The Role of the Motorist in Motorcycle Safety: A Preliminary Examination in Terms of (a) Motorcyclists' Opinions of Motorist Culpability and (b) The Influence of Motorcycling Experience on Motorists' Opinions and Knowledge

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"The views expressed herein are those of the authors alone and do not necessarily represent those of the Institute."
FOREWORD

The following report was prepared during a programme of research leading to the award of a Doctor of Philosophy degree. The arguments, concepts and findings introduced in this interim report are therefore to be more fully discussed in a PhD thesis of which the following two studies will form a part.

CLARIFICATION OF TERMS

In the discussion to follow, the term "motorcycle" encompasses mopeds and motor scooters in addition to conventional motorcycles. For clarity the term PTW, standing for Powered Two-Wheeler, will be used in this respect and the term "rider" or "motorcyclist" will include all operators of such vehicles.

The term "driver" or "motorist" is used only to refer to the operators of four-wheeled motor vehicles.
SUMMARY

The size and nature of the problem of driver culpability with regard to powered two-wheeler (PTW) accident causation is presented.

The initiation of a programme of research to gain further insight into driver culpability is described. Two initial studies are reported for their relevance in this respect.

A survey of 209 PTW operators was undertaken (Study 1). This fieldwork followed in-depth interviews with five motorcyclists which were conducted to determine how driver culpability was interpreted by these motorcyclists. Driver culpability is interpreted as stemming from a lack of knowledge about the complexities of motorcycling and/or a lack of respect for motorcyclists. Study 1 determined: (a) the extent of agreement with such interpretations; (b) the extent to which motorcyclists feel there is a need for improved driver behaviour as a major effective countermeasure for the prevention of PTW accidents. One hundred percent of the PTW operators surveyed were in favour of an improvement of car driver awareness in terms of greater respect for motorcyclists, and 98 percent were in favour of an improvement in car driver awareness in terms of greater knowledge of the complexities of motorcycling and rider vulnerability in certain conditions. In comparison with a selection of other possible countermeasures, the improvement of novice rider behaviour through rider training and the improvement of car driver awareness in terms of knowledge and respect were believed to have the greatest potential effectiveness for preventing PTW accidents.

In attempting to explain the driver behaviour which may result in a PTW accident, the concepts of technical awareness and social awareness are forwarded and argued to figure prominently in an approach to the problem which particularly considers social and psychological factors. The concepts enable a framework with which it is possible to encompass driver culpability as perceived by the PTW operators surveyed in Study 1.

Study 2 was conducted to deduce whether or not a sample of car drivers (N=216) could be discriminated, according to the nature and extent of their motorcycling experience, with regard to how they responded to a questionnaire relating, primarily, to technical and social awareness. Various discriminations on the basis of technical and social awareness were found possible between motorists who had no form of motorcycling experience and motorists who were past and/or present operators of PTWs. The results are discussed with regard to their possible implications for driver behaviour in the vicinity of a PTW. The discriminations serve to support the approach to the problem of PTW rider casualties and provide insight into the components and dimensions of the concepts of technical awareness and social awareness.

The primary directives of future research are briefly discussed. These include the further exploration of the technical and social awareness of motorists in terms of a possible relationship with driver performance, decision making and risk taking. Further suggestions, in the long term, consist of the evaluation of countermeasure development involving supplements to the education of present car drivers, the training of learner motorists and the enforcement of suitable driver behaviour.
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INTRODUCTION

Many statistical summaries of PTW accidents have shown a large involvement of motorists in PTW accidents. Moreover, there is a large assignment of responsibility to the other vehicle driver involved in the encounter. Taking a recent example, the opposing motorist rather than the motorcyclist was judged to be at fault 64.7 percent of the time in the multi-vehicle accident data obtained by Hurt et al. (1981) in the United States. Buchanan et al. (1982) chose to emphasise this data for revealing that three out of every four motorcycle accidents involved a collision with another vehicle. The Hurt et al. data was obtained from the on-scene, in-depth investigations of 900 motorcycle accidents in Los Angeles, California. Only 230 of the 900 accident cases were single-vehicle collisions where the motorcycle did not make contact with another vehicle. Even in some of these single-vehicle collisions "... another vehicle was involved in accident causation, for example, an automobile turns left infront of the oncoming vehicle, the motorcycle rider overbrakes, slides out and falls to the road-way but does not collide with the automobile. Forty-nine such cases occurred so that there were 181 cases where only the motorcycle was involved" (Hurt et al., 1981, p. 42).

Hurt et al. (p. 35) concluded from their investigation that "Any future research on motorcycle accidents should include more in-depth examination of characteristics of the driver of the other vehicle involved in collision with the motorcycle. The dominant culpability of the driver of the other vehicle shown in these data demands further detailed examination ...".

In Britain, Whittington (1981) considered the evidence from 55 Coroner's inquests, concerning 51 separate motorcycle accidents in Birmingham, and as a result found that "... the errors of other road users were the most significant individual cause of fatal accidents" (ibid., p. 267).

Extracting data from Road Accidents Great Britain (RAGB) 1980, Minter (1984) analysed the various casualty rates for riders and other road users in urban and rural locations. RAGB 1980 defined "casualty rate" as the number of casualties in a year divided by the distance travelled in that year. In considering the data for PTWs, Minter (p. 27) pointed out that "Town rates are higher than Country rates, and it is apparent that Town riding generates more minor injuries than Country riding. For cars, the position is different, in that Fatal and Serious casualty rates are higher in Country than in Town. ... This analysis reveals the very high damage rates to riders in built-up areas. The fact is very clear that in country riding the risk of injury is much lower than in town, while for cars it is the other way round. This indicates ... that TWMVs [i.e., Two-Wheeled Motor Vehicles, or PTWs] are not in themselves specially dangerous, but that injuries arise more through interaction with other traffic."

Indeed, one of Minter's four "principal recommendations" which stemmed from his analysis of statistics relating to motorcycling was: "Noting the substantial amount of rider casualties from TWMV-Car encounters, to press DTp [the Department of Transport] to find ways of improving car driver conduct towards TWMVs ..." (ibid., p. 43).
Considering such admissible indications of driver error in PTW accident causality it is surprising that no research in the field has as yet adequately contemplated or investigated the role of the social psychology which exists on the road and the decision-making process of the motorist. As McFarland (1968, p. 72) has pointed out, "Whatever is done on the part of the designers and manufacturers of motor vehicles, as well as in the design of urban and rural highways, the driver will continue to be called upon to play an increasingly active role." A driver/rider must "... be capable and willing to take certain preventive measures such as obeying the signals and stop lights as well as driving within his useful field of view in order to avoid oncoming vehicles. He must anticipate and exert caution for coping with unexpected events. Anything which will influence attention, or possible awareness of impending dangers, will obviously contribute to the possibility of becoming involved in an accident" (ibid., p. 72).

McFarland (p. 78) also argued that "... accidents result from interaction between the characteristics of the driver, those of the vehicle and those of the environment." Similarly, Knapper and Cropley (1980) have called for an approach to road safety which emphasises social and psychological factors: "... even when people are isolated in the anonymity of their cars, social norms that are shared with other drivers still govern much of their behaviour. ... Furthermore, drivers bring with them to the driving situation a whole set of attitudes, values and preconceptions which stem from their previous experience in the social system at large, and are not part of the objective environment at all" (ibid., p. 418).

Within the critical requirements of safe driving/riding and the various interactions which must underlie accident causation, obvious importance must be attributed to the driver's/rider's decision-making mechanism. Newsome (1975, p. 1) has argued that although little is known of this mechanism and its role in the process of driving a car, "... a sizeable proportion of automobile accidents that occur do so because of a wrong decision made by an involved driver."

Road accidents caused by faulty decisions must occur either because the information which is available to the driver/rider is insufficient to allow decisions that are appropriate for the situation, or because the available information, although sufficient, is used incorrectly in determining the action which is executed. With regard to driver/rider error specifically in multi-vehicle accidents, Howells et al. (1980) considered a decision to be characterised by three problem aspects: perceptual-computational factors which are based on the idea that the driver/rider must accurately perceive the presence, speed and distance of the other vehicle; driver/rider knowledge of the operating characteristics of the other vehicle; and personality factors such as the risk taking propensity of the driver/rider.

It can thus be seen that interaction and decision-making processes must contribute considerably to the driving process -- and hence represent factors which must be understood in terms of their contribution to driver error. However, research on other vehicle driver error in relation to PTW accident causality has been lacking. In essence, the only PTW safety research in which the involvement of the motorist is recognised has been work carried out on the
conspicuity of PTW's and their riders. The basis of such research was the understanding that many PTW accidents involve the situation in which a car either crosses or enters the path of an oncoming PTW. However, the general argument of such reports is that the car driver must fail to see the motorcyclist prior to the collision and so the necessary approach to the problem must be that of developing conspicuity aids worn by the rider or attached to the PTW (e.g., Stroud et al., 1980; Olson et al., 1981). Hence, in such work the role of the motorist was seen to be passive in nature -- i.e., he/she simply does not see a PTW and so the motorcyclist must become more conspicuous. A great deal of work employing such a rationale exists. Little, or no, attention has been given to the fact that the car driver is making decisions which result in inappropriate behaviour (e.g., perhaps a lack of adequate surveillance) in the vicinity of a PTW.

In addition to this criticism of the 'conspicuity-problem' research is the fact that although it has centred on the problem of failing to detect a PTW and its rider, much of the findings have actually indicated that the inappropriate driver behaviour occurred after detection had taken place.

For example, Olson et al. (1981) employed a gap acceptance measure in an investigation of the effects of motorcycle/motorcyclist conspicuity enhancement on driver behaviour. A gap was created in the traffic stream between a 'lead vehicle' (a car) and a 'test vehicle' (a motorcycle) so that at intersections the drivers of 'subject vehicles' (who were unaware that they were being observed or taking part in an experiment) could either 'accept' the gap, by merging with or crossing the traffic stream in front of the motorcycle, or 'reject' the gap by remaining stationary and waiting for a larger and safer break in the traffic.

Three types of junction manoeuvre by the subject vehicle were considered: where a motorist had to turn left out of a side road in order to drive on to a main road and travel in front of a motorcycle which was already travelling down the main road; where a car driver had to cross the path of an oncoming motorcycle to turn right and off the main road along which the motorcycle was travelling; where a car driver had to cross the path of an oncoming motorcycle in order to go straight ahead at cross-roads. (The Olson et al. study took place in the United States and so the right/left turns have been altered accordingly).

Various means of increasing conspicuity were developed (e.g., a motorcycle was fitted with a fluorescent fairing or with a modulating head-lamp, or the rider wore a fluorescent vest or a fluorescent helmet cover) and were tested by observing the gap acceptance behaviour of drivers for each condition.

