HOW PEOPLE SIT IN CARS: IMPLICATIONS FOR DRIVER AND PASSENGER SAFETY IN LATERAL COLLISIONS - THE CASE FOR ADVANCED RESTRAINTS.

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ABSTRACT

This paper reports on how front seat occupants sit in cars relative to the B-pillar and cant rail. Car occupants were filmed unobtrusively in the United States (U.S.) and the United Kingdom (U.K.). The results showed that 10.9% of drivers in the U.S., 2.9% of passengers in the U.S., and 7.2% of U.K. passengers had the top of the head level with or above the level of the cant rail. In addition, it was found that 42% of U.K. front seat passengers, 27.5% of U.S. front seat passengers, and 18% of U.S. drivers sit with their shoulder in line with or rearward of the B-pillar. The findings of this study clearly have implications for occupant safety in a side impact, and give support to an advanced restraint approach to side impact protection.

OCCUPANT PROTECTION IN A LATERAL COLLISION is aimed largely at protecting the head and thorax from impact with the vehicle interior. Research has shown that life threatening or severe injuries sustained in side impacts often occur to the chest, abdomen and head (Håland et al., 1993), and Håland (1994) concludes that an effective side impact protection system should protect the chest, abdomen, head, legs and neck areas. In addition, Kompass (1995) suggests that the head and upper body should be restrained in a side impact. An early attempt at side impact protection was the introduction of energy absorbing structures and padding. It has been found, however, that padding has not been as effective in lowering the Chest Viscous Criterion (Lau et al., 1986) as compared to the Thoracic Trauma Index (NHTSA, 1990), (Deng & Ng, 1993), and it does not reduce lateral displacement of the head relative to the side window as effectively as airbags. In addition, padding is not as economical as stored airbags in terms of space (Håland, 1994). Consequently, the concept of the side airbag is currently popular as a side impact protection device.

The fact that there is a minimal amount of space available in which to deploy a side airbag means that the latest developments in side impact protection have comprised small volume airbags aimed to protect specific areas of the body (Scholpp, 1994; Kompass, 1995). In terms of head protection, three solutions are currently at the forefront of design. Test results show that they would undoubtedly mitigate head injuries, but they are not without their limitations. Conventional head bag systems, located within the head restraint or cant rail have been criticized for not preventing lateral head flexions and neck injuries, since once the window glass has shattered the airbag is often no longer supported (Kompass, 1995). Similarly, the inflatable 'curtain', proposed by Håland (1994) efficiently addresses the problem of lateral flexion, but may not protect the head from impacting the B-pillar and cant rail. Further, the 'ITS bag' proposed by Kompass (1995) is also inadequate as it is designed on the basis of dummy eye positions and this practice has been questioned by Parkin et al. (1993), who found that eye positions of U.K. drivers are significantly further forwards than those of dummies used in crash tests under Federal Motor Vehicle Safety Standard (FMVSS) 208 (Bacon, 1989). Clearly there is a need to improve side impact protection, and to be most effective, future designs should address occupant sitting position as this is a very important factor in determining the risk of the occupant contacting metal structures of the vehicle.

The fact that the initial seated positions of car occupants affects the extent and type of their injuries has meant that several studies have attempted to place drivers spatially within their vehicles. Schneider et al. (1991), and Meldrum (1966), for example, attempted to quantify drivers' eye positions in post-driving conditions and during laboratory driving simulations. Similarly, Robbins et al. (1983) measured subjects in a 'standardized driving posture', with a fixed seat back angle, and data from this research now forms the basis of current dummy positioning in crash tests specified by FMVSS 208. In addition, Perchard (1994) demonstrated in a laboratory-based study that there is a relationship between the anthropometric size of drivers and the way they choose to sit in relation to the vehicle interior. With respect to driver sitting positions, however, very little research has been carried out in driving situations where the drivers are unaware of the fact that they are involved in a study. Nevertheless, Parkin et al. (1993) examined the sitting positions of drivers in the U.K. under such conditions and found that the positions adopted by real drivers appeared to differ greatly from the standard sitting positions assigned to Hybrid III dummies in crash tests. Consequently, since dummies do not appear to represent the real driver population in terms of head position, considerable doubt is thrown upon the practice of using conventional dummy positions in the design process. There is a need, therefore, for more research in this area to examine different car occupant populations. In particular, no work as yet has investigated the sitting positions of front seat passengers, despite the fact that they are not restricted by the driving task and are, therefore, less predictable. In addition, attention should be directed towards car occupants outside of Europe. In the U.S., for example, differences in occupant antropometry and in the vehicle fleet may have important implications for occupant safety in crash situations. Observational research investigating occupant sitting positions is, clearly, vital to the design of effective side impact protection devices for the real front seat occupant population.

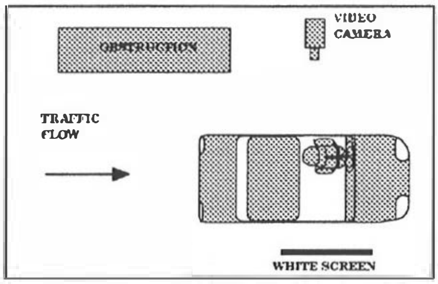
AIMS AND OBJECTIVES The aim of this work is to examine the sitting positions of front seat passengers in the U.K., and drivers and front seat passengers in the U.S., in the context of a purely lateral collision. Ultimately this research aims to supplement that of Parkin et al. (1993) by providing a comprehensive pool of internationally useful data which can be used in the design of advanced restraints.

