

**THE ROYAL SOCIETY FOR THE PREVENTION OF
ACCIDENTS**

**MOBILE PHONES AND DRIVING:
A LITERATURE REVIEW**

AUGUST 1997

INTRODUCTION

RoSPA has been actively campaigning since 1997 about the dangers posed by drivers who continue to drive whilst placing, receiving or holding conversations on a mobile phone. The campaign is based on an analysis of all the available evidence - RoSPA has reviewed a comprehensive collection of academic research papers on mobile phone use by drivers. This article summarises the main issues raised by the research.

The mobile phone industry is growing rapidly - with the annual number of new mobile phone subscriptions in the USA being greater than the birth rate in the last few years. The massive increase in mobile phone use is mainly due to the plummeting cost of purchasing a mobile, with some phones even being offered free with phone network subscriptions.

RoSPA is concerned, however, that as mobile phones are often sold with in-car kits included in the package, people may be encouraged to use their phone whilst driving. Doing this can distract drivers and result in accidents which could have been avoided otherwise.

Though mobile phones have several benefits, the evidence suggests that 'driver distraction' (including the driver's use of hands-held or hands-free phones) is the largest single contributory factor for all 'tow-away' collisions in the USA.

Researchers specialising in driver attention, behaviour and the analysis of road traffic accidents have had substantial reservations about mobile phone use by drivers for the last twenty-eight years, leading to several countries e.g. Brazil, Israel and Australia, and some USA states, imposing legislation against the use of mobile phones by drivers.

THE TYPES OF DISTRACTION FROM MOBILE PHONES

Drivers can be distracted by mobile phones in two ways - physically or mentally.

Physical Distraction

When using a mobile phone whether hands-free or hands-held, drivers are forced to move their hands off the steering wheel and their eyes off the road when placing or receiving calls on a mobile phone. This is known as 'physical distraction', as the use of the phone is interfering directly with the driver's focus on the main task of driving.

Physical distraction is obviously far greater with hands-held systems, since drivers have to steer and change gear with one hand as they hold the handset to their ear during a conversation with the other hand. Note-taking, looking through papers, map-reading, lighting and smoking a cigarette, using the car stereo, eating and drinking are some of the other things which drivers have also attempted to do when using a hands-free or hands-held mobile whilst driving.

Mental or Cognitive Distraction

Even though 'physical distraction' alone would seem to increase the likelihood of a collision, researchers have also identified 'cognitive distraction'. Cognitive distraction occurs when a driver is concentrating hard on something other than driving the car and this fact alone may be responsible for the majority of accidents where a driver is using a phone.

Although most people can think of other things when driving, researchers have found that as soon as drivers start to think that the driving conditions are easy or straightforward, their attention to the road lapses and they are actually more likely to have an accident.

Since 1969, researchers have been concerned that driving mobile phone users are more vulnerable to this form of distraction than other drivers, as conversations on a mobile phone in the car are more likely to be business-related, urgent and intense than conversations with passengers. This has led to some researchers stating that:

'It is clear that the effect of cellular phone use on operation of automobiles is not confined to the direct interference involved in attempting to handle equipment and is therefore not a concern that will disappear with widespread adoption of hand-free systems'.

McKnight and McKnight (1993:264)

THE DISTRACTION AFFORDED BY CAR RADIOS

Representatives of the mobile communications industry have argued that the use of a mobile phone whilst driving poses no more of a threat to road safety than the operation of a car radio.

Research has been conducted into the relative distraction of operating a car radios and mobile phones, although every study reviewed by RoSPA suffers a major drawback in the way the use of a car radio is tested.

Researchers have tested the level of distraction for drivers when they use a radio by asking them to use 'a continuous turning knob' on the dashboard, to locate stations or signals which were not pre-set. RoSPA argues that the majority of cars on the roads are now more likely to be fitted with radios which have pre-set channels and in many cases automatic radio signal detection facilities. These facilities enable drivers to search through radio stations with far less distraction than by turning a 'continuous tuning knob' to hunt for channel signals which have not been pre-set - some manufacturers even position radio controls so that hands do not have to be removed from the steering wheel.

The value of studies which investigate radio tuning in this way must be questioned as they are so dissimilar to today's driving conditions. Such studies may be referring to a far higher level of distraction from an outmoded means of radio use which has since been deliberately redesigned by most stereo manufacturers to reduce the level of distraction. Studies comparing mobile phone use against modern radio systems would be more meaningful, but have not yet been done.

THE DISTRACTION AFFORDED BY PASSENGERS

One criticism of RoSPA's stance on hands-free mobile phone systems is that a driver holding a conversation on a hands-free system is no more distracted from driving than if they were chatting to a passenger in the car.

A number of studies have been published which have investigated this issue and they have found that significantly less effort was required to maintain an intelligent conversation with a passenger than with a colleague when using a carphone.

