drive. In the US, women now account for about half of all new cars sold.' (Waller, 1997, p.207).

Age differences

So far we have noted that sex and exposure (amount and type) are related to crash-involvement. The age of the driver also makes a big difference. Young drivers are more crash-involved. In the UK, for example, drivers aged 17-21 comprise 10% of the driving population yet are involved in 20% of the road traffic accidents and make up 25% of the road deaths. But there are also confounds here: young drivers tend to drive older and smaller - and hence less crash resistant - vehicles, and to do more night driving. Males have a higher proportion of their crashes on bends, while overtaking, and during the hours of darkness than females - and these gender differences are largest amongst younger drivers (McKenna *et al*, 1998).

Table 8.3 gives figures from one of our studies at Manchester (Meadows, 1994) from which a complicated but comprehensive picture emerges. We asked a large, national sample of experienced drivers to tell us how many road traffic accidents of all kinds they had been involved in over the last three years. For the purposes of comparison we have divided age and annual mileage into three bands to create equivalent groups of female and male drivers and express the accident figures as annual probabilities. All three factors - sex, age and mileage - make a difference to the extent of crash involvement. Overall, male drivers reported more crashes and, for both females and males, younger drivers tended to report more and low mileage drivers tended to report fewer accidents.

Table 8.3

Waller notes similar findings from US studies. 'If you look at low-mileage women compared with low-mileage men or high-mileage women compared with high-mileage men, the women do at least as well as the men and possibly a little better.' (Waller, quoted in Faith, 1997, p.131)

Novice and expert drivers: survey data

We know that young drivers are particularly accident-prone during the early years of their driving careers. Do gender differences in crash rates also hold for these inexperienced, novice drivers? A large cohort of recently qualified drivers was extensively surveyed by the UK Department of Transport (Forsyth *et al*, 1995; Maycock, 1995). Drivers reported on the number of accidents that they had experienced in their first, second and third post-qualification years. Arranging the results by age at which they started driving, Maycock (1995) showed:

- that accident frequency was higher for the drivers who started when younger;
- for all age groups accident frequency decreased with added driving experience (i.e., from Year 1 to Year 3 post driving-test); and
- that women drivers were involved in fewer accidents per year than men drivers equivalent in age and experience - though 'their annual mileage is only 55-60% of that of the male drivers' (Maycock, 1995, p.1).

Table 8.4 shows mean number of accidents per driver per year for the two youngest age groups separately for female and male drivers. If annual mileage were the sole determinant of accident frequency, then we would expect the ratio of female to male accidents per driver per year to be around 55-60% - the same as their annual mileage ratio. In fact, when we calculate this ratio for all comparisons the ratio is greater than this and, for most comparisons, it is considerably so (see the final column of Table 8.4). Thus young, recently qualified female drivers report fewer accidents per year than males equivalent in age and experience, but more than would be expected on the basis of their reported lower mileage. Part of the reason for this is that accident rate (crashes per mile) is higher for all low mileage drivers - the

relationship between crash rate and exposure is not a simple linear one (Maycock, 1995). But part of it may also be that young females have particular difficulties in learning to drive.

Table 8.4

In an intriguing set of analyses conducted on data from the Department of Transport cohort of recently qualified drivers, driving examiners' scores relating to particular types of errors on test were used to estimate post-test crash-liability (Maycock, 1995). Of course, in so far as they had passed their driving tests, the type and severity of errors reported on the test were necessarily minor ones. 'A candidate fails the test if he or she commits one or more *[of the 46 different types of]* errors judged by the examiner to be either serious or dangerous. Any number of minor errors can be committed on test without the candidate failing.' (Maycock, 1995, p.5).

Maycock reported that, for both men and women, the more 'errors of awareness and anticipation' they committed on the driving test the more likely they were to be involved in an accident in the three years after passing their driving test. Falling under this heading were matters such as:

- Inadequate observation at junctions and while reversing and turning in the road;
- Not showing due regard for approaching traffic;
- Failing to take precautions of various kinds;
- Failure to act on the signals of other road users and to anticipate their actions.

These are all aspects of 'reading the road', and problems here seem to raise the accident liability of both male and female drivers. Comparing drivers who made four or more errors of this kind with those who made none showed an elevated accident liability of 24% for men and 19% for women.

Peculiar to female drivers, though, was an additional category of difficulties. Female novice drivers had problems - albeit minor - with what Maycock (1995) called 'manoeuvres'. These involved:

- Moving off;
- Reversing;
- Turning in the road;
- Stopping in an emergency

'Women drivers who committed three errors of this kind *[while on test]* had an accident liability which was 26% higher than those who did not make these errors' (Maycock, 1995, p.6).

Overall, from the 'cohort' study, Maycock (1995) concluded, inter alia:

- that there are some women learner drivers who take extensive tuition before finally passing;

- that for women learner drivers (minor) ‘manoeuvres’ errors made while passing the test are predictive of elevated accident involvement in the following three years;
- that women learner drivers tend to have more difficulty with vehicle control skills.