Two principle findings were of present relevance. The first was that the probability of drivers accepting small gaps (and hence exhibiting less safe behaviour by violating the motorcycle's right-of-way) was significantly greater for the two manoeuvres where the car driver passed across the path of the motorcycle rather than pulled in front of it to travel along the same road. Olson et al. (p. 242) stated that "Why the drivers behaved more cautiously on this maneuver than on
the other two is not clear, although it may arise from the fact that this maneuver places one in the path of an approaching vehicle much longer than the others."

Secondly, when discussing their findings in relation to means for improving conspicuity as a method of modifying the behaviour of car drivers, Olson et al. (p. 247) stated that "High visibility materials seem quite effective ... but work better when worn by the rider than when fitted to the bike.

The latter finding is somewhat surprising. In the opinion of the investigators, the fluorescent fairing treatment was a more effective attention-getter than the fluorescent vest or helmet cover. Yet the field test data indicate the opposite ... However, it is not clear why the results came about. One possible explanation is that effectiveness is improved by height above the road. Another is that by emphasizing the rider, speed-spacing judgments are facilitated. This might happen because apparent size is an important distance cue. However, it is based on knowledge of actual size. Most drivers' knowledge about the size of motorcycles, especially motorcycle fairings, than they do about people."

Hence, in order to explain both of the above findings, Olson et al. moved away from an interpretation in terms of a problem of seeing the motorcycle and rider in the first instance and moved toward an interpretation in terms of inappropriate decision making once detection had actually taken place. Furthermore, in doing this Olson et al. have emphasised the role of accurate knowledge in making decisions/judgements and have suggested that knowledge of certain aspects of motorcycles is likely to be lacking in certain motorists.

All-in-all, the need has become apparent to consider the decision-making process of the other vehicle driver which may contribute to lack of detection of motorcycles, but also the decision-making processes which contribute to a failure in acting appropriately in the vicinity of a PTW once detection has taken place. In this respect, therefore, the motorist must be considered active rather than merely as the passive 'victim'. It was such a realisation that has been largely lacking in the conspicuity-related research conducted to date.

Wigan (1976, p. 99) has appeared to share such misgivings of the 'conspicuity-problem' account of the multi-vehicle PTW accident problem and has summarised the situation concisely. "From a participant viewpoint, conspicuity measures have conflicting effects. The use of bright clothing, headlights, helmet and side reflection undoubtedly helps visibility, but the effects are often marginal or undetectable in day to day driving of a PTW, due to the lack of attention paid to motorcycles by most car, goods and PSV drivers. Visibility and attention capture have quite different aims and problems, and while efforts have been made to make the motorcyclist more visible, little comparable energy has been spent on educating drivers to take active cognisance of two wheeled vehicles, or to make more realistic estimates of driving speeds when moving out from a turning or when overtaking, or indeed in yielding priority to the smaller vehicles."
The central issue is one of recognition and response as opposed to visibility of the two wheeler: bridging the gap from visibility to appropriate conscious reaction and judgement is the most fruitful area for safety improvements in this area. General experiments on conspicuity have reinforced this view, as the improved driver response to more visible two wheelers has been far less than would be expected if pure conspicuity were the deciding factor" (Wigan, 1976, p. 108).

The need was therefore apparent to gain greater understanding of other vehicle driver culpability and to approach the problem by considering the culpable motorist as an active component in the system in which some sort of breakdown is occurring. To initiate such directives, two studies were conducted in order to gain insight into possible contributing factors to driver error in relation to PTW accident causation. These studies are reported below.

2 STUDY 1: Motorcyclists' Opinions of Motorist Culpability

2.1 Objectives

Despite the existence of accident data which indicated the need for research on other road users in relation to PTW safety, the opinions of PTW operators were considered necessary to indicate whether they themselves felt a need for improved driver behaviour as an accident countermeasure, and, if so, whether the potential effectiveness of such a measure was considered to be high in comparison with other possible countermeasures. Of primary importance, however, was determining the way in which motorcyclists interpreted other vehicle driver error and how they felt it should be improved (should they actually consider driver culpability to be a major cause of PTW accidents and therefore an important area to be countered) so that insight into the nature of this error might be offered.

In accordance with such objectives, a survey of motorcyclists' attitudes to various possible ways of countering PTW accidents was undertaken.

2.2 The Preventive Countermeasures Under Assessment

Preliminary small-scale qualitative work was undertaken to identify the range of possible attitudes, opinions and issues that would be relevant for this examination. This unstructured approach incorporated individual depth interviews of five motorcyclists (who were previously unknown to the authors and who also drove cars) and served both to indicate how these persons interpreted driver culpability and to give clearer ideas about the phraseology used in this respect. Two possible ways of improving driver behaviour were found to be covered by combining the views of these motorcyclists. They were found to refer to the way in which drivers perceive PTWs and their riders, and the level of motorists' knowledge about these vehicles.

A study of motorcyclists' attitudes to various accident countermeasures has been undertaken with Australian motorcyclists (Wardle, 1976). Wardle gave 74 motorcyclists a list of possible
preventive countermeasures and asked the respondents to rank order them in terms of their perceived potential. However, no reference to driver culpability was given by Wardle. It was therefore decided to basically repeat the Wardle study but to also introduce the two aspects of driver improvement as indicated in the in-depth interviews. The improvement in driver behaviour as felt necessary by the motorcyclists at the qualitative stage were expressed in the structured questionnaire used in the main survey as: (i) Improvement of car driver awareness in terms of greater knowledge of the complexities of motorcycling and rider vulnerability in certain conditions; (ii) Improvement of car driver awareness in terms of greater respect for motorcyclists.

The Australian study gave ten possible countermeasures to be ranked, and the top six as reported by Wardle were employed in the present investigation. These were: rider training, daytime use of headlight and tail-light, restriction of size of machine for inexperienced riders, high visibility jackets, compulsory white helmet, and increased audibility of the horn. In addition to these, the possible countermeasure of "anti-locking brakes on all motorcycles" was included, since Wardle reported this as being a common additional suggestion coming from the motorcyclists whom she surveyed. Wardle also suggested that reference to a 'white helmet' might have been ambiguous in her survey and that the term "high visibility" should have been used. This term was therefore employed in the present study. Also, the restriction of motorcycle engine capacity was stated as 125 cc (i.e., the present situation in Great Britain) to make it more specific. With the two 'car driver' suggestions this therefore made nine countermeasures in all.

2.3 Questionnaire and Procedure

Street interviews of the motorcyclists took place, essentially in areas of city centres where motorcyclists tended to accumulate through the existence of a designated area on which PTWs were able to park. Sampling took place on weekdays and, within reason, anyone parking, or returning to a parked PTW, was approached.

Brief details of the extent of the respondents motorcycling experience and type of PTW ridden were taken and the respondents were informed that the purpose of the survey was to gain an indication of motorcyclists' attitudes to some possible ways of stopping motorcycle accidents as previously suggested by other motorcyclists. The list of nine countermeasures was then shown to the respondent, who was asked whether he/she was either in favour or not in favour of each suggestion in turn. The main intention of this phase was to ensure that respondents were aware of exactly what was contained within the list before any attempts to rank order the material were made. The same list was then presented again so that such rank ordering in terms of potential effectiveness could take place.

The order of the countermeasures was randomly assigned and in reverse order in half of the questionnaires administered.

Copies of the questionnaire are available from the authors on request.
2.4 Subjects

The structured questionnaire was administered to 209 PTW operators, samples from Oxfordshire (n=73), Bedfordshire (n=62), Northamptonshire (n=41), Buckinghamshire (n=18) and Devonshire (n=15) being taken. Of this sample, 73.2 percent had been riding a PTW for over 18 months, 83 percent reported operating their PTW every day during the 'good weather months' (which were defined as between April and October), and 44 percent of the motorcyclists also drove a car.

Details of the type and size of PTW operated by the 209 respondents are given in Table 2.4.1 and Table 2.4.2 respectively.

Table 2.4.1 Absolute and Relative Frequencies of Type of PTW Ridden by the Respondents of Study 1.

<table>
<thead>
<tr>
<th>Type of PTW Ridden</th>
<th>Absolute Frequency</th>
<th>Relative Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOPED</td>
<td>27</td>
<td>12.9</td>
</tr>
<tr>
<td>MOTOR SCOOTER</td>
<td>11</td>
<td>5.3</td>
</tr>
<tr>
<td>MOTORCYCLE</td>
<td>171</td>
<td>81.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>209</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Table 2.4.2 Absolute and Relative Frequencies of Engine Capacity of PTW Ridden by Respondents of Study 1.

<table>
<thead>
<tr>
<th>Engine Capacity of PTW</th>
<th>Absolute Frequency</th>
<th>Relative Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;51 cc</td>
<td>30</td>
<td>14.4</td>
</tr>
<tr>
<td>51-150 cc</td>
<td>66</td>
<td>31.6</td>
</tr>
<tr>
<td>151-250 cc</td>
<td>26</td>
<td>12.4</td>
</tr>
<tr>
<td>251-500 cc</td>
<td>26</td>
<td>12.4</td>
</tr>
<tr>
<td>&gt;500 cc</td>
<td>61</td>
<td>29.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>209</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

2.5 Results

The only proposed countermeasure with which 100% of the sample were in favour was that of the improvement of car driver awareness in terms of greater respect for motorcyclists. Next, with a relative frequency of 98.1%, came improvement of car driver awareness in terms of greater knowledge of the complexities of motorcycling and rider vulnerability in certain conditions. Rider training was the countermeasure with which riders were third most often in favour, obtaining a relative frequency of 91.9%.
Of more importance was the potential effectiveness of the nine countermeasures which the motorcyclists considered such proposals to have. The results of this second and main aspect of the study are given in Table 2.5.1.

Table 2.5.1 Complete Composite Ranking for (A) The Set of 9 Possible Motorcycle Accident Preventive Countermeasures Judged by 209 Motorcyclists and (B) As Found for 74 Motorcyclists by Wardle (1976). (A rank of 1 signifies the most potentially effective).

<table>
<thead>
<tr>
<th>Rank of Potential Effectiveness</th>
<th>Countermeasure</th>
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<tr>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Present Wardle Study</td>
<td>Study</td>
</tr>
<tr>
<td>1</td>
<td>Improvement of car driver awareness in terms of greater knowledge of the complexities of motorcycling and rider vulnerability in certain conditions</td>
</tr>
<tr>
<td>2</td>
<td>Rider training</td>
</tr>
<tr>
<td>3</td>
<td>Improvement of car driver awareness in terms of greater respect for motorcyclists</td>
</tr>
<tr>
<td>4</td>
<td>Daytime use of headlight and tail-light</td>
</tr>
<tr>
<td>5</td>
<td>Restriction of size of machine to 125 cc for inexperienced riders</td>
</tr>
<tr>
<td>6</td>
<td>Anti-locking brakes on all motorcycles</td>
</tr>
<tr>
<td>7</td>
<td>High visibility jackets</td>
</tr>
<tr>
<td>8</td>
<td>Increased audibility of the horn</td>
</tr>
<tr>
<td>9</td>
<td>Compulsory high visibility helmet</td>
</tr>
</tbody>
</table>

From the rank-order information obtained it was possible to determine the proportion of occasions that a particular countermeasure suggestion was ranked higher than a specific other countermeasure suggestion (according to the estimation of proportions of comparative judgements (Guilford, 1954)).

