

Use of mobile phone while driving

Summary

The use of mobile phones while driving has negative effects on driving behaviour and increases the crash rate. This is because drivers are not only physically distracted by phoning and driving simultaneously, but they are also cognitively distracted by having to divide their attention between phoning and driving. Because of the cognitive distraction, handsfree phoning is hardly safer than handheld phoning.

As a complete ban on mobile phones in vehicles is not realistic, various countries have passed legal measures to at least limit phoning while driving. The ban on the use of a handheld mobile phone while driving is the most frequently used measure. In addition, responsible use of a mobile phone while driving can be promoted by technical measures, publicity campaigns, and in driver education manuals.

Background

Nearly 80% of crashes and 65% of near-crashes involve some form of driver inattention and distraction within 3 seconds before the crash (Neale et al. 2005). Distraction is caused by a competing activity, event, or object, from inside or outside the vehicle. In contrast, inattention may occur when no other specific object, event or activity is present, and can for instance be caused by daydreaming or competing thoughts.

Safety problems related to driver distraction are expected to escalate in the near future as more technologies become available for use in motorized vehicles. A relatively new technology, which is already widely present and accepted, is the mobile phone. While it is clear that mobile phones enhance business communication and increase personal convenience, use of mobile phones while driving has become a road safety concern.

How do mobile phones distract drivers?

The mobile phone distracts drivers in two ways: it causes physical distraction as well as cognitive distraction.

- Physical distraction occurs when drivers have to operate a mobile phone (i.e. reach, dial, hold) and their vehicle simultaneously.
- Cognitive distraction occurs when a driver has to divert part of his attention from driving to the telephone conversation. The ability to divide one's attention between two simultaneous tasks is limited. Therefore, mobile phone use while driving can have negative effects on the driving performance.

What makes mobile use so dangerous and why?

What happens when a driver engages in mobile phone conversation and drives at the same time? The 'impairment' potential of mobile phone usage while driving has been the focus of various behavioural studies. Although studies differ in the extent of behavioural changes they found, most of them give an affirmative answer to the question whether using a mobile phone while driving negatively affects different aspects of driving performance. The following aspects have come forward (Dragutinovic & Twisk, 2005):

- *Slower reactions and more misses*
The phone conversation results in a significantly slower response to traffic signals as well as in an increased probability of missing them.
- *Braking*
It has been found that the braking reaction time is slower during a telephone conversation. The decrease found in reaction time ranges from 0.3 to 0.7 seconds. During mobile phone use, drivers brake with more force, i.e. they stop faster. However, despite this more intense braking, they come to a standstill closer to the vehicle in front, a stopping line, or an intersection.
- *General awareness of other traffic*
All three elements of situation awareness (perception, comprehension and projection) show a significant decline due to the concentration demanded by car phone conversation.

- **Riskier decision-making**

Commonly encountered traffic situations (e.g. stopping at red light) tend to provoke cautious decision-making, but during less common or more complicated and therefore difficult events (e.g. weaving, left turns) a significant negative impact of a telephone conversation has been detected. Drivers accept shorter gaps, make fewer speed adjustments, and show poor adjustment to potentially dangerous road conditions such as a slippery road.

Studies found that drivers who use a mobile phone while driving have a higher crash rate than those who do not. The estimated rate increase varies with a factor 2 to 9. Redelmeier & Tibshirani (1997) and McEvoy et al. (2005) showed that the crash rate was four times higher when a mobile phone was used than the crash rate when the driver did not use a mobile phone. However, one has to be aware that although a link has been found, the studies did not establish a causal connection between the use of mobile phone and road accidents.

Studies have also shown that safety belt use was significantly lower for handheld mobile phone users than for non-users (e.g. Eby & Vivoda, 2003). That means that those who use a mobile phone are also more likely to sustain greater injury. They also engage in other risky behaviour like driving while intoxicated more often and exceeding the speed limit to a larger extent. This behaviour could lead to an even larger increase of crash rate while using a mobile phone than the estimated factor 4.

Do drivers change their driving behaviour?

Drivers generally feel that using a mobile phone makes driving more difficult. Therefore, in order to cope with these increased demands, they adopt certain 'risk compensation' strategies. A possible explanation for this compensatory behaviour could be that drivers attempt to reduce performance goals in order to achieve lower driving task demands. However, despite the lowering of their performance goals, drivers still report increased stress and effort.