However we need to remember that ‘young male drivers still have considerably higher accident rates than young women drivers’ (Maycock, 1995, p.7). So we need to look beyond car control for the full picture.

Speeding

Vehicle speed has two consequences for crashes, increasing both crash frequency and crash severity. What differences are there between female and male drivers in their speeding behaviours and in their attitudes to speeding? Table 8.5 summarises some illustrative findings extracted from several of the survey studies of UK drivers that the Manchester Driver Behaviour Research Group have conducted in this area. All of the studies involved large numbers of experienced female and male drivers completing questionnaires concerning various aspects of their driving attitudes and driving behaviour.

Table 8.5

Greater proportions of male drivers are likely to have been stopped for speeding by the police, to report speeding behaviour, to nominate higher speed preferences, and to endorse pro-speeding attitudes. Consistent with this pattern of gender differences, greater proportions of female drivers deem adverse consequences of speeding as more likely.

Attitudes to driving - and their importance

It is important to address drivers’ attitudes and frames of mind; both those they hold while driving and those with which they approach the whole business of driving. Many of the attitudinal differences between males and females are in place even before reaching the road. Boys in a Manchester study of pre-drivers (Stradling, 1991) reported more interest in cars, anticipated more thrill-seeking when they came to drive, rated current speed limits as ‘too slow’, and anticipated that driving would give them ‘a way of expressing themselves’ more than did the girls. Girls rated a range of traffic offences as both more serious and more dangerous than did the boys. Most of these differences were present from age 11 (the youngest group questioned).

Almost all drivers - even female drivers - will, if asked to rate their abilities as drivers, indicate that they think of themselves as ‘average or above average’. In reality, this cannot be the case. Lajunen and Summala’s (1995) *Driver Skill Inventory* (the DSI) gives drivers the opportunity to rate themselves on a wide range of driving competencies and tendencies. These divide into two main dimensions, one concerned with perceptual and motor *driving skills*, the other

with *safety-mindedness* on the roads. Table 8.6 gives some examples of the scale items and the method by which they are measured (a 5-point Likert type scale).

Table 8.6

In one recent Manchester study almost 300 drivers completed the DSI. Figure 8.1 graphs the mean scores on the two scales - skill and safety - for female and male drivers. The mean safety-orientation scores for female and male drivers did not differ, but those for skill did, with the males rating themselves significantly more skilful than did the females. However, the graph shows an interaction effect which suggests a further difference between the two groups: that the average male driver thinks he is more skilful than safe, while the average female driver thinks she is more safe than skilful. Computing a Safety:Skill ratio score for each driver (dividing their safety score by their skill score) and comparing female and male means on this measure yields a statistically significant value on a t-test, with females scoring higher.

Fig 8.1

There are many other attitudinal factors where sex differences between female and male drivers have been reliably demonstrated. For example, Rolls *et al* (1991) asked young drivers to rate the importance they attached to a number of factors in current car choice and ideal car choice. Males placed more importance on the appearance of their current car, while females were more concerned with its reliability. When the researchers looked at the ratings for an ideal car they found not only that preferences for speed, acceleration and engine size were higher for the young male drivers, and that preferences for safety and reliability were higher amongst the young females, but that preferences for speed, acceleration and engine size correlated positively, and preferences for safety and reliability correlated negatively with actual accident involvement.

Behaviour on the road: lapses, errors, violations and crashes

At Manchester we have conducted a number of survey studies asking drivers to rate how often when driving they experience departures from normative, reference driving behaviour (Rothengatter, 1997). These driving behaviours group into three basic types: lapses, errors and violations (Reason *et al*, 1990; Meadows, 1994; Parker *et al*, 1995a, b). This basic threefold typology has been recently replicated by studies in Australia (Blockley & Hartley, 1995) and in Sweden (Aberg & Rimmo, 1998). Table 8.7 gives examples of each type.

- *Lapses* are potentially embarrassing and may be a source of inconvenience to the driver, but are not usually life-threatening. They are more commonly reported by female drivers and by older drivers.
- *Errors* are an example of ‘the failure of planned actions to achieve their intended consequence’ (Reason *et al*, 1990, p.1315) and include both failures of observation and misjudgements.

- *Violations* are defined as 'deliberate [..] deviations from those practices believed necessary to maintain the safe operation of a potentially hazardous system' (Reason *et al*, 1990, p.1316). These are to be distinguished from the US usage of the term where a driver's traffic violations are an official record of the number of times he or she has been apprehended for breaches of the road traffic regulations.

Table 8.7

In terms of violations, our analyses show speeding to be the *most* frequent and drink-driving (these days) to be the *least* frequent. Drivers who committed one type of violation were more likely to commit other types. Typically in our studies at Manchester it was those drivers who scored high on violations, and not those who score high on lapses or errors, who were statistically more likely to have been involved in accidents in the past and to be accident-involved (again!) in the future.