The proportion of occasions that improvement of car driver awareness in terms of greater knowledge of the complexities of motorcycling and rider vulnerability in certain conditions was judged to have greater potential effectiveness than rider training was 0.52 (i.e., 52% of occasions). This was also the proportion with which rider training was preferred as having more potential effect than improvement of car driver awareness in terms of greater respect for motorcyclists.
Improvement of car driver awareness in terms of greater knowledge of the complexities of motorcycling and rider vulnerability in certain conditions was ranked higher than 'improvement in respect' on 54% (0.54) of occasions.

The proportion of occasions that the improvement of car driver awareness in terms of greater respect for motorcyclists (i.e., rank 3) was preferred as having greater potential effectiveness than the daytime use of headlight and tail-light (i.e., rank 4) was 0.76.

2.6 Discussion

It can thus be seen in Table 2.5.1 that improvement of car driver awareness in terms of greater knowledge of the complexities of motorcycling and rider vulnerability in certain conditions obtained the composite rank of 1, and was therefore perceived as having more potential effect in reducing PTW accidents than rider training, which obtained the top ranking in the Wardle study. Furthermore, of the nine countermeasure suggestions provided, the motorcyclists sampled felt that if car drivers had more respect for the riders of PTWs then this would be the third most potentially effective measure for preventing PTW accidents.

If one considers the proportions of occasions that the top three ranked countermeasures were preferred over each other, and the proportion for the third rank over the fourth rank, it can be seen that little distinction existed between the perceived merits of only the three highest ranked countermeasures. Whilst there was a 50/50 split in preference amongst the three highest ranked countermeasures, there was an 80/20 split for rank 3 over rank 4. The fourth rank and below were consistently and markedly considered to be of less potential effectiveness. Hence, direct attempts to improve road user behaviour, be it car driver or PTW operator, represent the major areas of worthwhile countermeasure development as perceived by these motorcyclists.

Furthermore, that an all-round improvement in road user behaviour -- i.e., novice riders as well as car drivers -- was favoured to about the same extent also indicates that the respondents were not merely 'passing the buck' when ranking improvements in driver awareness high. Rather, it would seem to suggest that they take their own role in road safety seriously, but also feel strongly about the behaviour of motorists in relation to accident causality.

It is interesting to note from Table 2.5.1 that if one excludes the two 'driver awareness' proposals and the additional 'anti-locking brakes' suggestion, then the rank order obtained for Wardle's countermeasures in the present study is the same as obtained in the previous survey with the exception that the two lowest ranks are the other way round. This would seem to add support to the validity of the findings, but more importantly it shows how misleading Wardle's findings were as a direct result of her exclusion of active attempts to reduce driver culpability.

For example, if one compares the two rankings of driver improvement with those countermeasures designed to enhance the conspicuity of PTWs
and their riders, it indicates that the motorcyclists surveyed perceive driver culpability as stemming from lack of knowledge and through lack of respect than purely through 'lack of seeing'. Such error represents active driver behaviour rather than merely representing the result of a motorist being subjected to a collision with a PTW because the PTW was not visible enough (i.e., "passive" driver behaviour). For instance, the proportion of occasions that improvement of car driver awareness in terms of greater knowledge of the complexities of motorcycling and rider vulnerability in certain conditions was preferred as having more potential effectiveness than the daytime use of headlight and tail-light was 0.77; whilst on 84 percent of occasions the improvement of car driver awareness in terms of greater respect for motorcyclists was judged superior to the wearing of high visibility jackets.

One must accept, however, that the sample size was relatively small (although not nearly as reduced as that used by Wardle), and the sampling technique was likely to generate responses from only those riders who were journeying into a town centre during the week — and particularly during their lunch break.

One can compare the relative frequencies of moped, scooter and motorcycle operators obtained in the present study with those obtained in a larger-scale postal survey of motorcyclists by Hobbs et al. (1983). From information on 2,000 registered PTW keepers supplied by the DVLC, Hobbs et al. selected a representative sample from all the data records for Britain on an equal interval basis. This latter methodology obtained relative frequencies of 24.2 percent moped operators, 3.4 percent motor scooter operators, and 72.2 percent motorcycle operators. Hence, these proportions are comparable with those obtained in the present study (see Table 2.4.1), although a slightly higher number of motorcycles to the decrement of the moped is apparent in the latter.

Furthermore, the engine size for PTWs used in Britain in 1982 as reported in Transport Statistics Great Britain 1972-1982 is given overleaf in Table 2.6.1. If one compares these figures with the frequencies obtained in the present survey (see Table 2.4.2), the only major misrepresentation would appear to be a lack of PTWs with engine capacities of under 51 cc, and an overrepresentation of motorcycles over 500 cc. The fall in motorcycles in the 151-250 cc category and the rise of those of 251-500 cc would be expected due to the effect of the 1981 Transport Act's restriction of learners to 125 cc machines or below. This has resulted in a decline of usership in the 151-250 cc market.

The greater proportion of respondents owning large PTWs does not seem to question the validity of the results obtained, although a more accurate representation of vehicle type and user would have been desirable. Whilst no recording of age was taken in this survey, there was a definite tendency for PTWs of 125 cc and below to belong to learner riders. The intention of this exercise was to approach the motorcyclist as the 'expert' with regard to what goes on on the road in relation to PTW safety — and especially with regard to driver culpability. The respondents owning and operating larger PTWs would therefore have been more likely to be the experienced and mature rider, with correspondingly greater insight into PTW riding.
Table 2.6.1 Motorcycles, Motor Scooters and Mopeds Licensed in 1982 by Engine Size. Source: Transport Statistics Great Britain 1972-1982, Table 2.17.

<table>
<thead>
<tr>
<th>Engine Capacity of PTW</th>
<th>Absolute Frequency (Thousand)</th>
<th>Relative Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;51 cc</td>
<td>489</td>
<td>35.7</td>
</tr>
<tr>
<td>51-150 cc</td>
<td>428</td>
<td>31.2</td>
</tr>
<tr>
<td>151-250 cc</td>
<td>272</td>
<td>19.8</td>
</tr>
<tr>
<td>251-500 cc</td>
<td>81</td>
<td>5.9</td>
</tr>
<tr>
<td>&gt;500 cc</td>
<td>100</td>
<td>7.3</td>
</tr>
<tr>
<td>All Vehicles</td>
<td>1,370</td>
<td></td>
</tr>
</tbody>
</table>

3 STUDY 2: The Influence of Motorcycling Experience on Motorists' Opinions and Knowledge.

3.1 Introduction to Objectives of Research

Study 1 indicated the significance which PTW operators attach to active driver behaviour in producing potential conflict or conflict situations involving a PTW (i.e., the term 'active' is employed to stress that information processing and decision making are leading to driver behaviour as an interactive process, and when these are for some reason inappropriate they are leading to driver error). Moreover, this behaviour was interpreted by such road users as stemming from either a lack of knowledge of the complexities of motorcycling and rider vulnerability and/or through a lack of respect for motorcyclists. No indication of a preference for one interpretation over the other was evident — an almost 50/50 split being encountered in the number of times respondents ranked one above the other. Although all respondents were asked at the end of the interview if they felt that any other possible aspect of PTW accident prevention had not been covered in the questionnaire, no additional interpretation of driver culpability was given.

Such findings supported the construction of the following two possible contributing factors to inappropriate driver behaviour.

First, it was argued that a lack of knowledge about PTWs and of the complexities involved with riding a PTW for those motorists having no such experience could influence (or fail to influence) a motorists' behaviour in potential conflict situations.

Secondly, it was argued that product-user stereotypes may exist, and that such distorted and incomplete information and experience may also affect the decision-making process and/or may lead to certain attitudes and, possibly, influence social interaction and hence behaviour. With regard to motorcyclists and motorcycling, such people and activity may be viewed in a 'negative' way by motorists who have neither had PTW experience or are not a close acquaintance of a
motorcyclist, resulting in a lack of 'social awareness' towards motorcyclists on the road. (The term "negative" here does not necessarily mean "anti"; rather, it is used primarily to describe inaccurate opinions and a reduced state of deliberation when compared with a 'socially aware' motorist).

The term "social awareness" (SA) will indeed be used in this report to refer to this possible phenomenon, whilst the term "technical awareness" (TA) will apply to the former concept -- i.e., representing the knowledge gained through motorcycling activities.

The issue representing the basis of Study 2 was whether or not a reduced level of awareness (in terms of TA and/or SA) was evident in motorists without certain motorcycling experience.

3.2 Questionnaire and Procedure

In accordance with the above rationale, the various categories of the motoring population were primarily:

(a) Motorists with present or past PTW operating experience,
(b) Motorists with a close acquaintance who is a motorcyclist but no PTW operating experience,
(c) Motorists who have no PTW riding experience nor a close acquaintance who is a motorcyclist.

The criteria for group membership will not be discussed in detail here due to constraints on space, although greater consideration of the groups involved is given in Section 3.4.

A quota sampling technique was employed for the survey undertaken, attempts being made to match the groups in terms of age, sex and social class (as derived from the Government Statistical Service's Classification of Occupations 1980).

The questionnaire for the survey consisted primarily of (i) questions (direct and indirect) to investigate the respondents' TA; (ii) opinion statements relating to motorcyclists and motorcycling to which respondents were asked to state how strongly they either agreed or disagreed with a particular statement (i.e., to get a measure of SA); and (iii) a selection of descriptions of potential car-PTW conflict situations in which the behaviour of a 'culpable motorist' was described and which the respondents were asked to rate as either good driving behaviour, acceptable driving behaviour, a minor deviation from acceptable driving behaviour, a moderately serious offence, or a serious offence.

With regard to the TA items, attempts were made to consider the following 'complexities' involved with riding a PTW and knowledge of PTWs. This list was compiled after consulting a variety of motorcycling literature and viewing a Department of Transport film designed for use during the training of Ministry of Transport driving examiners.

Copies of the questionnaire are available from the authors on request.
(a) Did motorists appreciate the extent to which the PTWs encountered on the road are more powerful in terms of acceleration than their own vehicle, so that motorists' experience of acceleration may be unsuitable when planning a manoeuvre which may involve a PTW?

(b) In terms of engine capacity, what did motorists consider to be a 'small motorcycle'? (Possible implications here were that, for example, the constant approach speed -- rather than the acceleration -- of some motorcycles may be underestimated when planning a manoeuvre which may involve a PTW).