METHODOLOGY

The method was based upon that used in the previous study of Parkin et al. (1993), which investigated the sitting positions of drivers in the U.K.. The field work took the form of three studies and examined front seat passengers in the U.K. and the U.S., and also U.S. drivers. The procedures used were essentially the same, but they were adapted for left-hand drive cars in the U.S..

FIELD SET-UP - A video camera equipped with a high speed shutter (1/2000 sec) was used to film occupants in cars which passed in front of a white screen. The camera was placed at right angles to the traffic flow at a height level with the mid point of the side window for an average vehicle, and this is shown, using U.S. drivers as an example, in Figure 1.

Figure 1 - Experimental Set-Up

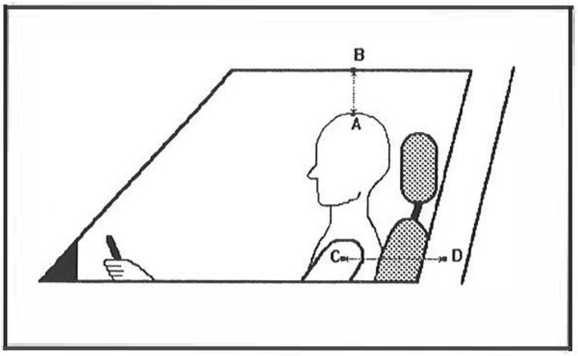


VIDEO ANALYSIS & CALIBRATION - Measurements were taken from a stilled video image on a television monitor. The dimensions recorded were the distance from the top of the head to the cant rail (A-B), and from the shoulder to the centre of the B-pillar (C-D) (see Figure 2).

The measures recorded were then converted to more useful dimensions. Initially a scaling factor, based upon the known dimension of B-pillars, was applied. A correction factor was also applied, and this was taken from Parkin et al. (1993) who used the same equipment and procedure as that used in this study. Since on-screen measures were found to be between 1% and 11% greater than actual values, the value of the correction factor was -6%, and this brought the level of accuracy of results to within +/- 5%. Once scaled and corrected, these measures were then converted geometrically into the final measures used in the analysis and these are listed below.

- The distance between the top of the head to the cant rail.
- The distance between centre of shoulder and centre of B pillar.

Figure 2 - Details of Measurements Recorded



VEHICLE SAMPLE - The sample of cars analyzed in the U.S. comprised 39 make/models selected on the basis of popularity. This was derived from sales figures from the preceding 2 years, and all vehicles were under 9 years old at the time of filming. The U.K. car sample was the same as that used by Parkin et al. (1993) and comprised 19 make/models also selected on the basis of popularity. For each study, the vehicle populations were broken down into size categories such that the vehicle range was representative of the car population. In total, 2935 cars were analyzed (see Appendix A).

OCCUPANT CHARACTERISTICS - Since the occupant population was self generating, occupant characteristics could not be controlled but were simply recorded in the video analysis. Only adults were included, and age was classified as 'young' if the occupant looked to be aged between 16 and 34 years, 'middle-aged' if between 35 and 55, and 'elderly' if over 55 years. Tables 1 and 2 show how the vehicle occupant population was comprised across both gender and age.

Table 1 - Vehicle Occupant Population by Gender

Gender	U.K. Front Seat Passengers	U.S. Front Seat Passengers	U.S. Drivers	Total
Male	367 (36.7%)	325 (35.0%)	576 (57.2%)	1268 (43.2%)
Female	633 (63.3%)	603 (65.0%)	431 (42.8%)	1667 (56.8%)
Total	**1000**	**928**	**1007**	**2935**

Table 2 - Vehicle Occupant Population by Age

Age	U.K. Front Seat Passengers	U.S. Front Seat Passengers	U.S. Drivers	Total
Young	482 (48.2%)	531 (57.2%)	524 (52.0%)	1537 (52.4%)
Middle Aged	379 (37.9%)	311 (35.5%)	387 (38.4%)	1077 (36.7%)
Elderly	139 (13.9%)	86 (9.3%)	96 (9.5%)	321 (10.9%)
Total	**1000**	**928**	**1007**	**2935**

RESULTS

HEAD TO CANT RAIL - The results relating to the distance between the head and the cant rail are shown in Table 3. In addition to mean distances, 99th percentile male values are listed since these give an indication of the extremes that should be accounted for in the design process. In all cases, the value of 0 represents a position where the head is level with the rail.