When we divided drivers into high, medium and low violators we found that:

- around 40% of male drivers were high violators as opposed to 20% of female drivers; and
- over 50% of male drivers aged 17-25 and approaching 40% of female drivers aged 17-25 were high violators.

Thus male drivers and young drivers are over-represented in the high violator group. However we should bear in mind that:

- not all high Violators are young and male (around 10% of female drivers over age 35 years are);
- not all young male drivers are high Violators (around 20% are low Violators)

so that persuasive materials (e.g. road safety campaigns) aimed solely at young male drivers will miss some targets and may antagonise others who should be role models, not targets.

In a series of studies at Manchester, looking at a range of particular violations, high violators were shown to differ from other drivers in a number of ways. Table 8.8 gives a summary of these findings.

Table 8.8

Different kinds of crashes and their correlates

Do female and male drivers have different kinds of crashes? Pioneering work by West (1995) classified crashes into a number of different types, such as:

- *Shunts*: One vehicle hits another on the same carriageway from behind (around 30% of self-reported crashes overall);

- *Right of way contraventions*: A vehicle pulls on to or across a carriageway without the right of way (around 20% of crashes overall); and
- *Loss of control*: A driver fails to control the direction of a vehicle and keep it on the carriageway (around 10% of crashes overall).

Younger drivers are more likely to be killed in single-vehicle, rollover crashes (loss of control) (Evans, 1991), and older drivers are at greater risk of injury from multi-vehicle side-impact collisions (right of way contraventions) (Viano *et al*, 1990).

For most crashes it is also possible to characterise them as:
- *active* crashes - where the reporting driver's vehicle runs into another or off the road; and
- *passive* crashes - where the reporting driver's vehicle is struck by another.

Table 8.9 shows the separate main effects for annual mileage, gender, age and violation score (categorised into low, medium or high thirds) on the frequency of reported *active* crashes in the previous three years.

Table 8.9

Overall, 18% of drivers in this sample of 1,000 drivers aged 18 - 70 with at least four months post-test driving experience reported one or more active crashes in the previous three years. Table 8.9 shows that variations in reported annual mileage, sex, age and violation score each made a significant difference to active crash frequency when they were considered separately.

However, when the combined effects of all four variables were tested together, the optimum solution for *active* crashes was as shown in Table 8.10. Here violation score proved to be the best single predictor of variation in active crash frequency, and there was also a sex by violation interaction effect. Twelve percent of female low or medium violators reported one or more active crashes in the previous three years, compared to 18% of male low or medium violators and 25% of high violators. Thus male drivers who drove carefully were 50% more at risk of active crashes than female drivers with the same driving style (18% v. 12%). But a high violating manner of driving doubled the active crash risk for female drivers (12% to 25%) and increased by a half that for male drivers (18% to 25%). For high violators, whether the driver was male or female made no difference to the frequency of active crash involvement, they were equally at risk.

Tables 8.9 and 8.10

The picture was intriguingly different for *passive* crash involvement. Table 8.11 shows three of the four measures had a significant effect here. Male and female drivers in this sample did not differ in their passive crash involvement in the previous three years, but there was a difference between lower and higher mileage drivers, between drivers below and above age 55, and between low violators and high and medium violators.

Table 8.12 charts the best combined solution. High mileage drivers were more at risk of passive crashes - having other road users run into them - simply by virtue of their greater exposure (24% v. 14%). But there was an interaction between mileage and frequency of committing violations. Here careful and considerate driving - low violating - protected high mileage drivers, reducing their risk (13%) to the same level as that of low mileage drivers (14%).

Tables 8.11 and 8.12

The female and male drivers in this study differed in their mean annual mileages (men driving more than women) and in their mean violation scores (men scoring higher than women) - though not in their mean age. But the statistical software used for these analyses (SPSS CHAID) takes account of such relationships between predictor variables when producing the solutions of Tables 8.10 and 8.12. We may thus confidently conclude that, when the other factors - possible confounding variables - had been taken into account statistically, there remained a significant tendency for female low and medium violators to have fewer *active* accidents than equivalent male drivers, but that there was no sex effect for passive accidents. Thus:

- amongst 'careful' drivers (low, medium violators) active crash involvement was higher for males than for females;
- amongst high violating drivers, women and men had the same (elevated) level of active crash involvement, and
- that the passive crash involvement of both female and male drivers was determined by how much and how badly they drove (exposure and violation tendency), not by what sex they were.

The contribution of sex differences to crash involvement: a model

Most drivers 'drive as they live' (Beirness, 1993). Female and male drivers can be considered as just females and males who are driving. The findings we have sketched in this chapter mirror those from studies of sex differences in other areas of risk-taking behaviour.

> 'Most typically, though not universally, studies find males take greater risks and risk taking decreases with age. Such results are primarily descriptive: ... In fact, gender differences [*in risk taking*] may be spurious, that is they can be attributed to situational variables which are gender-linked.' (Bromiley and Curley, 1992, pp 121, 122).