(c) Were motorists as inaccurately obsessed as some road safety researchers (e.g., Plowden and Hillman, 1984) with the idea that it is the larger PTWs, with their greater potential for speed, which are more dangerous on the road? (Thus, for example, implying the irresponsible behaviour, and/or lack of control of PTWs, by their riders as the major perceived causal factor).

(d) Did motorists appreciate that rapid and successful braking is generally harder to achieve for a motorcyclist than it is for a car driver?

(e) Did motorists appreciate how the braking performance of a PTW is reduced in wet conditions?

(f) Did motorists realise how handicapped PTWs become by various road surfaces and road conditions?

(g) Did motorists realise that a PTW travelling at speed (e.g., over 15 mph), despite its size and manoeuvrability in slow traffic, is less manoeuvrable and stable in taking evasive action than a car?

(h) Did motorists realise that it is essential that a motorcyclist makes no sudden alteration of course or speed when the PTW being operated is not directly upright (e.g., when cornering)?

The opinion statements for obtaining indications of SA were obtained from two sources. 1) Preliminary unstructured individual depth interviews involving five motorists with present PTW operating experience, five motorists with no operating or pillion experience nor a close acquaintance who rides a PTW, and three motorists with no PTW operating experience but with a close acquaintance who rides a PTW. These motorists were previously unknown to the authors and were naive to the fundamental intentions of the exercise other than it being an initial exploratory approach prior to a programme of research on motorcycle safety. Topics explored in this manner included the motorist's views on how most PTW accidents are caused, what actions there should be to help amend the situation, what the motorist thought of motorcyclists, believed the typical car driver to think of motorcyclists, believed the reason for riding PTWs to be, and in what ways car drivers differ from motorcyclists. 2) The second source of material was the PTW safety literature.

The potential conflict situations (PCSs) employed were descriptions of typical pre-multivehicle accident configurations as commonly referred to in the motorcycle literature. Some of these items were also used as indirect measures of TA if a particular aspect was not considered amenable to a more direct question.

An initial draft of the TA and PCS component of the questionnaire was completed by five driving instructors and examiners from the
Department of Transport Driving Establishment in order to ensure consensus of opinion and accuracy of the items.

The questionnaire was designed in order to try to conceal the fact that the central issue was purely one of PTW safety by placing many 'dummy' questions on other road safety matters in all sections. However, some of these additional items were also intended for analysis for comparative purposes. These were in terms of whether there were any differences between the groups with respect to 'technical awareness of car driving', and also with respect to the possibility that a respondent who may have been found to be 'negative' towards motorcyclists and motorcycling was similarly negative towards all other road users.

The entire questionnaire was therefore rather voluminous and so divided into two parts. The first part (containing the 'knowledge' items) was completed by an interviewer while interviewing the respondent on the street. Respondents were then requested to take away the second half of the questionnaire to complete by themselves in their own time and to return to Cranfield in the stamped addressed envelope provided.

3.3 Study Hypotheses

The two major hypotheses of interest in this investigation were:

1. Motorists who also operate PTWs or have had operating experience will exhibit (i) greater TA, (ii) greater SA, and (iii) will rate the behaviour of a 'culpable motorist' as more serious, in comparison with motorists without any form of motorcycling experience.

Since the data was multi-variate in nature, discriminant function analyses were to be performed. Hence this hypothesis can fundamentally be considered as stating that it is possible to discriminate between these groups in their responses to the three classes of items, and that the direction of this discrimination as indicated by relatively more accurate/favourable responses or less accurate/favourable responses will be as stated above.

2. In terms of (i) amount of TA, (ii) amount of SA, and (iii) the rating of driver culpability as a serious offence, having motorcycling experience produces greater discrimination with motorists without any form of motorcycling experience than with motorists having a close acquaintance who is a motorcyclist. However, having a close acquaintance who is a motorcyclist induces greater (i) TA, (ii) SA and (iii) ratings of seriousness of driver behaviour in comparison with a motorist having no riding experience and no close acquaintance who rides a PTW.

The basic rationale for the second hypothesis was that a PTW operator, or ex-operator, would have both TA and SA, whilst motorists with a close acquaintance who rides a PTW would only really have SA.
3.4 Group Assignment of Motorists

It was considered that some persons having a close acquaintance who operates a PTW would be likely to ride, or to have ridden, pillion on such a vehicle, thus perhaps having some TA, whilst others in this group would not. It was therefore thought necessary to distinguish two sub-groups within this grouping on the basis of pillion experience.

Sub-groups were also defined for subjects who presently operate a PTW and those who have operated a PTW in the past. This enabled further exploration. A criterion of greater than 18 months operating experience (in addition to a certain minimum frequency of winter riding) was incorporated to ensure that such subjects would reasonably be expected to have full TA.

Hence, the five major groups within the motoring population were as follows:

GROUP 1: Motorists with - no PTW operating experience
- no pillion experience
- no close acquaintance who rides a PTW

GROUP 2: Motorists with - no PTW operating experience
- no pillion experience
- a close acquaintance who rides a PTW

GROUP 3: Motorists with - no PTW operating experience
- pillion experience
- a close acquaintance who rides a PTW

GROUP 4: Motorists with present PTW operating experience and who have operated a PTW for greater than 18 months.

GROUP 5: Motorists with past PTW operating experience and who had operated a PTW for greater than 18 months.

3.5 Subjects

As with Study 1, surveying took the form of (initially) street interviews in Bedfordshire, Buckinghamshire, Devonshire, Northamptonshire and Oxfordshire. Eighty-seven percent of the sample were residing in these five counties.

The initial questionnaire was completed for, and the second part left with, 216 motorists. Of these, only 43 persons failed to complete and return the second questionnaire. Hence, complete data was obtained for 173 respondents, and this reduced sample size only affected the SA and PCS items since the car and PTW TA items were contained in the initial contact questionnaire.

Eighty-six percent (n=186) of the total sample were males. All respondents were aged between 17 and 63 years (median = 29). Thirteen percent of the total sample were classified according to occupation in social class 1, 22 percent belonged to social class 2, 45 percent social class 3, 8 percent social class 4 and 1 percent (n=3) social
class 5. Nine percent of the sample (n=19) were in full-time further or higher education, while 1 percent (n=2) were unemployed and had had no previous form of employment which could be used for classification.

3.6 Results and Discussion

3.6.1 Some Initial Comments

In presenting the major results below, an attempt to maintain a certain level of conciseness and to enhance as much clarity as is possible in a potentially complex listing of results is to be made. With an original set of five groups of respondents and some 85 variables, the comparisons possible were vast. However, in all of the following analyses, unless otherwise stated, a two- or multi-group Discriminant Function Analysis (DFA) was carried out, and the "Stepwise" method of including relevant variables employed. This in itself served to simplify the data to a desired level of meaning.

Furthermore, a quantitative report of the DFA analyses performed is avoided and only the resulting interpretations presented. However, the major discriminations are accompanied by the frequency distributions of responses to the relevant items. General observations will be made of the results with each presentation.

The results obtained are considered for each area of enquiry in turn.

The groups of respondents concerned do not, unfortunately, lend themselves to an easily definable and recognisable abbreviation, and so the terminology of "Group 1", "Group 2", ..., "Group 5" is employed. Whilst attempts are frequently made to re-describe the groups involved, the reader is reminded of the existence of Section 3.4, which should serve as a quick and easy reference for this purpose.

The quota sampling technique employed naturally meant that no prior control could be exerted on the experience of the subjects who were recruited. Unfortunately, the level and nature of the motorcycling experiences obtained did not enable an even distribution of respondents in the five groups intended for analysis. Indeed, of the 216 motorists surveyed, only nine could be assigned to Group 2 and only eleven could be assigned to Group 3. Such sample sizes were considered insufficient for consideration in the following material. Hence, by the necessary inclusion of only data for Group 1 (n=77), Group 4 (n=65) and Group 5 (n=39), it was not possible to test the second study hypothesis as stated in Section 3.3. (Fifteen of the respondents surveyed were present or past users of PTWs but had operated a PTW for less than 18 months. This makes the 216 respondents in all. This data was also unanalysed other than for a Principal Components Analysis on total driver opinion described in Section 3.6.6).

3.6.2 Equality of Group Assignment

To ensure that the groups did not differ in terms of age, sex and social class, a two-way ANOVA for the non-metric factors of sex and
social class and for the metric covariate of age was performed. No significant differences were found between the groups of drivers who completed and returned the second part of the questionnaire (i.e., 'responders').

Insignificant differences were also found for age and social class between the groups who failed to complete and return the second part of the questionnaire (i.e., 'non-responders'). (Sex was not included as it was a constant for these groups; hence, a one-way ANOVA was performed).

A comparison between 'responders' and 'non-responders' in terms of a two-way ANOVA also revealed no significant differences on the three measures involved.

3.6.3 Motorists' Knowledge of Certain Aspects of Car Driving

Group 1 (i.e., motorists having no form of motorcycling experience) could only be discriminated from any other group on one of the seven items relevant to this area of enquiry. Primary distinction could be made between this group and Group 4 (i.e., motorists who presently operate a PTW and have done so for greater than 18 months) on the basis of the item "Please list the types of road surfaces and types of road conditions that you feel can be dangerous".

The frequency distribution of responses to this particular item for Group 1, Group 4 and Group 5 is shown below. Responses are grouped according to how many dangerous road surfaces/conditions were given by respondents in each group, where "0" indicates that no answer could be given and "11" indicates that eleven such examples were given. (The replies given that were accepted and coded in this way fell into the following cases: wet roads; ice/frost/snow; loose surfaces -- e.g., gravel; mud on road; leaves; oil/diesel; road camber; metal in/on road, surface -- e.g., man-hole covers, studs, expansion plates; wet road markings; wet wood in/on road -- e.g., at level crossings; tyre rubber impregnated into road surfaces -- e.g., at heavily used junctions and roundabouts; potholes/uneven repairs, etc.).

<table>
<thead>
<tr>
<th>Number of Replies given</th>
<th>Group 1 (%)</th>
<th>Group 4 (%)</th>
<th>Group 5 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>6.5</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>1</td>
<td>11.7</td>
<td>1.5</td>
<td>2.6</td>
</tr>
<tr>
<td>2</td>
<td>35.0</td>
<td>1.5</td>
<td>10.2</td>
</tr>
<tr>
<td>3</td>
<td>27.3</td>
<td>12.3</td>
<td>30.8</td>
</tr>
<tr>
<td>4</td>
<td>13.0</td>
<td>18.5</td>
<td>41.0</td>
</tr>
<tr>
<td>5</td>
<td>6.5</td>
<td>26.1</td>
<td>12.8</td>
</tr>
<tr>
<td>6</td>
<td>0.0</td>
<td>15.4</td>
<td>0.0</td>
</tr>
<tr>
<td>7</td>
<td>0.0</td>
<td>7.7</td>
<td>2.6</td>
</tr>
<tr>
<td>8</td>
<td>0.0</td>
<td>7.7</td>
<td>0.0</td>
</tr>
<tr>
<td>9</td>
<td>0.0</td>
<td>6.2</td>
<td>0.0</td>
</tr>
<tr>
<td>10</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>11</td>
<td>0.0</td>
<td>3.1</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Thus, whilst 94% of Group 1 respondents (i.e., motorists with no form of motorcycling experience) could only give up to four types of
dangerous surface/condition, 66% of Group 4 respondents (i.e., motorists who presently operate a PTW and have done so for over 18 months) named five or more. Although Group 5 respondents (i.e., motorists who have operated a PTW in the past and did so for over 18 months) generally gave fewer replies than present motorcyclists, they were more often able to name more examples than Group 1.