The most obvious example of compensatory behaviour is a lower average speed. In some cases, a lower average speed is also accompanied by larger speed variations, which in turn could be a sign of the reduction in performance goals. However, there is another potential explanation for this risk compensation behaviour: it could be the consequence of the attention being diverted from the driving goals to a phone conversation. Without sufficient resources for the primary driving task, it can be expected that drivers will be less able to cope with emergency situations or other abrupt increases in driving task demands. Even if drivers are engaged in risk compensation behaviour by lowering the performance standards, the newly accepted standards may still be significantly below the safety requirements of a momentary driving situation. Moreover, it appears that most drivers are not well-calibrated to the distracting effects of mobile phone conversation and that their subjective estimates of distraction effects are not always related to the actual magnitude of distraction (Hurry et al., 2008).

Are handsfree mobile phones safer than handheld ones?

Handheld versus handsfree use of mobile phones remains one of the most frequently investigated issues. The vast majority of studies report that handsfree phoning does not have a significant safety advantage over handheld phoning. Although handheld units are responsible for an additional burden on the driving task due to the need for manual manipulation, the most important negative factor of mobile phone use remains the same for both types of phone: the diversion of attention from driving to the conversation itself. The impact of conversation on driving performance is the same for both handheld and handsfree phones (e.g. Consiglio et al. 2003; Patten et al. 2004; Strayer & Johnston, 2001).

How much are mobile phones used in traffic?

With 478.4 million mobile phones in use, the penetration rate for mobile phones in Europe is now 103% of the population, an 8% increase from 95% in 2005. In 2005, there were 16.3 million mobile phone subscribers in the Netherlands, an increase of 1.5 % since 2004 (source: www.cbs.nl).

In 2005, approximately 50% of Dutch drivers stated they use a mobile phone while driving. Of these drivers 75% said never to use a hand-held mobile phone (*Table 1*). It is still not known how many kilometres are driven while phoning in the Netherlands (Barten et al., 2006). Research abroad shows that in 3 to 8% of all kilometres driven the mobile phone is used. Assuming that the situation in the Netherlands is more or less the same and using the lowest percentage of 3%, approximately 3 billion kilometres a year are driven while phoning in the Netherlands (2004 data in Dragutinovic & Twisk, 2005).

Frequency	Handheld (%)	Handsfree (%)
Often	2	14
Sometimes	24	27
Never	75	59

Table 1. *User-reported handheld and handsfree use of mobile phones while driving in the Netherlands, 2005 (Barten et al. 2006).*

How many crashes are caused by the use of mobile phones?

The collection and registration of data about the mobile phone involvement in road crashes is neither widespread nor very systematic. In most countries, the presence or use of a mobile phone in a vehicle during a crash is not recorded. Consequently, this presents a problem for estimating the crash rate of mobile phone users in vehicles. The lack of systematic data collection gives rise to concerns about the obvious underreporting of mobile phone use as a cause of traffic crashes. An additional factor contributing to underreporting is that drivers who are involved in a crash are probably reluctant to report to the police that they were using a mobile phone because of the fear of liability. It is generally estimated that the crashes caused by mobile phone use are a small proportion of the total number of accidents. The problems with recording road crashes caused by mobile phone use make it difficult to determine the exact risk associated with the use of a mobile phone while driving.

In the following calculation we assume that the situation in the Netherlands is the same as in other countries. Based on the total number of kilometres travelled while phoning, the number of road victims in crashes involving at least one car, and a four times higher crash rate per car kilometre while phoning, SWOV estimates that if mobile phone use while driving could be abandoned completely, nearly 600 road deaths and in-patients per year (2004 data) would be saved in the Netherlands. This is approximately 8% of the total number of registered deaths and in-patients in 2004 (Dragutinovic & Twisk, 2005).

How does the use of mobile phones compare to other negative influences on driving performance?

Clear social norms exist for some 'sources of impairment' (e.g. alcohol) while driving. Therefore, if an activity like mobile phone use induces driver impairment equal or larger than that of a source for which norms already are defined, this activity should at least be subject to the same social norms.