We have seen that females and males behind the wheel differ not only in the detail of the amount and type of their crash-involvement, but in a large number of other aspects of driving behaviour - namely:

- in how much, where, when and how they drive,
- in the views they hold about and the satisfactions that they seek from driving,
- and - in particular - in the extent to which they commit driving violations

all of which factors themselves have demonstrable links to crash-involvement.

Figure 8.2 (adapted from Lajunen, 1997, p. 32) provides a descriptive model or outline framework which attempts to summarise the various routes of influence from demographic differences (such as female versus male) to crash involvement. The top two rows of the model refer to *driver* differences, subsequent layers to *driving* differences. Generally factors above influence factors below - though a full model would need to specify the plethora of interactions and feedback loops to do justice to the complexity of human behaviour on the road. Age and gender make documented differences to the factors below them. Age and gender *and* all the factors below them have documented links to crash involvement (e.g., Beirness, 1993; Elander *et al*, 1993; Maycock *et al*, 1991; Parker *et al* 1995a, b).

Figure 8.2

Conclusions

> '... are men and women equal with regard to traffic risks? In conclusion it can be stated .. that if men are more exposed to risk, this is obviously not only because they use their car differently, but also because they are more attracted to risk - in accordance with their social stereotype - and because risky behaviour is made possible by the condition of the traffic system as such'. (Barjonet, 1988, p.137)

We regard driving as an expressive activity. Male and female drivers - and, indeed, younger and older drivers - express themselves in different ways on the road. We believe that these different ways have consequences for their crash involvement.

So are women better drivers than men? Women are more successful than men In limiting the frequency and - especially - the severity of their crash-involvement. Men are - on average - more skilful and more dangerous. The proximal cause of road traffic accidents is driving with reduced safety margins. The extent to which a driver adopts reduced safety margins is a function of their driving style. Driving style is affected by the particular beliefs and attitudes a person holds about driving. Unsafe attitudes and beliefs are more frequently - but not exclusively - held by young male drivers. Psychologists have methods for studying and techniques for changing a driver's values, beliefs, attitudes and motivations in order to influence the manner in which they drive. Short of banning cars or removing discretionary decision-making from drivers, it is in changing attitudes that the best hope lies of reducing the carnage of the roads that has seen upwards of 20 million persons across the planet killed by automobiles this century (Faith, 1997).

Discussion questions

1. Summarise the differences in crash involvement between female and male car drivers.
2. What potential confounding variables need to be taken into account when looking at gender differences in crash involvement?
3. What other tools can you think of that would be useful in furthering our understanding of the different driving patterns of males and females?
4. Given what you have learned about the correlates of crash involvement, what road safety countermeasures would you recommend, and for whom?

Suggested further reading

Faith, N. (1997) *Crash. The Limits of Car Safety*. London: Boxtree.
A tie-in with the UK 1997 Channel 4 television 'Crash' series, this book provides a very readable account of the first 100 years of our love affair with the automobile and some of the havoc it has caused. The first half examines vehicle safety, the second half looks at 'the nut behind the wheel'.

Elander, J., West, R. and French, D. (1993) Behavioral correlates of individual differences in road-traffic crash risk: An examination of methods and findings, *Psychological Bulletin*, 113: 279-294. This paper provides a state-of-the-art academic overview of the types of people that psychologists have linked to crash rates, and of the kinds of research methods that have been used.

Rothengatter, T. and Vaya, E. C. (eds) (1997) *Traffic and Transport Psychology. Theory and Application*. Amsterdam: Pergamon.
The most up-to-date textbook in the field which, while expensive, provides a compendium of recent research on driver behaviour illustrating the breadth of the field and the multidisciplinary mix of theory and methods.

References

Aberg, L. and Rimmo, P-A. (1998) Dimensions of aberrant driver behaviour, *Ergonomics*, 41: 39-56.

Barjonet, P. (1988) Sex differences in risk exposure and risk perception, in T. Rothengatter and R. de Bruin (eds) *Road User Behaviour: Theory and Research*. Maastricht: Van Gorcum.

Beirness, D. J. (1993) Do we really drive as we live? The role of personality factors in road crashes, *Alcohol, Drugs and Driving*, 9: 129-143.

Blockley, P. N. and Hartley, L. R. (1995) Aberrant driving behaviour: errors and violations, *Ergonomics*, 38: 1759-1771.

Bromiley, P. and Curley, S. P. (1992) Individual differences in risk taking, in J. Frank Yates (Ed) *Risk-Taking Behavior*. Chichester: John Wiley & Sons.

Cameron, K. (1998) Driver testing and training - is it relevant in today's conditions?, in *'Drivers: Licensed to kill?' Proceedings of the RoSPA 63rd Road Safety Congress*. Birmingham: The Royal Society for the Prevention of Accidents.

Cuerden, R. and Hill, J. (1997) Collision types and risk of injury for different driver characteristics, in *'Drivers: Licensed to Kill?', Proceedings of the RoSPA 63rd Road Safety Congress*. Birmingham: The Royal Society for the Prevention of Accidents.