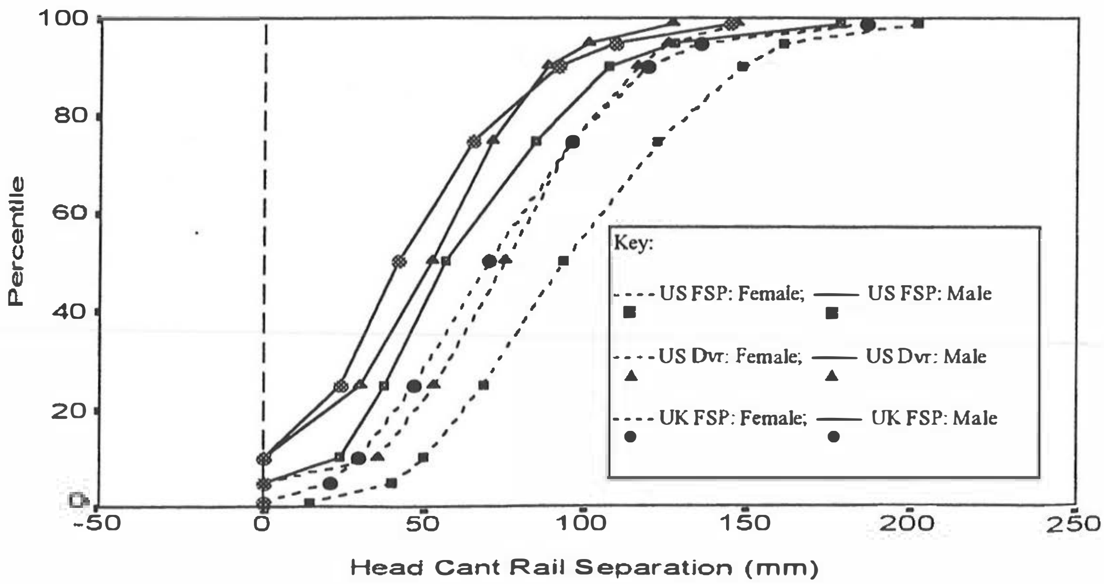
Table 3 - Head to Cant Rail Separation

Population Group	99th %ile Male	Mean	Std. Dev.
U.K. Passengers	0mm	63mm	38mm
U.S. Drivers	0mm	61mm	34mm
U.S. Passengers	0mm	85mm	42mm

An Analysis of Variance (ANOVA) was used to examine the effect of population characteristics on head to cant rail separation, and this technique was also used to investigate vehicle characteristics.

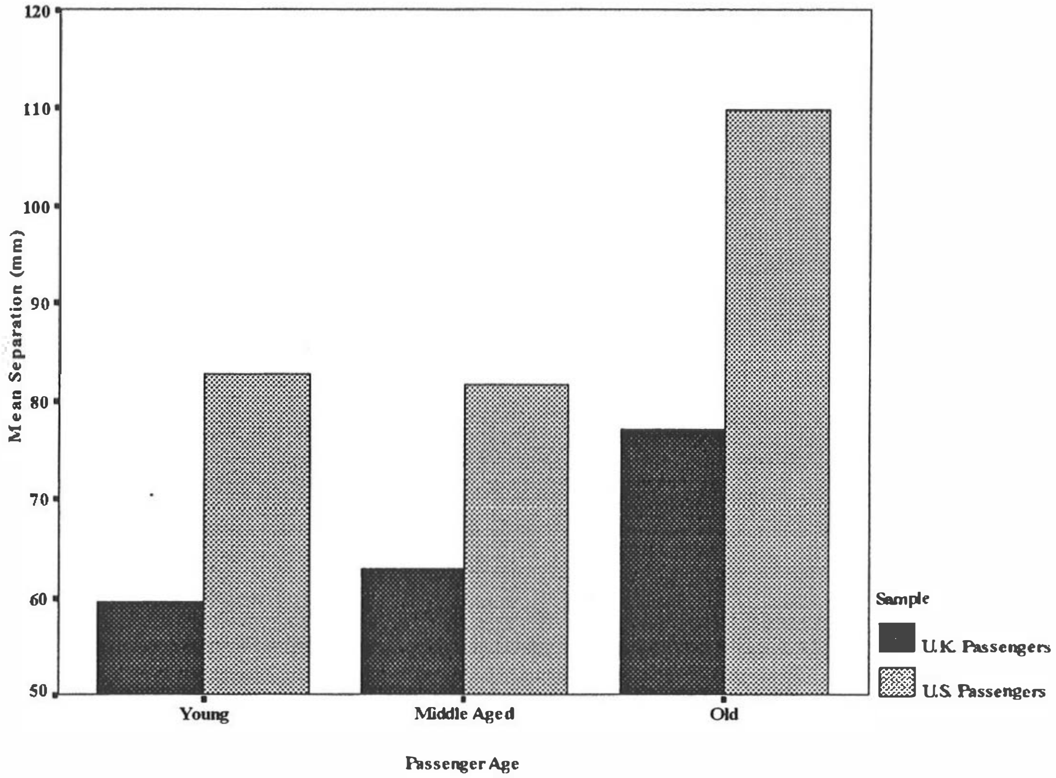
Occupant gender was found to significantly affect separation for U.S. drivers ($F(1,1006) = 79.75$, $p<0.01$), and also passengers in the U.S. ($F(1,927) = 84.82$, $p<0.01$), and in the U.K. ($F(1,999) = 85.93$, $p<0.01$). In each case, male occupants had less separation between the head and the cant rail than female occupants (see Figure 3), and in fact, just over 15% of all male drivers, as opposed to 5% of female drivers, were observed with the top of the head level with the rail. Similarly, the relevant figures for U.S. passengers were 7.1% of males compared to 0.7% of females, and in the case of U.K. passengers, 15.5% of men compared to only 2.4% of women were observed to have no separation between the top of the head and the cant rail.