For any other car related item discrimination between the three groups was not possible, thus indicating an homogeneous sample of car drivers in respect of such knowledge.

3.6.4 Motorists' Knowledge of Certain Aspects of PTWs: "Technical Awareness" (TA)

As hypothesised, several discriminations on the grounds of TA could be made. The item which made the most important contribution to discrimination was that asking for the estimated stopping distance of a "large motorcycle" in wet conditions. In comparison with Group 4, Group 1 respondents regularly underestimated this distance, despite there being no difference between these groups for their knowledge of car braking distances in wet or dry conditions. Also with regard to these two groups, Group 4 expressed more disagreement with "The bigger, more powerful motorcycles are more dangerous on the road than the smaller bikes", but agreed more often or more strongly that "The nature of the road surface is of more importance in determining the stability of a motorcycle than for a car when braking and cornering".

However, Group 1 was found to give relatively lower cc sizes as representative of "small bikes" than the group of motorcyclists, and were also less often of the opinion that "When travelling at 50 mph a motorcycle is more manoeuvrable than a car".

The frequency distributions for the three groups for these particular TA items are shown below.

<table>
<thead>
<tr>
<th>Item</th>
<th>Group 1 (%)</th>
<th>Group 4 (%)</th>
<th>Group 5 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>The overall stopping distance for a car travelling at 30mph on a dry road is about 75 feet. Would you say that the stopping distance for a large motorcycle in wet conditions would be: A. 70 feet; B. 100 feet; C. 115 feet; D. 135 feet; E. Have no idea.</em></td>
<td>70 feet: 6.5</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td>100 feet: 26.0</td>
<td>9.2</td>
<td>10.3</td>
</tr>
<tr>
<td></td>
<td>115 feet: 19.5</td>
<td>35.4</td>
<td>33.3</td>
</tr>
<tr>
<td></td>
<td>135 feet: 19.5</td>
<td>47.7</td>
<td>41.0</td>
</tr>
<tr>
<td></td>
<td>&quot;No idea&quot;: 28.5</td>
<td>7.7</td>
<td>15.4</td>
</tr>
</tbody>
</table>

The correct answer, according to figures presented by Watson et al. (1976), is in the region of 135 feet. However, whilst 83% of the motorists with present motorcycling experience (i.e., Group 4) gave the answer of either 115 feet or 135 feet, only 39% of Group 1 motorists gave either one of these replies. Almost 29% had "no idea" of the distance. Nearly 33% of Group 1 estimated the stopping distance to be 100 feet or below.

The frequency distribution for the sample of motorists having past PTW operating experience (i.e., Group 5) can be seen to be similar to that of Group 4, although relatively more respondents in Group 5 replied "Have no idea" to this question (i.e., 15% as opposed to 8%).
"Below what cc size would you consider a motorcycle to be a 'small bike'? A. Below 750 cc; B. Below 500 cc; C. Below 250 cc; D. Below 125 cc; E. Below 50 cc; F. Don't know."

Therefore, both Group 4 and Group 5 motorists more often considered 250 cc motorcycles and below as 'small bikes' than Group 1 motorists. Perhaps of more interest, however, is the fact that just over 10% of the motorists having no form of motorcycling experience answered 'Don't know' to the question.

"The bigger, more powerful motorcycles are more dangerous on the road than the smaller bikes"

"The nature of the road surface is of more importance in determining the stability of a motorcycle than a car when braking and cornering"

"When travelling at 50 mph a motorcycle is more manoeuvrable than a car"

Whilst the majority of Group 1 motorists disagreed that the larger, more powerful motorcycles are more dangerous on the road than the smaller bikes, over 10% did actually agree/strongly agree, whereas only 2% of Group 4 respondents agreed with this statement. Also, motorists who presently operate a PTW were much more likely to strongly disagree with the statement -- i.e., 48% as opposed to 10% for Group 1.

Group 5 motorists (i.e., past operators of PTWs) were also more likely to strongly disagree with this statement, although on the whole the
frequency distribution for this group resembles that of Group 1 more than Group 4 (present motorcyclists).

The majority of Group 1 agreed that the nature of the road surface is of more importance in determining the stability of a motorcycle than a car when braking and cornering; although only 87. strongly agreed whereas 40% of Group 4 and 23% of Group 5 strongly agreed with this.

Whereas more Group 1 motorists disagreed than agreed with the statement when travelling at 50 mph a motorcycle is more manoeuvrable than a car (i.e., 27% and 48% respectively), Group 4 were much more evenly split on this (i.e., 51% and 42% respectively). However, about 25% of the motorcyclists in Group 1 were uncertain on this issue, in comparison with only 8% of Group 4. Group 5 only had 5% of respondents uncertain about this statement, although the majority (56%) were in agreement that the PTW is more manoeuvrable than a car.

3.6.5 Motorists' Rating of Inappropriate Driver Behaviour in Various Potential Conflict Situations (PCSs) Involving a PTW

With regard to the responses to the PCS descriptions, it was found possible to discriminate motorists likely to have TA and SA (i.e., Groups 4 and 5) with the proposed no SA or TA group of motorists (i.e., Group 1). Such discrimination between Group 1 and the two PTW operating groups involved the PCSs in which a culpable motorist turned left into the path of a motorcyclist, turned right across the path of an oncoming PTW, or executed an action which was likely to necessitate some alteration of forces by the PTW on what was described as a "sharp bend".

Since the PCS items were contained within the second part of the questionnaire, sample size was slightly reduced for this area of enquiry: 64 motorists in Group 1, 55 motorists in Group 4 and 25 motorists in Group 5.

The frequency distributions of these three PCS items were as follows. (For each item respondents were asked to rate the behaviour of "the motorist" in the description).

"A motorist is turning out of a private drive-way in a built up area.

This is:"

<table>
<thead>
<tr>
<th></th>
<th>Group 1 (%)</th>
<th>Group 4 (%)</th>
<th>Group 5 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A serious offence</td>
<td>35.9</td>
<td>63.6</td>
<td>60.0</td>
</tr>
<tr>
<td>A moderately serious offence</td>
<td>37.5</td>
<td>27.3</td>
<td>16.0</td>
</tr>
<tr>
<td>A minor deviation from acceptable driving behaviour</td>
<td>25.0</td>
<td>9.1</td>
<td>20.0</td>
</tr>
<tr>
<td>Acceptable driving behaviour</td>
<td>1.6</td>
<td>0.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Good driving behaviour</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>
"A motorist makes a right turn from a major road into a side road in a 30 mph zone.

Before making this manoeuvre the motorist was halting traffic in his/her lane since a lorry was immediately behind him/her and so no vehicles could pass on his/her left-hand side, and also there was a persistent flow of oncoming traffic.

The turn was made when a break in this oncoming traffic occurred and the motorist saw an oncoming motorcycle which was estimated at about 100 feet (or about 7 car lengths) away from the junction.

This is:

<table>
<thead>
<tr>
<th></th>
<th>Group 1 (%)</th>
<th>Group 4 (%)</th>
<th>Group 5 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A serious offence</td>
<td>10.9</td>
<td>38.2</td>
<td>36.0</td>
</tr>
<tr>
<td>A moderately serious offence</td>
<td>26.6</td>
<td>27.3</td>
<td>20.0</td>
</tr>
<tr>
<td>A minor deviation from acceptable driving behaviour</td>
<td>23.3</td>
<td>12.7</td>
<td>28.0</td>
</tr>
<tr>
<td>Acceptable driving behaviour</td>
<td>31.3</td>
<td>14.5</td>
<td>16.0</td>
</tr>
<tr>
<td>Good driving behaviour</td>
<td>7.8</td>
<td>7.3</td>
<td>0.0</td>
</tr>
</tbody>
</table>

The latter description was accompanied with a simple diagram which indicated the position of the car driven by the motorist and the nature of the turn executed. The next item also incorporated use of a diagram to clarify the description, but in particular to show that the car involved (which was briefly stopping to drop off some passengers) was positioned on a bend and taking up most of its lane. The respondents were also informed that the road was in a 40 mph zone and:

"... Whilst stopping the motorist notices a motorcycle coming round the sharp bend behind him/her and so quickly indicates left.

This is:

<table>
<thead>
<tr>
<th></th>
<th>Group 1 (%)</th>
<th>Group 4 (%)</th>
<th>Group 5 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A serious offence</td>
<td>10.9</td>
<td>25.5</td>
<td>12.0</td>
</tr>
<tr>
<td>A moderately serious offence</td>
<td>37.5</td>
<td>25.5</td>
<td>28.0</td>
</tr>
<tr>
<td>A minor deviation from acceptable driving behaviour</td>
<td>17.2</td>
<td>29.0</td>
<td>40.0</td>
</tr>
<tr>
<td>Acceptable driving behaviour</td>
<td>23.4</td>
<td>20.0</td>
<td>16.0</td>
</tr>
<tr>
<td>Good driving behaviour</td>
<td>10.9</td>
<td>0.0</td>
<td>4.0</td>
</tr>
</tbody>
</table>

Hence, despite being presented with identical information, the motorists sampled rated the behaviour of the motorist described in these three situations in differing ways. In accordance with Hypothesis 1, the car drivers without any motorcycling experience (Group 1) were less likely to rate the potentially conflicting behaviour of the motorist as being so serious as respondents from Group 4 and Group 5.

Causing a PTW to brake by pulling out in front of it was considered a serious offence by 36% of Group 1 but by 64% of Group 4 and 60% of Group 5.

In an analysis of multi-vehicle PTW accidents occurring in Victoria, Australia, Williams (1976) reported that violations of the PTW's right of way generally occurred when the two vehicles were separated by a
distance in the order of 25-30 meters (82-98 feet) when the motorist began to manoeuvre his vehicle, and when the PTW was generally travelling at 50 kph (31 mph). However, only 11% of Group 1 motorists rated turning across the path of an oncoming PTW, which was said to be 100 feet away in a 30 mph zone, as a serious offence. (On the other hand, 38% of Group 4 and 36% of Group 5 considered the behaviour to be a serious offence). Indeed, the largest proportion (31%) of Group 1 respondents rated the behaviour described as acceptable driving behaviour.