Elander, J., West, R. and French, D. (1993) Behavioral correlates of individual differences in road-traffic crash risk: An examination of methods and findings, *Psychological Bulletin*, 113: 279-294.

Evans, L. (1991) Airbag effectiveness in preventing fatalities predicted according to type of crash, driver age, and blood alcohol concentration, *Accident Analysis and Prevention*, 23: 531-541.

Faith, N. (1997) *Crash. The Limits of Car Safety*. London: Boxtree.

Forsyth, E., Maycock, G. and Sexton, B. (1995) *Cohort Study of Learner and Novice Drivers, Part 3: Accidents, Offences and Driving Experience in the First Three Years of Driving*. Project Report PR111. Crowthorne, Transport Research Laboratory.

Horswill, M. S. and McKenna, F. P. (1997) Measuring, manipulating and understanding drivers' speed choice, in G. B. Grayson (Ed) *Behavioural Research in Road Safety VII*. Crowthorne: Transport Research Laboratory (PA 3296/97).

Lajunen, T. (1997) 'Personality factors, driving style and traffic safety' PhD thesis, Faculty of Arts, University of Helsinki.

Lajunen, T. and Summala, H. (1995) Driving experience, personality, and skill and safety-motive dimensions in drivers' self-assessments, *Personality and Individual Differences*, 19: 307-318.

Maycock, G. (1995) Novice driver accidents in relation to learning to drive, the driving test and driving ability and behaviour, in G. B. Grayson (Ed) *Behavioural Research in Road Safety V*. Crowthorne: Transport Research Laboratory (PA3081/95).

Maycock, G. (1997) Speed, speed choice and accidents, in G. B. Grayson (Ed) *Behavioural Research in Road Safety VII*. Crowthorne: Transport Research Laboratory (PA 3296/97).

Maycock, G., Lockwood, C. R. and Lester, J. F. (1991) *The Accident Liability of Car Drivers*. TRRL Report RR315. Crowthorne: Transport and Road Research Laboratory.

McKenna, F. P., Waylen, A. E. and Burkes, M. E. (1998) *Male and Female Drivers: How Different Are They?* Basingstoke: AA Foundation for Road Safety Research.

Meadows, M. L. (1994) 'Psychological Correlates of Road Crash Types', unpublished PhD Thesis, University of Manchester.

Meadows, M. L. and Stradling, S. G. (1995) Large-scale questionnaire research on drivers, in J. T. Haworth (Ed) *Psychological Research: Innovative Methods and Strategies*. London: Routledge.

Parker, D., Reason, J. T., Manstead, A. S. R. and Stradling, S. G. (1995a) Driving errors, driving violations and accident involvement, *Ergonomics*, 38(5): 1036-1048.

Parker, D., West, R., Stradling, S. G. and Manstead, A. S. R. (1995b) Behavioural traits and road traffic accident involvement, *Accident Analysis and Prevention*, 27(4): 571-581.

Reason, J. T., Manstead, A. S. R., Stradling, S. G., Baxter, J. S. and Campbell, K. A. (1990) Errors and violations on the road: a real distinction? *Ergonomics*, 33(10/11): 1315-1332.

Rolls, G. W. P., Hall, R. D, Ingham, R. and McDonald, M. (1991) *Accident Risk and Behavioural Patterns of Younger Drivers*. Basingstoke: AA Foundation for Road Safety Research.

Rothengatter, T. (1997) Errors and violations as factors in accident causation, in T. Rothengatter and E. Carbonell Vaya (Eds) *Traffic and Transport Psychology. Theory and Application*. Amsterdam: Pergamon.

Stradling, S. G. (1991) Age and gender differences in attitudes of pre-drivers, in G. B. Grayson and J. F. Lester (Eds) *Behavioural Research in Road Safety I*. Crowthorne: Transport and Road Research Laboratory.

UK Department of the Environment, Transport and the Regions (DETR) (1997a) *Road Accidents Great Britain: 1996. The Casualty Report*. London: The Stationery Office.