Figure 3: Head to Cant Rail Separation by Sample and Gender



Similarly, occupant age was also significant in affecting head to cant rail separation for each sample. In the case of U.S. drivers, middle aged members of the population were found to be sitting in closer proximity to the cant rail than young or senior members ($F(2,1006)=7.40$, $p<0.01$). Conversely, in the case of passengers in the U.S. ($F(2,927)=10.69$, $p<0.01$), and in the U.K. ($F(2,999)=13.10$, $p<0.01$), older people were seen to sit further from the cant rail than young or middle aged people, and this is shown in Figure 4.

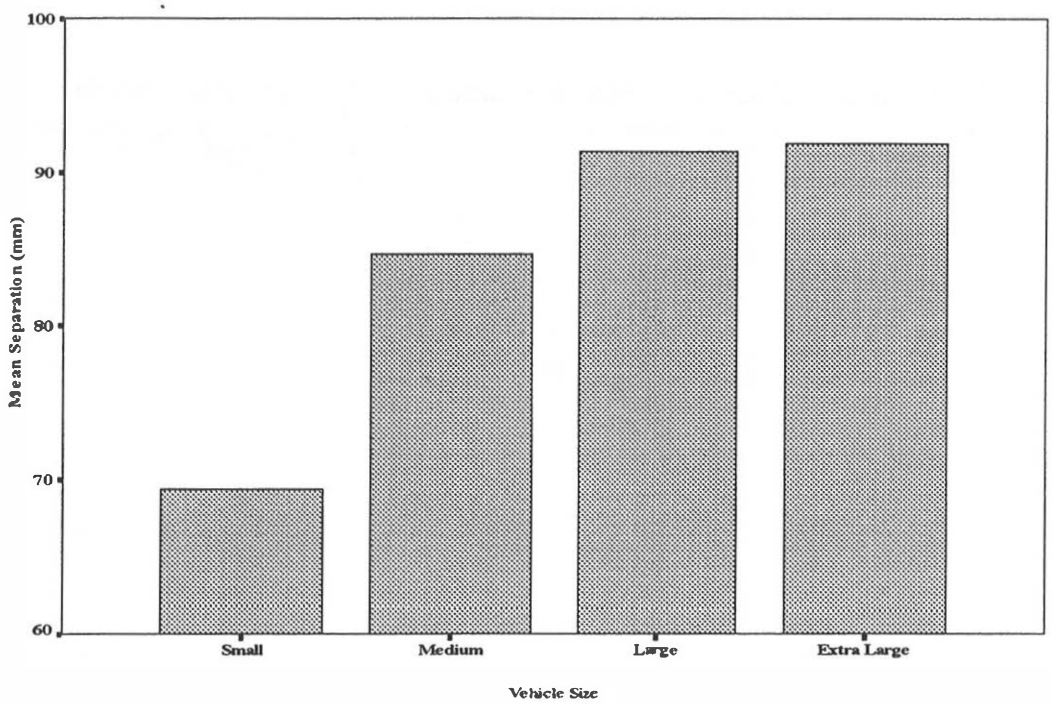
Figure 4 - Head to Cant Rail Separation by Age: U.S. and U.K. Passengers.



Characteristics of the vehicle were also significant in affecting separation for each population group. It was found that for drivers in the U.S. ($F(3,1006)=6.93$, $p<0.01$), and front seat passengers in both the U.S. ($F(3,927)= 10.19$, $p<0.01$), and the U.K, ($F(2,999) = 21.22$, $p<0.01$), vehicle size has a significant bearing on the distance between the head and the cant rail, such that occupants in smaller cars had a smaller separation than those in larger vehicles. The effect of vehicle size is illustrated for U.S. passengers in Figure 5.

In addition, the number of doors a vehicle had also significantly affected head to cant rail separation for U.S. drivers ($F(1,1006)=12.55$, $p<0.01$), U.S. passengers ($F(1,927) = 7.65$, $p<0.01$), and also passengers in the U.K. ($F(1,512) = 4.26$, $p<0.05$). In the case of drivers, separation was greater in 5 as opposed to 3 door cars, whereas for passengers, the reverse was true.

Figure 5 -Head to Cant Rail Separation by Vehicle Size:



SHOULDER TO B-PILLAR - The results relating to the distance between the shoulder and the B-pillar are shown in Table 4. In addition to mean distances, 99th percentile male values are listed since these give an indication of the extremes that should be accounted for in the design process. In all cases a value of 0 represents a position where the shoulder is level with the B-pillar.