Similarly, 11% of Group 1 considered the driver behaviour in the final PCS reported above to be a serious offence. However, whilst 26% of Group 4 believed this to be the case, only 12% of Group 5 motorists rated the behaviour in this manner. Nevertheless, whereas 66% of Group 1 considered it as either a deviation from acceptable driving behaviour or some scale of offence, 80% of both Group 4 and Group 5 rated the behaviour in this manner.

3.6.6 Motorists' Responses to the Opinion Statements: "Social Awareness" (SA)

With regard to the final major area of analysis, the exploration of responses to the opinion statements in terms of proposed differences in SA was anticipated to be more complex. This was primarily because of the size of the initial item pool. In order to cover the range of opinions and beliefs which became apparent from the in-depth interviews and existing literature it was necessary to include 40 statements on motorcyclists and motorcycling. This thus compares with just 6 PCS items, 7 PTW TA items and 7 car TA items. Furthermore, 20 of the ‘dummy’ statements relating to either car drivers, pedestrians or cyclists were to be used for possible comparative purposes. The intention was therefore to examine this comprehensive collection of measurement variables by reducing the number of these original variables into a simpler and more manageable set of meta-variables by the means of Principal Components Analysis prior to the comparisons between the different groups.

Thus, using Principal Components Analysis the 60 Likert Scale items were reduced to 15 orthogonal meta-variables which accounted for 68.1 percent of the total variance among driver opinion (N=173). Seven of these meta-variables, or factors, were references to motorcycling or motorcyclists.

An initial analysis carried out on this data was a multi-group DFA on the 15 factors.

It was not possible to discriminate between Groups 1, 4 and 5 on any of the factors relating to road users other than motorcyclists.

The major discrimination possible was again between Group 1 and Group 4. The most important contributor to discrimination was a very general factor consisting of opinions on motorcyclists and motorcycling (which will be termed "GENOPINIONS"). On the whole, motorists in Group 1 (motorists having no form of motorcycling experience) expressed less positive/more negative and more stereotyped opinions in comparison with Group 4 (motorists who presently operate a PTW and have done so
for over 18 months). This factor is addressed more specifically at a later stage below.

An ECONOMY factor was also found to discriminate these motorists. This factor consisted of the two opinion statements as shown below with their respective frequency distribution of responses.

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Group 4</th>
<th>Group 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>(%)</td>
<td>(%)</td>
<td>(%)</td>
</tr>
<tr>
<td>Very Strongly Agree</td>
<td>4.7</td>
<td>5.4</td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>7.8</td>
<td>9.1</td>
</tr>
<tr>
<td>Agree</td>
<td>42.2</td>
<td>16.4</td>
</tr>
<tr>
<td>Disagree</td>
<td>40.6</td>
<td>32.7</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>4.7</td>
<td>10.9</td>
</tr>
<tr>
<td>Very Strongly Disagree</td>
<td>0.0</td>
<td>25.5</td>
</tr>
</tbody>
</table>

"Motorcycles are mainly a popular means of transport for those who cannot afford a car"

Thus, 55% of respondents in Group 1 were of the opinion that motorcycles are mainly a popular means of transport for those who cannot afford a car, whereas 69% of Group 4 disagreed with this (one quarter of the sample very strongly disagreeing) and 64% of Group 5 were also in disagreement.

Furthermore, just over half of the motorists in Group 1 (53%) believed that motorcyclists who aren't ruffians ride more for economy than for fun, with 16% either strongly or very strongly in agreement. On the other hand, the majority of Group 4 and Group 5 motorists (85% and 64% respectively) were in disagreement. Forty-five percent of motorists who presently ride a PTW very strongly disagreed with this particular statement.

Unlike the ECONOMY factor, a third and final factor selected during the DFA did not lend itself to an obvious and convenient summary label. It was also composed of two items.

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Group 4</th>
<th>Group 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>(%)</td>
<td>(%)</td>
<td>(%)</td>
</tr>
<tr>
<td>Very Strongly Agree</td>
<td>14.0</td>
<td>7.3</td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>12.5</td>
<td>21.8</td>
</tr>
<tr>
<td>Agree</td>
<td>70.3</td>
<td>63.5</td>
</tr>
<tr>
<td>Disagree</td>
<td>1.6</td>
<td>3.6</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Very Strongly Disagree</td>
<td>1.6</td>
<td>1.8</td>
</tr>
</tbody>
</table>

"Young drivers are not necessarily the most dangerous"
"Most motorcyclists come from the lower classes"

The first item is unlike the others in that it does not refer specifically to motorcyclists or motorcycling. Indeed, little difference actually exists between the frequency distribution of responses to this statement.

However, the second item reveals that one quarter of Group 1 were in agreement with the belief that most motorcyclists come from the lower classes. Although only about 15% of motorists presently operating a PTW were in agreement with this, 20% of motorists who had operated a PTW in the past for over 18 months felt that this was indeed the case. Group 1 and Group 5 have fairly similar frequency distributions for this issue, whilst 20% of Group 4 motorists very strongly disagreed with the statement.

Since the GENOPINIONS factor was found to have the most important discriminating power between the groups of motorists but interpretation was vague due to the generality of this meta-variable (it being composed of some 21 opinion statements), this meta-variable was specifically explored for further meaning. Indeed, when a DFA was conducted on just these 21 variables a simpler picture of differences between the groups emerged.

Once again, primary discrimination was between Group 1 and Group 4. It was with respect to the statement "I like motorcycles very much". Eighty-eight percent of Group 1 were in disagreement with this statement, with 20% disagreeing either strongly or very strongly. On the other hand, only 7% of Group 4 and 28% of Group 5 were in disagreement with this; and 71% of Group 4 either strongly or very strongly agreed with the statement.

Three other variables were included in the DFA by the Stepwise analysis for their discriminating power between Group 1 and Group 5 and/or Group 4. These were:

"Motorcyclists are exhibitionists"
"Motorcyclists cannot expect equal rights with cars on the road unless they pay the same amount of road tax"

<table>
<thead>
<tr>
<th></th>
<th>Group 1 (%)</th>
<th>Group 4 (%)</th>
<th>Group 5 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Strongly Agree</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Agree</td>
<td>1.6</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Disagree</td>
<td>67.2</td>
<td>12.7</td>
<td>56.0</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>14.1</td>
<td>10.9</td>
<td>20.0</td>
</tr>
<tr>
<td>Very Strongly Disagree</td>
<td>17.2</td>
<td>76.4</td>
<td>24.0</td>
</tr>
</tbody>
</table>

"It is the speed of a motorcycle that is lethal"

<table>
<thead>
<tr>
<th></th>
<th>Group 1 (%)</th>
<th>Group 4 (%)</th>
<th>Group 5 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Strongly Agree</td>
<td>6.3</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>3.1</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Agree</td>
<td>17.2</td>
<td>1.8</td>
<td>4.0</td>
</tr>
<tr>
<td>Disagree</td>
<td>53.1</td>
<td>34.5</td>
<td>68.0</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>18.7</td>
<td>25.5</td>
<td>8.0</td>
</tr>
<tr>
<td>Very Strongly Disagree</td>
<td>1.6</td>
<td>38.2</td>
<td>20.0</td>
</tr>
</tbody>
</table>

Thus, 36% of the motorists sampled who had no form of motorcycling experience believed motorcyclists to be exhibitionists, in comparison with 20% of Group 4 and only 8% of Group 5. Twenty-four percent of Group 4 very strongly disagreed with this statement.

Although only 1% of Group 1 agreed that motorcyclists cannot expect equal rights with cars on the road unless they pay the same amount of road tax, only 31% of Group 1 motorists strongly or very strongly disagreed with this statement, in comparison with 87% of Group 4 and 44% of Group 5.

Finally, a greater range of response occurred to the issue of speed of a motorcycle perhaps being its potentially lethal attribute. Whilst 98% of Group 4 and 96% of Group 5 disagreed with this (many very strongly), 27% of Group 1 agreed with the statement, of which nearly 10% agreed strongly or very strongly.

4 GENERAL DISCUSSION

Study 1 indicated how a sample of PTW operators perceived driver culpability and the potential effectiveness they considered direct driver improvement to have alongside rider training and the other preventive countermeasures given. The motorcyclists considered the measures to improve the active behaviour of both other vehicle operators and novice PTW operators as having the greatest potential for reducing PTW accidents. Indirect attempts to improve other vehicle driver behaviour by increasing the conspicuity of PTWs and their riders was not considered to have the potential effectiveness as directly improving both the level of motorists' knowledge of PTWs and the level of respect for their users. In addition, therefore, the results supported an interpretation in terms of TA and SA when approaching the problem of other vehicle driver error in the vicinity of a PTW.
Furthermore, Study 2 has indeed shown some motorists to be lacking in certain aspects of TA and SA (to the extent that such concepts were adequately presented and can be considered measurable in the questionnaire study undertaken). The first hypothesis given in Section 3.3 has been supported in that it was possible to discriminate between a sample of the motoring population on the basis of their motorcycling experience. For each area of enquiry it was possible to discriminate between motorists who have no form of motorcycling experience and motorists who presently operate a PTW and have done so for over 18 months. Moreover, these were chiefly the primary distinctions to be made in each case, although Group 5 respondents often produced frequency distributions which were similar to Group 4 and in contrast with Group 1.

Although Group 5 produced responses which were similar to Group 4 more often than they resembled Group 1, it is perhaps not surprising that slight differences between the views of present and past operators of PTWs were apparent on some issues. One would expect differences of opinion since, for some reason, one motoring sub-population had persisted in PTW usage whilst the other, although similar in basic demographic variables, had decided to stop.

The major discriminations possible with regard to both TA and SA would seem to have obvious implications for decision-making processes and social interaction between motorcyclists and non-motorcyclists on and off the road.

For example, it would appear that motorists without any previous motorcycling experience are unaware of, or fail to appreciate the dangers inherent in, certain road surfaces and conditions. It could be argued that some of the cases recorded cannot be considered dangerous to the occupant of a four-wheeled vehicle (e.g., man-hole covers). Nevertheless, it is important that the operators of other vehicles are aware of the limitations of PTWs under various circumstances so that they can accurately predict the paths of PTWs in the traffic stream, interpret their behaviour correctly in making necessary judgements, and be in a position to modify behaviour accordingly so as to cause events which have the best possible outcome for all vehicles/persons concerned. Furthermore, the questionnaire survey was stated to be on road safety in general and was geared more for the car driver than the PTW operator. However, despite such attempts to ensure that the motorcyclists involved were responding as car drivers rather than as motorcyclists for certain items, the listing of dangerous road surfaces/conditions would indicate that Group 4 (and Group 5 to a lesser extent) were 'thinking as motorcyclists' during this exercise. It therefore seems likely that such enhanced deliberation may also occur in such motorists when actually operating a four-wheeled vehicle.