This is confirmed by measurements of the drivers' heart rate (a physical measure of driver stress) which has been found to be significantly higher in drivers during mobile phone conversations than in conversations with passengers. Drivers have also rated a conversation held on the mobile phone when driving as being more stressful than with a passenger.

Differences were also noted in the conversations between the driver and passenger and between driver and phone caller in terms of intonation and timing of speech. It has been established that passengers monitor the traffic as well as the driver and so modify the delivery and content of their speech accordingly (e.g. ceasing to talk if they see that the driver is having to concentrate on a particular traffic situation). Passengers also warn drivers of hazards which they had not noted.

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Researchers have pointed out that people calling a driver on a mobile phone are not able to see the traffic situation and argue that this is one of the reasons for the increased stress for the driver. Drivers attempt to maintain the flow of conversation in a style suited to normal stationary conditions, but which is inappropriate for the constantly changing demands on their attention from the driving environment.

Stressed drivers have been shown to be more likely to be involved in an accident, thus the use of any in-car equipment which is not essential for guiding the car and where use is linked with increased stress should be avoided when driving.

HOW DRIVING PERFORMANCE ALTERS WITH USE OF MOBILE PHONES

Research studies have assessed the effect of mobile phones (hands-held or free) on specific aspects of driving performance.

Lateral Position

'Lateral position', is the vehicle's position in relation to the centre of the lane in which they are driving. The majority of research indicates that lateral position is adversely affected by mobile phone use, with one researcher calculating that one out of every nine vehicles tends to veer out of lane when the driver places a call on a mobile phone. It has also been found that a driver's lateral position varies significantly when manually placing a call using a phone keypad on a hands-held or hands-free system - even when driving on a straight road with no other traffic.

Speed

It has been noted that drivers tend to reduce their speed when driving and using a mobile phone, which indicates that the driver is experiencing difficulty maintaining their attention on driving as normal.

Braking and Reaction Times

Braking response and overall reactions are slower in drivers using a mobile phone, regardless of their age. A driver's ability to react to changes in the speed of the vehicle in front is also reduced by 0.6 seconds to the point where it:

'... could well be relevant in emergency situations'.

Brookhuis et al (1991:315)

Negotiating Gaps

Drivers tend to try to drive through gaps smaller than their car when using a phone compared to driving without using a phone. This has obvious implications for road safety.

Workload

'Workload' refers to the amount of mental effort which a person has to expend in order to complete a task correctly. Drivers of all ages rated driving as having a higher workload and to be more frustrating when using a mobile phone.

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Drivers also rate the workload of using a phone during driving as greater than when not using a phone - regardless of whether the phone was hands-held or hands-free.

Attention To Safe Driving

Drivers using a mobile phone are less likely to check their mirrors in a busy 'ring-road' urban condition than any other road situation. Arguably this is the condition in which drivers should be using their mirrors most often in order to negotiate traffic safely.

Collisions

A study conducted in 1997 revealed that drivers are more than four times more likely to experience an accident during and up to *5 minutes after* a mobile phone conversation ends. Drivers are still at an increased likelihood of having an accident *up to 15 minutes after* having a conversation on a mobile. These findings reflect the generally urgent, intense and complex nature of the calls made and received by drivers - and the distraction which results.

THE UNDERESTIMATION OF RISK

Although the research indicates that there are substantial differences in how people drive when they are using a mobile phone compared to when they are not and these differences increase the probability of an accident, it may very well be that the studies reviewed by RoSPA actually *underestimate* the risks of drivers using mobile phones.

Automatic Vehicles

Of the research studies reviewed by RoSPA, only two studies were conducted using vehicles with manual transmission. All other studies tested the effect of mobile phones on the driving of automatic vehicles only.

Research which has compared the driving demands of an automatic relative to a manual geared vehicle has shown that drivers of automatic vehicles are subject to significantly lower levels of stress and workload - as low as the stress and workload experienced by the *passenger* sitting next to them.

Drivers of manual vehicles experience significantly greater stress and workload relative to drivers of automatic vehicles. This may well mean that phone-using drivers of manual transmission cars could have greater problems with their driving and a greater accident likelihood when using of mobile phones, than implies by research on the drivers of automatic vehicles.

Also - as well as placing a greater strain on a driver's attention, the use of mobile phones in manual cars is also likely to create more physical interference with driving (particularly changing gear), when a driver is attempting to use the phone keypad to either answer a call, dial out or when holding the handset to their ear.

The majority of cars in the UK have manual transmission. As a result, more serious and more frequent distractions to UK drivers using mobile phones when driving are likely to occur than is suggested above. This is a particular cause for concern, as the studies indicate considerable risk associated with phone use - *even to drivers using hands-free systems in cars which are automatics*.