Table 4 - Shoulder to B-Pillar Separation

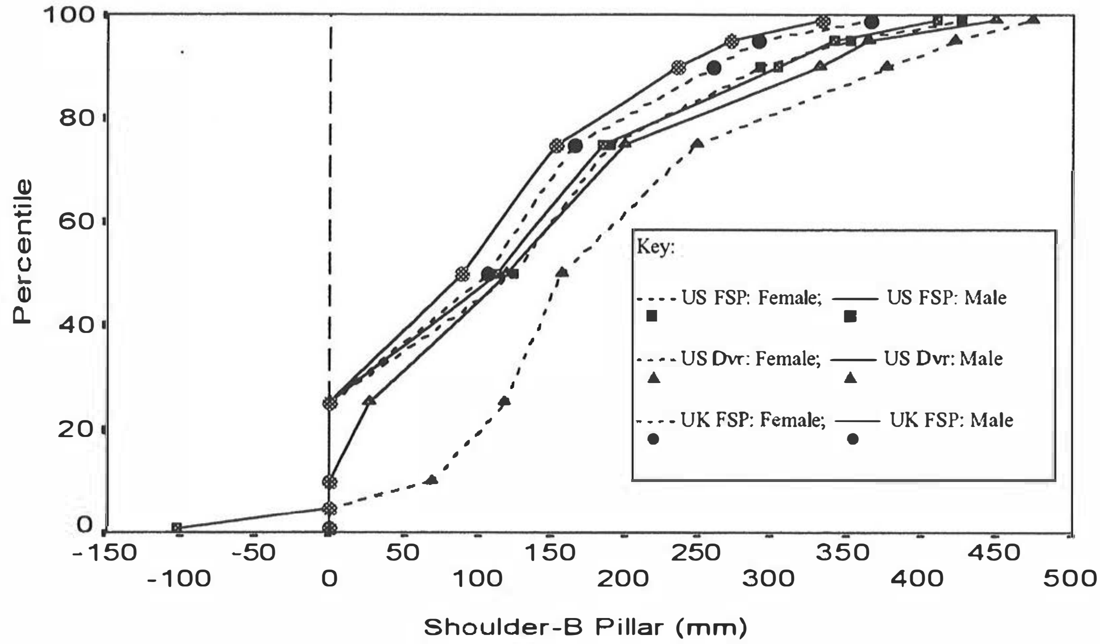
Population Group	99th %ile Male	Mean	Std. Dev.
U.K. Passengers	0mm	98mm	101mm
U.S. Drivers	0mm	159mm	121mm
U.S. Passengers	-102mm	129mm	113mm

Further, it was observed that overall, 18% of U.S. drivers, 28% of U.S. passengers, and 42% of U.K. passengers were sitting with the shoulder in line with or rearward of the B-pillar.

An Analysis of Variance (ANOVA) was used to examine the effect of population and vehicle characteristics on shoulder to B-pillar separation.

Occupant gender was found to significantly affect separation for only drivers in the U.S. (F(1,1006) =19.46, $p<0.01$), and passengers in the U.K. (F(1,999) =4.26, $p<0.05$). In these population groups, males were seen to sit closer than females to the pillar and this is shown in Figure 6.

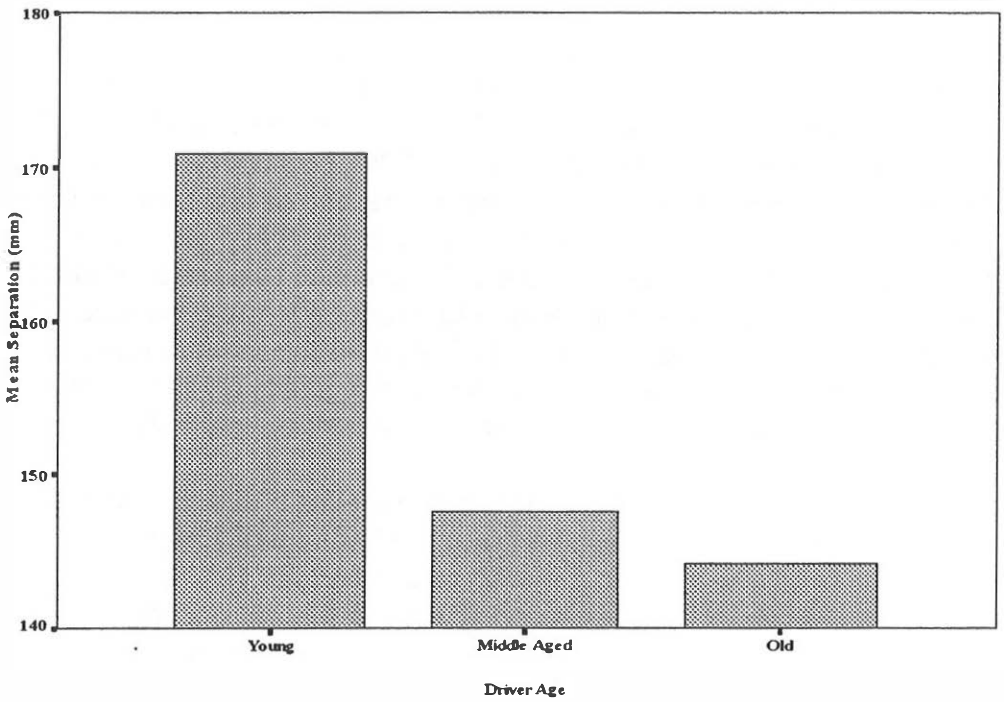
Figure 6: Shoulder to B-Pillar Separation by Sample and Gender



Occupant age was also significant in affecting shoulder to B-pillar separation, but only for U.S. drivers (F(2,1006)=4.43, $p<0.05$) such that young drivers were further from the pillar than middle aged or old drivers (see Figure 7).