Incorrect perceptions of a PTW's stopping power in the wet also have obvious implications for potential conflict situations involving PTWs and cars. Furthermore, since PTW braking is so dependent on the nature of the road surface and the amount of traction afforded, knowledge of the many dangerous road surfaces/conditions that influence braking and stability would appear essential for reliable error-free driving in the vicinity of a PTW.
It was not surprising that, when directly asked to consider whether or not the nature of the road surface is more important in determining the stability of a motorcycle than a car, the majority of Group 1 respondents decided that the single track vehicle must be less stable. However, only 8 percent strongly agreed, as opposed to 40 percent of Group 4. That the motorcycling population felt it necessary to strongly agree with this particular TA item may once again indicate a greater level of awareness and appreciation which would be likely to continue into the day-to-day driving of a car.

That motorists without motorcycling experience consistently underestimated the stopping distance of a 'large motorcycle' in wet conditions (whereas Group 4 and Group 5 respondents did not) was particularly surprising. This is because these three groups could not be discriminated on the grounds of replies given to an item asking "About how many car lengths are required for stopping a car travelling at 50 mph?", and an item asking the extent to which the gap between a car and the vehicle infront should be increased on wet roads. For the latter item the majority of all respondents correctly reported that it should be at least doubled (71% of Group 1, 77% of Group 4 and 79% of Group 5). Despite knowing this and being supplied with the stopping distance for a car in dry conditions, a very large proportion of motorists in Group 1 (80%) gave an inaccurate answer to this particular TA item on PTW stopping power.

One cause of PTW right-of-way violations and accident involvement is likely to be an incorrect estimate of the PTW's approach speed on the part of the other vehicle driver. This in turn may sometimes be attributable to the other vehicle driver failing to recognise the PTW as a high performance vehicle (e.g., incorrectly processing information about a 'moped' rather than a 'motorcycle', or 'bicycle' rather than 'moped'). The item asking respondents to indicate which cc size-and-below they considered to represent a 'small bike' was therefore included to determine whether motorists without motorcycling experience tended to inaccurately consider high performance motorcycles (e.g., of 250 cc-and-above) as 'small'. This could perhaps result from the inability to compare the cc size and performance of cars with the smaller engine capacities of PTWs. However, it was found that, contrary to this expectation, Group 1 tended to give smaller cc sizes as indicative of a 'small bike' than either Group 4 or Group 5. Of course, this does not necessarily mean that the Group 1 motorists would have been able to recognise the different cc sizes when viewed in the traffic stream; and the extent to which such motorists appreciate the range of performance and diversity within this group of vehicles remains unanswerable at present.

In an investigation of drivers' speed judgement of oncoming motorcycles conducted by Nagayama et al. (1980), an initial experiment consisted of a speed anticipation task involving various vehicle types. Subjects were seated in a car which was parked against the approaching traffic flow, on the edge of the road. They could only view a particular vehicle for a duration of two seconds and when it was 100 meters in the distance. Subjects were required to press a response key just as they judged the vehicle to have passed in front of them. Subjective speed could be calculated since a timer was started when the target vehicle passed the 100 meter point and was
stopped by the subject’s response. Nagayama et al. found no significant difference for the subjective approach speed of vehicles when they were either motorcycles, cars or trucks.

A second experiment involved a modification of the gap acceptance methodology. Subjects were seated in a car which was parked on the edge of a road at a right angle to approaching traffic. These subjects observed vehicles approaching from the right (this would be from the left in Britain) and indicated, again by means of a response key, the time when they would not consider it safe to pull out and cross the road. The time interval between a subject’s judgement of the ‘last safe moment’ and the arrival of the target vehicle represented the subject’s critical gap time.

Results showed that critical gap size was significantly smaller for motorcycles than both for cars or trucks, whilst there was no significant difference in critical gap time for cars and trucks. Taken in conjunction with the finding of the first experiment, Nagayama et al. therefore argued that explanations on the basis of a difference of a perceptual factor of subjective speed for approaching vehicle types were not possible and that they should be attributed to a nonperceptual factor such as a decision criterion.

Hence, although Group 1 respondents in the present study did not have inaccurate basic perceptions of cc size of a PTW and its classification as a small bike, other decision criteria, which may be influenced by TA and SA, will no doubt influence the driving response. Indeed, the different sub-populations of the present sample of motorists were found to respond differently to the rating of driver behaviour in potential conflict situations with PTWs. This indicated that the presence or absence of motorcycling experience was associated with these ratings. As stated in Hypothesis 1 (Section 3.3), in comparison with Group 4 and Group 5, Group 1 motorists were less likely to consider the behaviour of a motorist in such situations as such a serious offence or even as a deviation from acceptable driving behaviour. This must be assumed to be because in interpreting the description given to them, Group 1, unlike Group 4 and Group 5, considered accident involvement to be less likely to take place, and/or considered the consequences of such an accident to be less serious. A role for TA and SA in making such assessments is apparent. Decisional criteria were necessary in this exercise and were seen to differ as hypothesised.

In final consideration of the present findings in relation to TA, 10 percent of Group 1 were actually unable to select from the multiple choice answers a cc size-and-below which they felt represented a ‘small bike’. Also, 25 percent of Group 1 were uncertain as to whether a motorcycle is either more or less manoeuvrable, in comparison with a car, when travelling at 50 mph. It would thus appear that such motorists would not be in a position to make quick, reliable judgements and predictions of a PTW’s behaviour in the potential conflict situations where such knowledge would be necessary to aid the motorist.

A review of the motorcycle literature reveals that a PTW travelling in excess of 10-15 mph is considered less stable and manoeuvrable than a four-wheeled vehicle (e.g., Foldvary, 1967, p. 49; Messiter, 1972, p.
However, the motorcycling population of motorists sampled were split on this issue and it was actually Group 1 respondents who more often tended to disagree that the motorcycle is more manoeuvrable. Thus, whilst one quarter of the sample in Group 1 must be considered technically unaware with regard to this particular aspect of motorcycling, the remaining motorists in the group were appreciative of the fact — indeed, more so than Group 4 and Group 5.

An important aspect which must be considered in research on other driver culpability is the issue of 'lack of respect for motorcyclists' which arose from Study 1 and which the motorcyclists surveyed felt strongly about in terms of accident causality. The possibility of a lack of respect is covered by (but by no means represents in entirety) the concept of SA presented in Section 3.1.

Again in accordance with Hypothesis 1, it was possible to discriminate Group 1 motorists on the basis of certain of the opinion statements. The frequency distributions of responses provided for these items indicate the extent to which such discrimination represents a 'negative' versus a 'positive' stance on a particular belief.

Implications of 'respect' are evident in the opinions for which discrimination was possible. For example, over half of the respondents with no motorcycling experience (Group 1) believed the buying and running of motorcycles to be cheap and to be the primary motivation for riding a motorcycle — especially if the motorcyclist is not considered to be a 'ruffian'. This therefore strongly contrasts with the views of the majority of past and present motorcyclists and must be considered an inaccurate and gross generalisation in view of the leisure interest involved with motorcycling and the far from inexpensive purchasing and running of the medium to high performance machines. Also, notions of all PTWs being on the road because of economy, and thus perhaps the inability to afford other motorised transport, may well induce feelings that the PTW (and rider) is in some way inferior and perhaps influence interactions with such vehicles/people. (Furthermore, 25% of Group 1 agreed that most motorcyclists belong to the lower classes, and a similar argument may exist here). Indeed, Wilde (1976) has argued how social factors will influence a driver's subjective estimate of danger and has reported evidence for a role played by prestige characteristics of car drivers in their decision making in relation to other motorists.

Issues of 'liking of motorcycles', 'motorcyclists as exhibitionists', 'equal rights' and 'speed of motorcycles' were also important for primary distinction between Group 1 and Group 4. The latter two issues are of particular interest.

In recognising the active role of other vehicle drivers in PTW accident causation, Johnson (1969) and Buchanan et al. (1982) have argued the need to inform car drivers of the motorist's high incidence of culpability in PTW accidents and the typical traffic situations in which car-PTW collisions often occur. By believing that it is the speed of a motorcycle that is lethal, over 25 percent of Group 1 motorists were apparently indicating the belief that speed is very largely, if not primarily, associated with accidents. It would certainly appear that it was assumed that PTW accidents commonly occur.
on the faster roads, and perhaps also indicated the belief that culpability must primarily be attributed to the PTW operator rather than any other road user. However, many analyses of PTW accidents have shown that the majority of accidents (including those resulting in rider fatalities (e.g., Henderson, 1970)) involve another vehicle violating the right-of-way of a PTW when the PTW is travelling in the order of 30 mph (e.g., Williams, 1976; Whitaker, 1980; Hurt et al., 1981). Some motorists without motorcycling experience may therefore be lacking the awareness that driver culpability is a major cause of PTW accidents.

It was surprising that relatively few motorists in Group 1 felt the need to 'very strongly disagree' with the statement 'motorcyclists cannot expect equal rights with cars on the road unless they pay the same amount of road tax' (although only one respondent actually agreed with this opinion). Buchanan et al. (1982) and Fleming (1982) have reported that some attempts to improve motorcycle safety by educating other road users via public information campaigns have actually been implemented in parts of the United States. In view of the latter finding in the present study it is therefore interesting to note the theme of such public information efforts. Buchanan et al. (pp. 19-20) have stated that "Efforts to use the mass media have centred on TV and radio spots, posters and special publications designed to foster a concept within drivers of sharing the road safely with motorcycles"; and argued that "Material in high school driver education courses should impress upon potential drivers that motorcyclists have the same rights as all other drivers ...". Similarly, Fleming (p. 5) reported that "In 1980, the Department of Transportation launched an information and education program aimed at convincing the other driver that motorcycles and mopeds are legitimate motor vehicles with a legal right to use the roads and streets of Wisconsin." During an official Motorcycle Safety Awareness Month in this State, more than seven million brochures were distributed as part of this programme, having the slogan "Equal Rights for Motorcycles".

It should be emphasised, however, that relatively few of the 40 opinion statements were selected for their discriminatory power and that on the whole the motorists without motorcycling experience of any kind responded to the opinion statements in a positive manner (i.e., not wishing to generalise or stereotype motorcyclists in a negative way). A review of all of the responses to the Likert items for the three groups did not take place in the present report since the central aim, with regard to Study 2, has been that of presenting the results in relation to Hypothesis 1 stated in Section 3.3. Hence, only areas in which major discriminations between the groups involved were evident were described (although, of course, issues with which all groups agreed/disagreed are of additional interest). Although certain discriminations on the basis of the opinion statements were possible and do appear to have important consequences with regard to the social interaction which takes place between all road users, the problem encompassed by the concept of lack of SA is apparently much more subtle than that of markedly inappropriate attitudes.