Numbers of Subjects Participating in Studies

Using small numbers of people in a study is often convenient and cheap, allowing the study to be performed and written up more quickly than if more people are included in the testing procedures. However, the smaller the number of people used, the less likely it is that the way in which the subjects react to the experiment will actually represent the way in which the majority of the driving public would react to the same conditions and the less likely it is that the full range of problems which may result from using a mobile phone whilst driving, will become obvious.

Most of the studies reviewed by RoSPA involved fewer than 50 subjects - one study tested how mobile phones affected the driving performance of only 10 people.

THE RISK OF DRIVING AND MOBILE PHONE USE

The extensive review conducted by RoSPA continues - but to date the following points are paramount in the debate on the safety of drivers using mobile phones whilst driving:

- By far the most research has been done using automatic vehicles and so may greatly underestimate the problems faced by drivers of manual transmission vehicles. Even so, significant changes in driving style and an increased likelihood of an accident have still been found in studies investigating the effect of hands-free systems on automatic vehicle drivers. This suggests that the issue may be a very serious topic for drivers in the UK, where drivers may be attempting to use hands-held phones whilst driving a manually geared vehicle. The risk posed by mobile phone use whilst driving has already been considered serious enough for several countries to have imposed legislation on the use of hands-held and hands-free phones by drivers;
- RoSPA has been unable to determine any type of call which cannot be made or received by a driver who has pulled over into a safe place and parked their vehicle, with the exception of drivers engaged in the emergency services or armed forces.
- Using a mobile phone distracts a driver from the manner in which they manage the vehicle and also from concentrating on the traffic environment around them. Research shows that conversations held over a mobile phone are more distracting than a conversation held with a passenger within the car and are likely to be far more distracting than retuning the radio.

As a result of the issues raised by this review, RoSPA will be conducting further research into the effects of using mobile phones on driving. The research will be performed in co-operation with specialists in driver behaviour at a co-operating university and will address the shortfalls identified in the research reviewed above.

By doing this, RoSPA will help provide a more balanced and clear view of how driving is affected by the use of a mobile phone.

CONCLUSION

RoSPA has considered the information provided in this paper and taken account of the numbers of accidents which have been recorded (through action in the courts) where mobile communications equipment was identified as a cause. The Society has also recognised, by implication, that there will also have been a number of incidents involving personal injury where mobile communications equipment was involved but not identified. In the light of all these data, RoSPA has developed the following comments:

1. This study has considered all the identified and available data concerning 'in-vehicle distractions'.
2. It has focussed on those that are directly relevant to drivers using mobile communications equipment - primarily mobile phones.
3. In so doing, it has objectively analysed the information and drawn comparators where appropriate and possible with other often quoted in-vehicle distractions.
4. RoSPA does not accept that other well-known in-vehicle activities with the potential to distract the driver are appropriate and they are certainly not essential to the safe and efficient management of the vehicle. The receipt of a call may in fact generate some of these distracting activities. Activities such as map-reading, note-taking, checking an itinerary or diary, reviewing a business quotation etc. There are additional complicating features of the issue such as the difficulty posed for the recipient about terminating a call once it has been 'accepted' if it has been received at an inappropriate time (such as when negotiating difficult traffic conditions).
5. RoSPA asserts that the use of mobile communication equipment is not part of the essential driving task.
6. The only areas where it might be argued that it is, relates to the three 'emergency services' (Fire, Police and Ambulance).
7. RoSPA has reservations about the safety of some types of communication between (particularly) police vehicles which are not equipped with hands-free and voice activated communication equipment, used by officers who are not trained as drivers at the highest levels in situations where their safety, and the safety of the public may be compromised. It is noted that in traffic cars officers sometimes have their personal radios turned on as well as the in-car communication system.

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8. Additional areas for further research are indicated by this study and they include:
- Comparison between the distraction levels when driving a vehicle with a manual gearbox and using hand-held and hands-free phones; with that of driving a vehicle with automatic transmission. Most of the research on this topic is USA or Scandinavian based where the majority of vehicles are 'auto-trans'.
 - Comparison between relative distraction generated by a range of in-vehicle activities using different levels of driving difficulty to provide indications of likely distraction values.
 - Confirmation of the 'after-effects' of receiving or making a call. Levels and lengths of distraction.
 - Confirmation of the type and nature of effects on the driving task of taking or making a call:
 - slowing or speeding-up inappropriately
 - lateral lane positioning
 - maintaining a safe following distance
 - use of mirrors/maintaining a check on traffic
 - The relative effect of using hand-held compared with hands-free systems
 - The distractive effect of using voice-activated systems.
 - Cross reference of this research area to the Management of Occupational Road Risk issues (fatigue, exposure, experience, company policies on in-car communication and gadgets)
9. Unless and until there is objective evidence to indicate that the use of mobile communications equipment has no (or little) detrimental effect on driving by way of distraction during or after the receipt or making of a call, RoSPA contends that there must be active consideration of a ban. In the interim, its use must be actively discouraged and enforcement maintained at a high level.

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