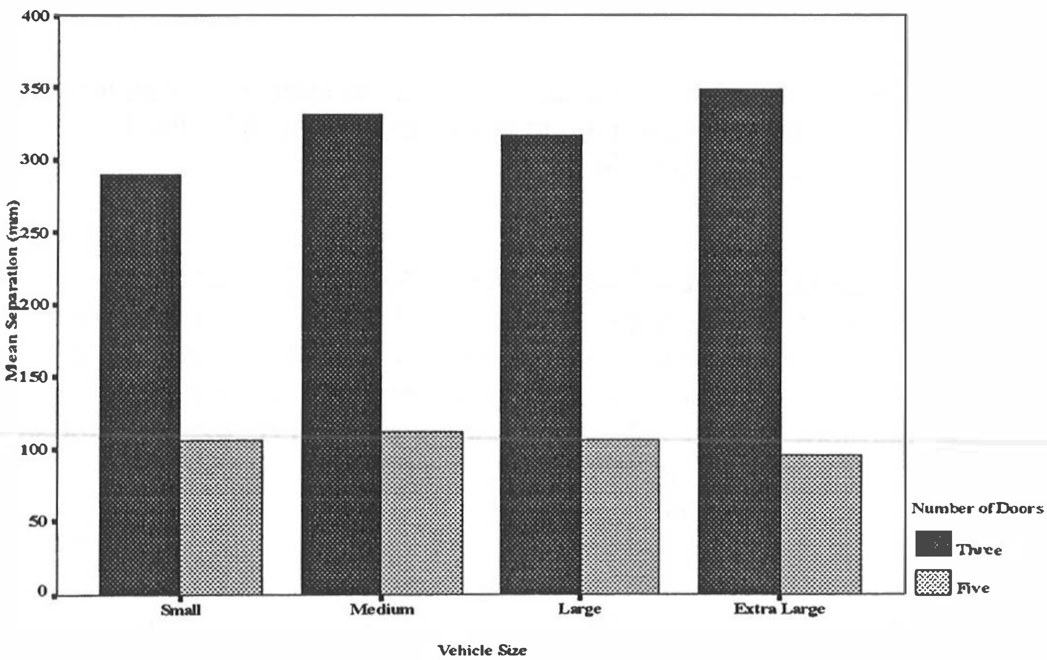
An ANOVA also showed that vehicle size had an effect upon distance to the B-pillar for U.S. drivers (F(3,1006)= 21.19, $p<0.01$), U.S. passengers (F(3,927)= 2.91, $p<0.05$), and U.K. passengers (F(2,999)= 94.56, $p<0.01$). Broadly speaking, the separation was found to increase with increasing vehicle size. In the case of U.S. passengers, however, the relationship between shoulder and B-pillar was found to be anomalous, since the expected increase in separation was not seen in the large category.

Figure 7 - Shoulder to B-Pillar Separation by Age: U.S. Drivers



Finally, the number of doors a vehicle had also affected shoulder to B-pillar separation. In the case of U.S. drivers ($F(1,1006)=1377.47$, $p<0.01$), U.S. passengers ($F(1,927) = 659.84$, $p<0.01$), and U.K. passengers ($F(1,512) = 409.12$, $p<0.01$), the distance was smaller in five as opposed to three door cars. The effect of vehicle characteristics is shown for U.S. drivers in Figure 8.

Figure 8 - Shoulder B-Pillar Separation by Size & Door Number: U.S. Drivers



DISCUSSION.

TOP OF HEAD TO CANT RAIL SEPARATION - In the event of a side impact, the distance between the head and the cant rail has a large effect upon the risk of head injury in that it determines the risk of a head strike occurring. The results of this study show, therefore, that 2.9% of passengers in the U.S., 7.2% of those in the U.K., and 10.9% of drivers are at risk of a head strike and a subsequent head injury. In addition, the figures show that passengers in the U.K. were at greater risk than those in the U.S., and it is suggested that this may be explained by the greater proportion of small cars found on roads in the U.K.. Further, it was found that within the U.S. population, drivers were at greater risk than passengers of a head strike, and this is likely to reflect an altered physical attitude taken by drivers to access vehicle controls.

The factors affecting head to cant rail separation were both occupant and vehicle characteristics, and this is in line with the findings of Parkin et al. (1993), who found that the head to cant rail separations of U.K. drivers were primarily affected by the individual characteristics of the car occupant. Within each sample, males had the head closer than females to the rail, and this probably relates to generally accepted differences in stature and seated height. Indeed, in the case of U.S. drivers, 15.3% of men as compared to 5.1% were women were observed with the head level with or above the cant rail. Differences in stature, together with postural changes can also explain the fact that older passengers were observed to be further from the rail than those in the middle aged or young categories. The results also showed that occupants in small vehicles were closer than those in large vehicles to the cant rail, and this clearly reflects the spatial limitations within small cars. Finally, the number of doors a vehicles had also affected the separation. In the case of drivers, those in three door cars were closer to the rail, whereas for passengers the reverse was true.

Clearly, therefore, the car occupants most likely to sustain a head injury in the event of a lateral collision are men in the young and middle aged categories, and particularly those in small cars.

CENTRE OF SHOULDER TO CENTRE OF B-PILLAR - The distance between the shoulder and the B-pillar also has a large effect upon injury risk in a side impact, in that it determines the risk of the occupant contacting the rigid pillar and sustaining an injury to the head or upper body. The results of this study show, therefore, that 27.5% of passengers in the U.S., 42.1% of those in the U.K., and 18% of drivers are at risk of a contact and a subsequent injury. The figures also show that passengers in the U.K. were at greater risk of contacting the pillar than those in the U.S., and again it is suggested that this may be explained by the greater proportion of small cars found on roads in the U.K.. Further, it was found that within the U.S. population, passengers were at greater injury risk than drivers, and this is likely to reflect a more forward position taken by drivers to access vehicle controls. Passengers, on the other hand, are able to sit in as rearward a position as they choose.