Nevertheless, a point which must be borne in mind is the problem of sampling which was encountered in Study 2. First of all, the respondents were persons who (a) were willing to stop and listen to a male conducting a survey of some kind in a town centre, (b) agreed to
stop for five minutes to answer questions on road safety in the
knowledge that a second part to the questionnaire existed, (c) were
willing to take away this second half to complete, (d) actually
completed this latter part in at least 20 minutes of their own time
and (e) posted it back to the authors. Hence, considerable selection
of possible respondents must have taken place. Therefore, the sample
size was not only small (173 for the SA aspect of the investigation)
but also particularly non-representative. Only certain types of
person would have been willing to take part in the survey; and these
may not necessarily be the kind of persons whom motorcyclists
experience displaying dangerous behaviour in their vicinity on the
road, or perhaps even indicate a 'lack of respect' off the road. That
any discrimination was found at all within such a sample, in
particular for the SA and PCS items, must therefore be taken as an
important finding.

A study of European attitudes towards motorcycling which included a
sample from Great Britain has previously been undertaken (Marton,
1982). The seven European countries in which the research was carried
out were found to form three groups in terms of the image of
motorcycle users amongst non-users. Marton (p. 120) reported that the
first group included Great Britain, Holland and Sweden. It was found
to be "... tolerant towards motorcycles and with no fear of
motorcyclists ... The second group, showing a large amount of fear and
intolerance, consists of France, Belgium and Spain. The third group,
with balanced opinions and neutral attitudes, comprises only Germany."

Initial fieldwork was conducted on a sample (n=800) of the French
population who were not themselves motorcyclists. Marton (p. 120-121)
reported that "The main conclusion from the first stage of the
research was that motorcyclists are stereotyped by others (people who
have no personal experience of motoring and who do not own or use
motorbikes) as a threat to human beings (rape, death, suicide).
Motorbikes are regarded as polluting the environment (noise,
destruction of nature); and it is felt that motorcyclists and their
motorbikes are on the road for pleasure, whereas car drivers use the
road by necessity."

However, France, unlike Britain, was finally placed in the
'intolerant' grouping and so is apparently representative of an
extremely negative stance towards motorcycling. Also, the present
investigation in Britain found 'economy' to be the overwhelming
opinion among non-motorcyclists with regard to motivations for PTW
usage. In addition, Marton was vague in defining exactly what the
experiences of the persons sampled were. In the above quotation it is
evident that the sample was one having no experience of any form of
motorised transport (although this was not necessarily always the
case), and so any generalisation to the possibility of a lack of SA in
car drivers without motorcycling experience would seem dubious.

To obtain a suitable questionnaire for larger distribution, the French
data was factor analysed. The final European data consisted of Likert
attitude scales on four statements: "I like motorcycles", "Motorcycles
are a constant danger on the roads", "Motorcyclists are undisciplined"
and "I feel threatened by motorcyclists". As Marton admitted, there
was no way to determine whether these four items covered all of the
opinions of respondents in the other countries. Indeed, from the
qualitative work and fieldwork conducted during the present research, this would appear to be a very limited picture of the dimensions and content of such attitudes for motorists in Britain. Marton's four statements were included in the questionnaire used in the present investigation. However, only one of these (I like motorcycles very much -- changed slightly because Marton reported that very positive attitudes were the most discriminating in his study) was selected during the DFAs conducted.

Additionally, Marton's attitude survey did not consider the likely possibility that attitudes and opinions to motorcycling may differ if one has a close acquaintance who operates a motorcycle.

These caveats aside, consideration will be given to the main findings specific to the British sample (n=962). According to Marton (p. 124) the degree of sympathy towards motorcyclists in Britain is not high overall and is conditioned by sex, age and community size. "It is considerably lower in big cities than elsewhere. Middle classes are, on the whole, less enthusiastic than upper and lower classes. Danger is considered more important by women than by men, by lower classes than by the upper classes, by inhabitants of big cities and by old and inactive people."

Four distinctive groups were revealed after factor analysis: "Men under 25 years, lower class, living in medium size towns, with positive attitudes and free of the fear of danger ... People between 25 and 45, living in rural communities and holding mildly positive attitudes ... Women who dislike motorcycles and consider motorcyclists in a mildly negative way ... People over 45 living in big cities who strongly dislike motorcycles and consider that they are dangerous on the roads. Inactive people in big cities also display their fear of aggression by motorcyclists" (ibid.).

Inclusion of Marton's four statements was obviously necessary in the present survey. (Also, sampling took place in towns of reasonably similar size). Furthermore, since Marton reported sex, age and social class differences in his data, the need for an exploration in these terms on the data for Group 1 was indicated (since this was the class of road user for which the nature and extent of SA was of most interest and probably most resembled Marton's sample). However, whilst this was intended, the sample sizes for such sub-populations were insufficient to warrant such analyses. A quota sampling technique was necessary to match groups once the basic age, sex and social class representations of Group 4 were known (i.e., the motorcycling population of motorists remains undefined in such terms and so such a sampling technique was necessitated). This resulted in only eight females and only six respondents over the age of 45 in Group 1.

Thus, several important analyses were not possible due to unfortunate limits upon sample size. Moreover, it was not possible to test Hypothesis 2 because of similar constraints. Of the 216 motorists interviewed, only 20 (9%) could be assigned to either Group 2 or Group 3.
This problem would not be easy to overcome. In addition to the need for quota sampling because no adequate sampling frame was in existence, the need for interviews for completion of the first part of the questionnaire was necessary since the exploration of TA required a series of knowledge questions. Obviously, knowledge items were not amenable to a self-completion procedure, where the absence of an interviewer removes the control on respondents being unable to look up, or consult others for, the answers. An exploration of Hypothesis 2 is still required, particularly since Hypothesis 1 was supported and the second hypothesis serves to explore further the possible existence of TA and SA with different levels of motorcycling experience. It seems unlikely that motorists having a close acquaintance who is a motorcyclist represent quite such a small sub-population in reality. Nevertheless, sufficient resources to enable a sample size capable of presenting adequate data for these two sub-populations would be required.

5 RECOMMENDED AREAS FOR FUTURE RESEARCH

Continued deliberation in terms of lack of TA and SA and their possible contribution to driver error in certain motorists is thus supported. Brief attention will therefore be given to the major areas in which research in such terms could develop.

5.1 Driver Performance and Technical and/or Social Awareness

A need which now becomes particularly apparent is for an indication that a lack of TA and/or SA is associated with driver culpability. The only way in which this could be adequately investigated would be to analyse actual multi-vehicle accident data and to obtain relevant information on the other vehicle driver involved in the collision/encounter. With such data available, the existence of a relationship between lack of TA and/or SA of a motorist and accident involvement with a PTW could be tested. For example, in keeping with the rationale of Study 2, motorists classified as belonging to "Group 1" would be expected to be overrepresented in this data, whilst Group 4 and Group 5, and perhaps Groups 2 and 3, would be underrepresented.

5.2 Exploration of the Decision Making and Risk Taking Behaviour of the Motorist

An investigation into the role of TA and/or SA in decision-making and risk-taking processes would necessitate the obtainment of behavioural data in controlled, experimental settings.

The findings in Study 2 for the rating of driver behaviour in potential conflict situations indicated that motorists without motorcycling experience have different decision criteria to those motorists with motorcycling experience. The assumption made in Section 4 was that relative absence/presence of TA and/or SA influenced the decisions which were made during this exercise. Laboratory manipulations could allow further insight to be gained on whether or not this was actually the case; and, if so, which aspects of TA and/or SA (or any other possible contributor to driver
behaviour) influence the decision-making processes in a variety of potential conflict situations involving a PTW.

Laboratory manipulations would be enabled by means of a driving simulator and by obtaining measures of, for example, estimated speed of approaching vehicles, magnitude of gap acceptance at simulated intersection manoeuvres, or critical gap acceptance as employed in the study by Nagayama et al. (1980) described in Section 4. By varying the motorcycling experience of the motorists taking part in the exercise, the information available to subjects, and certain features of the potential conflict situation presented it would seem possible to dissect and assess the processes of decision-making and social interaction which lead to driver behaviour.

Such a series of experiments would be critical for obtaining a thorough comprehension of driver culpability so that efficient production of countermeasures could take place.

5.3 Countermeasure Development

In view of the high involvement and level of responsibility of the motorist in PTW accidents, efficient countermeasures are required to help protect the PTW rider (and also the other vehicle driver by avoiding accident involvement). In conjunction with existing moves for more emphasis upon rider training/education and improvements in vehicle and road design, a more comprehensive safety programme would result and would thus be better able to tackle the variance which exists in PTW accident causality.

Three major directives with regard to countermeasure development appear to be open once the nature and role of TA and/or SA and/or other contributing factors are better understood. These correspond to the main methods available for inducing behavioural change -- i.e., (i) education, (ii) training and (iii) enforcement -- and can be summarised as follows.

5.3.1 Driver Education

An investigation into and development of a relevant driver education programme to increase, for example, TA and/or SA in those persons presently holding a full driving licence. Particular emphasis would need to be on the necessary content of, and exposure to, the education programme with respect to short and long term efficiency.

5.3.2 Driver Training

An investigation of present methods of car driving instruction, with particular emphasis on the possibility of introducing components to effect an increase in, for example, TA and/or SA. Again, content and exposure would be critical issues. Also, the suggestion made to the authors by representatives of TRRL (Wells, 1984) would be of relevance here, this being an examination of persons training drivers (and riders) in terms of what attitudes/knowledge they have concerning other classes of road user and the extent to which they pass on their attitudes/knowledge.
5.3.3 Evaluation of a Role for Enforcement in Improving Driver Behaviour

Once the social psychology and decision-making processes leading to inappropriate driver behaviour in the vicinity of a PTW are more fully understood, an investigation of whether this driver culpability is at least partly amenable to change through legislation directed to protect the PTW rider may be indicated. Hence, attempts to obtain official legal recognition of the involvement and responsibility of motorists in PTW accidents may be necessitated.

The study by Hurt et al. (1981, p. 421) referred to in Section 1 concluded the following: "One impression developed during this research, and encountered in many motorcycle accident investigations throughout the various states, was the lack of punitive action for the culpable driver of the other vehicle involved in the accident with the motorcycle. The outward appearance is that the offending driver is rarely faced with effective prosecution of right-of-way violation, negligent or reckless driving causing injury, or even vehicular manslaughter. Often there is the incorrect impression of excess speed or recklessness of the motorcycle rider. In most cases there is not an adequate collection of evidence and accurate reconstruction of the accident because of the police traffic accident investigator's unfamiliarity with motorcycle accident analysis. Many times there is simply the impression that 'this was just another motorcycle accident'. This lack of effective punitive action needs research for a more precise definition of the problem and evaluation for accident countermeasures."

A similar state of affairs may exist in Britain. Thus, the increased understanding that would result from the programme of research outlined above would also seem likely to enable a move towards proposals having the potential to remedy this possible situation.

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