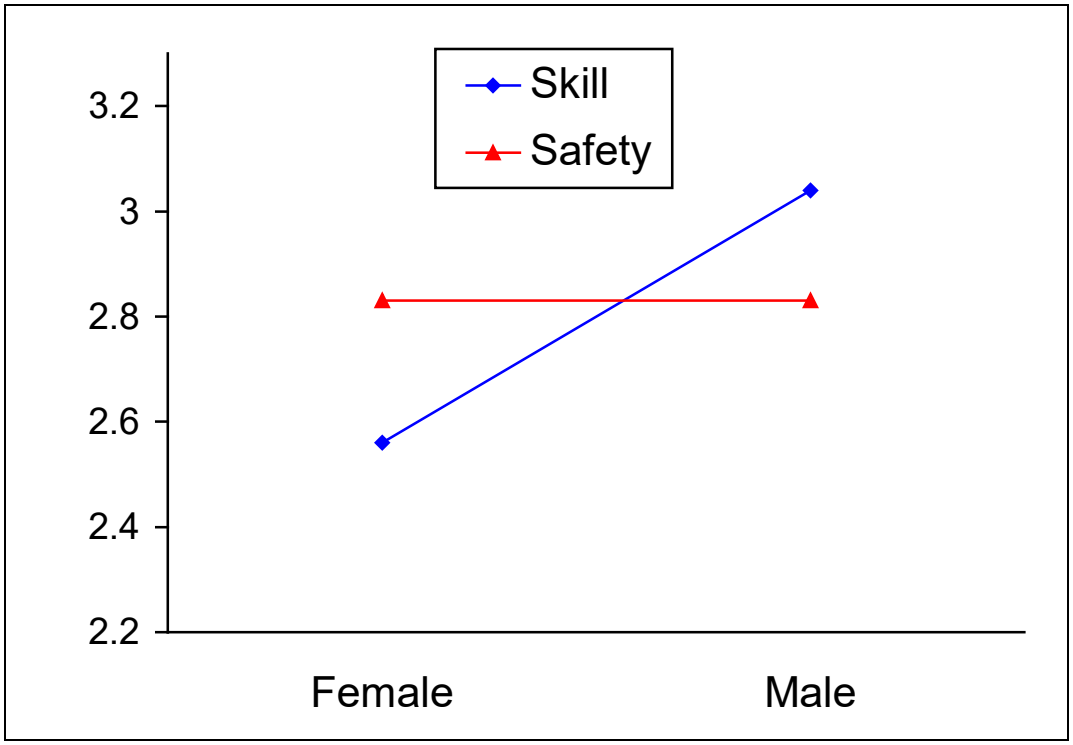
UK Department of the Environment, Transport and the Regions (DETR) (1997b) *Directorate of Statistics. National Travel Surveys*. London: The Stationery Office.

Viano, D. C, Culver, C. C., Evans, L., Frick, M. C. and Scott, R. (1990) Involvement of older drivers in multivehicle side-impact crashes, *Accident Analysis and Prevention*, 22: 177-199.

Waller, P. (1997) Future possibilities for behavioural research, in G. B. Grayson (Ed) *Behavioural Research in Road Safety VII*. Crowthorne: Transport Research Laboratory (PA 3296/97).

West, R. (1995) *Accident Script Analysis*. Contractors Report CR343. Crowthorne: Transport Research Laboratory.

Figure 8.1 Skill and safety-orientation scores for UK male and female drivers.



[Scale range: 0 = Below Average to 4 = Above Average]

Figure 8.2 An outline model of the distal influence of age and gender on crash involvement (adapted from Lajunen, 1997)