The factors affecting shoulder to B-pillar separation were both occupant and vehicle characteristics but differed between the populations assessed. In the case of drivers, males were seen to be closer than females to the pillar. More specifically, one quarter of all male drivers compared to 9% of female drivers were seen to be sitting level with or rearward of the pillar, and this is in line with the results of Parkin et al. (1993), who found that approximately 25% of the U.K. male driving population could contact the B-pillar in the event of a purely lateral collision. Further, the finding that shoulder to B-pillar separation can be predicted in part by driver gender is also in accordance with Parkin et al. (1993), and this is likely to reflect differences in stature brought out by the requirement to access vehicle controls. Driver age was also important such that young drivers were on average 2.5 cm further from the pillar than middle aged and older drivers, and this may relate to differences in choice of vehicle for these age groups, which were be examined in this study. In the case of passengers, males in the U.K. were seen to be closer to the pillar than females, but otherwise, occupant characteristics were not important in determining passenger shoulder to B-pillar separation. In the case of both the U.S. and the U.K. front seat passenger populations, all age groups appeared to be equally at risk from contact with the B-pillar in the event of a lateral collision.

The results also showed that vehicle characteristics, particularly the number of doors a vehicle had, were important in determining the risk of head or shoulder contacts with the B-pillar in the event of a lateral collision. Within each sample, occupants in small vehicles were closer than those in large vehicles to the B-pillar, and again this clearly reflects the spatial limitations within small cars. Further, for each sample, occupants in five door as opposed to three door cars were closer to the pillar. In the case of drivers, those in three door vehicles were seen to sit on average 22cm further from the B-pillar than those driving five-door models, and where front seat passengers are concerned, shoulder to B-pillar separations are 16-17cm greater in three as opposed to five door cars. In fact, this effect is so marked that in the U.S., front seat passengers across the whole range of vehicle size categories were significantly more at risk from contact with the B-pillar in a side impact if they were seated in a five door as opposed to a three door model. This result differs from that of U.K. front seat passengers in that those seated in 'small' three door cars were at greater risk than those in 'large' five door vehicles. The reason for the increased risk in five door cars is suggested to reflect the fact that three door vehicles typically have a larger front seat passenger door and consequently a more rearward B-pillar than vehicles with five doors.

Clearly, therefore, in the event of a purely lateral collision, the drivers most likely to sustain an injury-inducing shoulder or head impact with the B-pillar are men in the old and middle aged categories, and particularly those in small five door cars. In the case of passengers, those at most risk are passengers in small five door vehicles.

IMPLICATIONS FOR RESTRAINT DESIGN- Recently developed devices for occupant protection in a side impact are the inflatable curtain (Håland, 1994), and the 'ITS' bag (Kompass, 1995), and these have been shown to have some potential in reducing the incidence and severity of head injuries. As previously stated, however, the effectiveness of these devices depends to a large extent on their positioning within the vehicle. The results of this study, therefore, showing how drivers and front seat passengers sit relative to the cant rail and B-pillar, have important implications for restraint design.

Firstly, the results support those of Parkin et al. (1993) in throwing doubt upon the positions assigned to dummies in crash tests. In particular, in the case of front seat passengers, the results show that longitudinal sitting position cannot be predicted on the basis of gender or age population norms, and this throws doubt upon current design which assumes a relationship between the positions of crash test dummies those of passengers. The fact that a 5th percentile female member of the U.S. front seat passenger population may choose to sit in the most rearward seat position, clearly violates the assumptions made by the designers. It is suggested, therefore, that basing any restraint design upon dummy positions may not adequately reflect reality since the positions observed in reality appear on the whole to be further rearward and closer to the cant rail than the positions assigned to equivalent dummies. Further, these two studies show that occupant head positions are generally subject to a large amount of variation and movement, which is not characteristic of dummies used in crash tests.

In addition, the present research shows that a large proportion of the front seat occupant population are likely to contact the cant rail or B-pillar in a side impact, and this highlights a safety requirement which future designs should address. Indeed, 2.9% of passengers in the U.S., 7.2% of those in the U.K., and 10.9% of drivers were observed to have the top of the head level with or above the level of the cant rail. Clearly, therefore, designers of future side impact protection devices should recognise the necessity for head impact protection to extend into the roof structures. Similarly, 18% of U.S. drivers, 27.5% of U.S. passengers, and 42.1% of U.K. passengers were observed to be sitting with the shoulder level with or rearward of the centre of the B-pillar. Again, therefore, future restraint designers should, recognise that protection must be given against impact with the B-pillar, and this highlights the limitations of door mounted airbags, particularly for a large number of occupants in the U.K.. Instead, an airbag mounted in the seat itself is more likely to offer increased safety to a larger proportion of car occupants. This could ensure optimum protection for all occupant sizes in all seat positions, independent of the position of the occupant relative to the door, and such a system is already in production in Volvo cars (Pilhall et al, 1994).

Finally, the current research shows that there is wide variation in the sitting positions of front seat car occupants, and this also has implications for restraint design. There are differences in the sitting positions taken by drivers as opposed to passengers, and by occupants in the U.K. as compared to those in the U.S.. For example, in both the U.S. and the U.K., front seat passengers tend to have larger head to cant rail separations than drivers. In a side impact, therefore, passengers are less likely than drivers to make a head contact with the cant rail, but could pass underneath some proposed inflatable side impact devices. Similarly, it is more likely to be members of the front seat passenger population who sustain injurious contacts with the B-pillar during a lateral collision, than members of the driving population. Further, within each population group there are differences in sitting positions as a result of occupant gender and age, and also of vehicle characteristics. There is, therefore, a need for restraint designers to take the differing sitting positions of front seat passengers and drivers into account when designing side impact protection. In addition, for optimal safety, future restraints should attempt to address variable occupant and vehicle characteristics, and this has led to the concept of advanced restrains. One possibility is the use of automatically adjusting restraints which could address occupant characteristics. For example, occupant head position could be monitored continuously, and the restraint characteristics could then be tailored accordingly which would also address the problem of protecting occupants who are temporarily out of position. In addition, characteristics of the vehicle could be addressed by the restraint by being incorporated into the initial design process. More specifically, attention must be paid by designers to protecting occupants of small 5-door vehicles, who, with significantly smaller shoulder to B-pillar and head to cant rail separations, appear to be more at risk from impacting interior metal side structures than occupants in any other vehicle type.

In general, therefore, these findings reiterate the need for design based on data pertaining to real vehicle occupant populations as opposed to dummies with assumed sitting positions. In addition, this research leads to a consideration of an advanced restraint approach to side impact protection, which could take into account the large differences between the driver and the front seat passenger in terms of sitting position. Further work is, however, required to examine other members of the passenger population such as juvenile front seat passengers, and passengers in the rear. In addition, the interaction of vehicle size and door number with individual occupant factors needs to be investigated in more detail. Finally, more work is needed to establish head and thorax position in relation to the side structures of the vehicle interior in the lateral plane.

CONCLUSIONS

• 7.2% of front seat passengers in the U.K., 2.9% of front seat passengers in the U.S., and 10.9% of U.S. drivers sit with the top of their head level with or above the level of the cant rail.

• The position of drivers and front seat passengers in relation to the cant rail is determined by both occupant and vehicle characteristics.

• 42% of front seat passengers in the U.K., 27.5% of front seat passengers in the U.S., and 18% of U.S. drivers sit with the centre of their shoulder in line with, or rearwards of the centre of the B-pillar.

• The position of the driver in relation to the B-pillar is largely determined by both occupant and vehicle characteristics, whereas the position of the front seat passenger is predominantly dependent upon vehicle characteristics.

• Drivers in the U.S. sit similarly to drivers in the U.K. in relation to the cant rail and B-pillar, but U.S. front seat passengers sit further from the B-pillar and the cant rail than U.K. front seat passengers

ACKNOWLEDGEMENTS

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APPENDIX A - Vehicle Populations

Table 1: U.K. Passengers

Make/Model	Size	Freq.
Citroen BX	3	31
Ford Escort Mk3	1	62
Ford Escort Mk4	1	86
Ford Fiesta	1	78
Ford Sierra	3	160
Ford Granada	3	36
Peugeot 205	1	54
Peugeot 405	3	40
Rover 200/400	2	108
Rover 800	3	18
Rover Metro	1	70
Rover Montego	2	78
Vauxhall Astra	2	30
Vauxhall Carlton	3	18
Vauxhall Cavalier	3	78
Vauxhall Nova	1	29
Volvo 7 Series	3	8
VW Golf	2	9
VW Polo	1	7
Total		**1000**

Table 2: U.S. Drivers & Passengers

Make/Model	Size	Freq. (Drivers)	Freq. (Pass.)
Acura Integra	2	18	16
Acura Legend	4	22	8
Buick Century	3	15	9
Buick Le Sabre	3	11	10
Cadillac De Ville	4	5	18
Cadillac El Dorado	3	0	5
Cadillac Seville	3	0	5
Chevrolet Cavalier	2	35	30
Chevrolet Corsica	2	6	9
Chevrolet Lumina	3	4	6
Chrysler Le Baron	2	7	4
Dodge Intrepid	4	1	2
Dodge Neon	3	13	9
Ford Escort	2	55	37
Ford Mustang	2	7	9
Ford Taurus	3	93	64
Ford Thunderbird	4	9	6
Geo Prizm	1	8	9
Honda Accord	3	158	152
Honda Civic	2	11	87
Lexus ES	2	2	3
Lincoln Town Car	4	8	12
Mazda 626	2	18	13
Mazda Protege	2	17	12
Nissan Altima	2	14	14
Nissan Maxima	3	16	18
Nissan Sentra	2	45	38
Oldsmobile Achieva	2	5	5
Oldsmobile Ciera	3	27	16
Pontiac Grand Am	2	23	23
Pontiac Grand Prix	3	7	6
Toyota Camry	2	89	112
Toyota Corolla	1	95	98
Toyota Paseo	1	2	4
Toyota Turcell	1	32	25
VW Golf	1	11	13
Volvo 7 Series	3	7	10
Volvo 8 Series	3	7	5
Volvo 9 Series	3	4	6
Total		**1007**	**928**

Size:
1=Small
2=Medium
3=Large
4=Extra Large