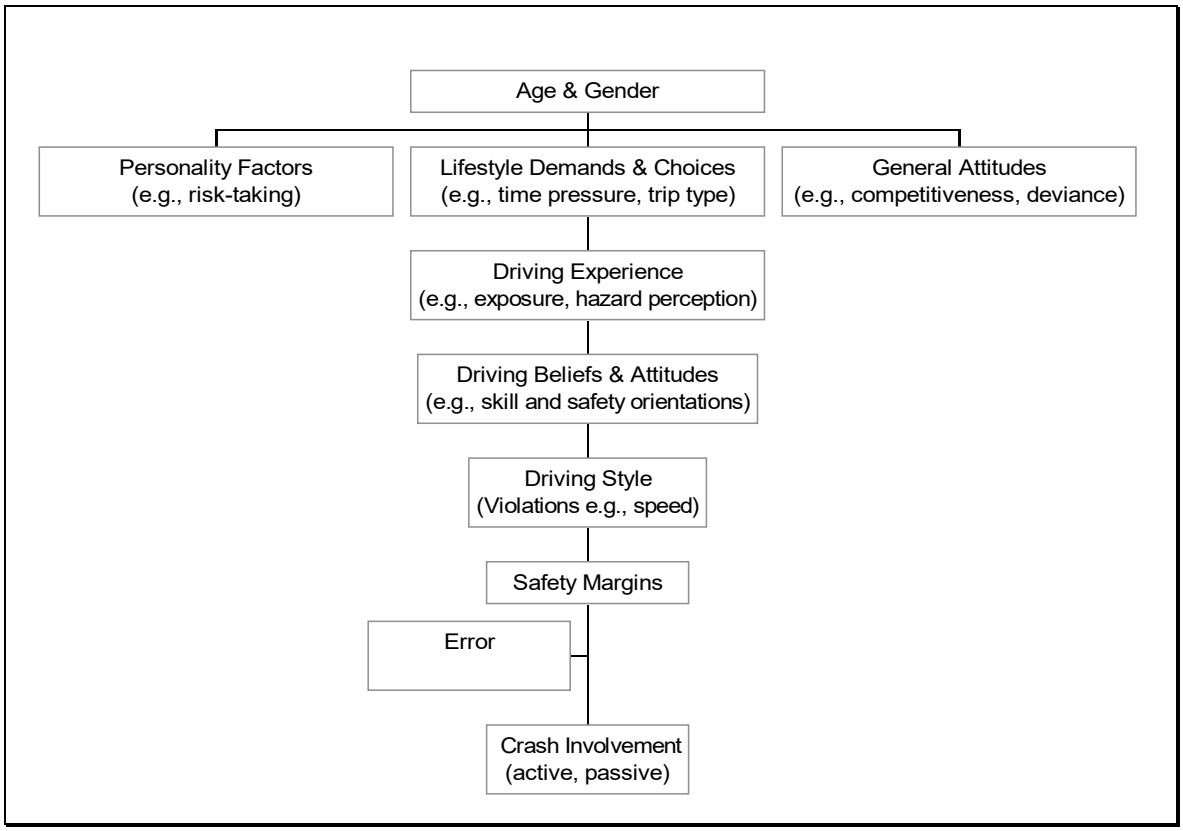


Table 8.1 Numbers of injury accidents for female and male car drivers in the UK in Great Britain. (Data from UK DETR, 1997a: Tables 5a and 5b.)

	All injury	KSI	Killed	Killed/day
Female drivers	56443	5240	249	0.68
Male drivers	72416	9770	897	2.46
F/M as %	78%	54%	28%	(28%)

KSI = Killed or Seriously Injured

Table 8.2 Numbers of female and male registered drivers by age group in Great Britain, 1993/95. (Data from UK DETR, 1997b; Cuerden & Hill, 1997)

Age band	Female	Male	F as % of M
17-20	0.55[1]	0.69	80%
21-29	2.62	3.29	80%
30-39	3.09	3.83	81%
40-49	2.77	3.40	81%
50-59	1.79	2.66	67%
60-69	1.10	2.08	53%
70+	0.74	1.47	50%
Total	12.66m	17.42m	73%

[1] millions of persons

Table 8.3 Mean accidents per driver per year for experienced male and female drivers by age-band and annual mileage. (Data from Meadows, 1994.)

Accidents per driver per year	Female			Male		
Annual Mileage	Lo (0-5K)	Med (5-12K)	Hi (12K+)	Lo (0-5K)	Med (5-12K)	Hi (12K+)
Age band						
21-25	.113[1]	.167	.147	.173	.163	.223
26-39	.073	.093	.080	.127	.110	.143
40-70	.070	.133	.097	.093	.137	.103

[1] interpret this figure as: female drivers aged 21-25 years who drove less than 5000 miles a year had an annual probability of RTA involvement of 0.113 i.e., 11.3% x 3 = 34% of them reported at least 1 RTA in the previous 3 years.

Table 8.4 Mean accidents per driver per year. (Data from Maycock, 1995, Table 1.)

Accidents per driver per year	Female (F)	Male (M)	F/M x 100%
Age 17-19			
Yr 1	.202	.317	64%
Yr 2	.142	.190	75%
Yr 3	.128	.141	91%
Age 20-24			
Yr 1	.177	.203	87%
Yr 2	.111	.146	76%
Yr 3	.096	.145	66%

*Table 8.*5 Comparisons of speeding behaviours and attitudes of female and male drivers.

		Female	Male
Speeding offences			
Stopped for speeding in the last 12 months	'Yes'	11%	21%
Self-reported speeding			
'I disregard the speed limits late at night or very early in the morning'	Agree	8%	22%
'I am always speeding'	Agree	8%	17%
Preferred speed	Mean mph		
'At what speed do you prefer to drive on ..			
A busy High Street?		F = M	
A road through a residential area?		F = M	
Winding country lanes?		F < M	
Motorways?		F < M	
Persistent speeders (Hi on all 4 of the above)		7%	15%
Attitudes to speed	*Strongly*:		
'I find travelling at high speed no thrill at all'	Disagree	20%	32%
'I really enjoy the feeling of accelerating hard'	Agree	8%	23%
'It is completely unimportant who is first away from the traffic lights'	Disagree	11%	15%
'It is important to me that driving is exciting'	Agree	4%	12%
Consequences of speed. 'How likely is it that disregarding the speed limit:			
will cause an accident?'	Likely	39%	26%
will give offence to other road users?'	Likely	50%	33%
would make me feel sorry and/or guilty?'	Likely	41%	28%

Table 8.6 Examples of skill and safety items from the *Driver Skill Inventory* (DSI).

'Please estimate how you compare on each of the following aspects of driving'	Below Average				Above Average
Skill items	0	1	2	3	4
Fluent lane-changing in heavy traffic					
Overtaking					
Driving in the dark					
Driving in a strange city					
Safety items					
Keeping sufficient following distance					
Adjusting your speed to the conditions					
Tolerating other drivers' blunders calmly					
Conforming to the traffic rules					

Table 8.7 Examples of lapses, errors and violations.

Lapses
How often* do you:
- Try to pull away from the traffic lights in third gear?
- Switch on one thing when you meant to switch on another?
- Take the wrong lane approaching a roundabout or junction?
- Forget where you left the car in the car park?

Errors
How often* do you:
- Fail to see a `Stop' or `Give Way' sign and narrowly avoid colliding with traffic having right of way?
- On turning nearside, fail to see a cyclist who has come up on your inside?
- Underestimate the speed of an oncoming vehicle when overtaking?
- Brake too quickly on a slippery road, or steer the wrong way in a skid?

Violations
How often* do you:
- Disregard the speed limits late at night or very early in the morning?
- Cross a junction knowing that the traffic lights have already turned against you?
- Drive especially close to the car in front as a signal to its driver to go faster or get out of the way?
- Drive even though you realise you may be over the legal blood-alcohol limit?

*rated on a 6-point scale from `Never' to `Nearly all the time'.

Table 8.8 Psychological characteristics of high violators

High Violators tend to:

- consider themselves (even) better drivers than do others
- report stronger intentions to speed across 5 different road types (residential road, shopping street, country lane, dual carriageway, 3-lane motorway)
- over-estimate the number of other drivers who speed, drive too close, etc.
- rate the potential adverse consequences of their actions (e.g. having an accident, being stopped by the police) as less likely, and as less bad
- believe that their significant others are less likely to disapprove
- think that other drivers will be less upset by the bad behaviour
- are more likely to experience immediate, positive affect (`feel good') while violating
- are less likely to anticipate feeling regret after violating
- think refraining from the behaviours would be more difficult and thus that they are less in control of their behaviour
- show greater outward irritability (anger directed towards others)

Table 8.9 Active crash involvement: separate effects. (Data based on Meadows, 1994.)

Active Crashes: Separate Effects* Overall: **18**%			
Annual Mileage	<7K **14**%	7-16K **25**%	>16K **15**%
Sex	Female **14**%	Male **21**%	
Age	18-30 **23**%	31-70 **14**%	
Violations	Lo, Med **15**%	Hi **25**%	

* all of which are statistically significant (chi-square) at $p < .05$

Table 8.10 Active crash involvement: interactive effects

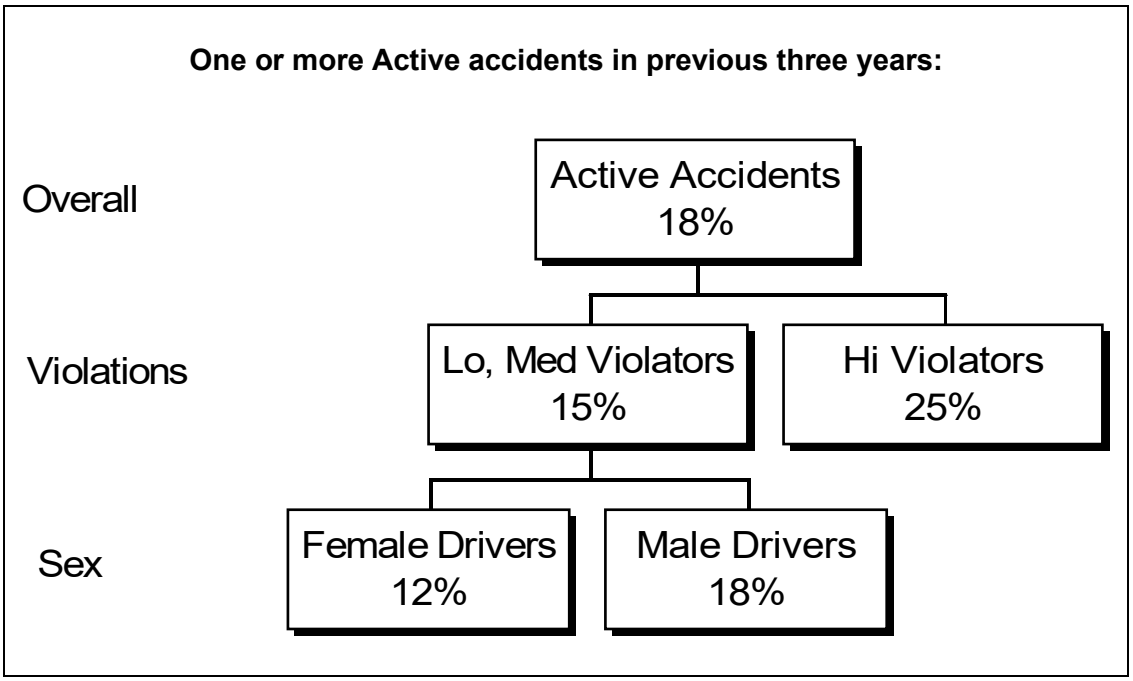


Table 8.11 Passive crash involvement: separate effects

Passive Crashes: Separate Effects* Overall: **17**%		
Annual Mileage	<11K **14**%	>11K **21**%
Sex	Female = Male = **17**%	
Age	18-55 **18**%	56-70 **8**%
Violations	Lo **13**%	Med, Hi **19**%

* 3 of which are statistically significant (chi-square) at $p < .05$

Table 8.12 Passive crash involvement: interactive effects.