Mobile phone use and drink driving

Several international studies compared the driving performance of drivers while conversing on a mobile phone and when driving while intoxicated. The blood alcohol concentration (BAC) was 0.8g/l, which is higher than the Dutch legal limit of 0.5 g/l. In general, even when instructed to maintain a set speed drivers tend to slow down when using a mobile phone, they have slower reaction times to road signs, and they miss significantly more of the direction signs. When driving while intoxicated, drivers drive with increased speed, they use a more aggressive driving style with shorter following distances, and they brake with greater force. In general, intoxicated drivers tend to have a better driving performance than drivers using a mobile phone. The drivers' own subjective assessment also shows that they find it easier to drive while intoxicated than to drive while using a phone. It is not easy to compare impairment of driving performance due to having consumed alcohol and impairment caused by phone conversation. Nevertheless, the general conclusion is that although the driving performance is clearly impaired while the driver is intoxicated, certain aspects of driving performance are even more impaired by mobile phone use. However, the mechanisms of the two types of impairment are different: the mobile phone impairment is associated with the diversion of attention and is transitory, while impairment from alcohol persists for longer periods of time. While mobile phone drivers have some kind of control (e.g. pausing the conversation), drivers who are intoxicated cannot do much to control their performance. Alcohol impairs drivers' judgment while mobile phone use does not impair it as such, but may delay or reduce judgment (Strayer et al. 2004; Burnes et al. 2002).

Driver distraction

Passengers are a well-recognized source of distraction. Therefore, one of the most frequently heard arguments against a mobile phone ban is that conversation via the mobile phone is not different from conversation with a passenger. Regarding the content of the conversation, it seems that there are no differences between passenger or mobile phone conversations. However, experts are of the opinion that the main difference between the mobile phone conversation and the conversation with a

passenger is that passenger conversations are self-regulating because of the direct contact. Passengers themselves are aware of the driving situation, whereas during a mobile phone conversation the other person may not even be aware that the conversation partner is driving at that particular moment.

Also, listening to a radio impairs the driving performance to a lesser extent than a mobile phone conversation. However, this conclusion refers only to the listening and not to the operating part of the radio task.

Which new trends are to be expected?

Technological developments

To increase attractiveness of mobile phone use, new services like travel information services, become available every day. The possibilities of mobile phones seem to be almost unlimited. Drivers can combine their mobile phones with a whole range of computerized devices and applications like personal organisers, address books, e-mail or their company's computer system (see, for example, Braimaister, 2002); thus converting their car into an office. With these new features and available services, it is not just dialling and being engaged in a conversation that can interfere with the driving task, but a whole new range of activities that requires increased interaction while driving. For almost all these activities, there is no data about the effects on driving behaviour. However, based on experiences with other similar distractors, it is to be expected that these activities will have negative safety effects. The more frequent use of the mobile phone to display a variety of visual information (e.g. SMS) will distract a driver's visual attention from the road. This can have implications for safe driving because driving is primarily a visual task.

Trends in mobile phone design like miniaturization, could also add to the problems of mobile phone use while driving.

Cultural and social developments

While in the early days of the mobile phone era, businessmen and other adults were the main users of mobile phones, nowadays youngsters are taking that position. At the same time, young people also belong to the group of novice drivers. Studies have shown this group to have a crash rate which is about four times higher than that of other age categories.

Although no studies were found that specifically investigated the risk of mobile phone use for novice drivers, some results suggest that mobile phone use could have stronger impairment effects on younger drivers (SWOV Fact sheet [Young novice drivers](#)). Therefore, the extensive use of mobile phones by young drivers could be particularly dangerous and could increase the already high crash rate for novice drivers.

What are the effective countermeasures?

The mobile phone has undeniably become part of our everyday life and it would be unrealistic to expect people to completely stop using mobile phones in vehicles (or to obey a total ban on mobile phones). Therefore, different countries have introduced legislation aimed at restricting the use of mobile phones while driving.

Existing legislation¹

One of the most frequent legislative measures concerning the use of mobile phones in vehicles is the ban on handheld mobile phones. In some countries, even drivers who use a handsfree phone can be fined when they are involved in a crash while using the phone, or they can forfeit their insurance coverage. Other measures include prohibiting the use of a mobile phone by drivers of some special categories such as drivers with specific responsibilities (e.g. school bus drivers) or young drivers who have only a learner's driving license. Besides regulations which specifically deal with the use of mobile phone while driving, there are also general regulations regarding careless or dangerous driving which can be applied in the case of mobile phone use (e.g. Multitasking statement, Highway code, etc.). Recently, some countries have made it common policy to collect information about mobile phone involvement in crashes.

¹ A detailed overview of the legislation has been included in Dragutinovic & Twisk (2005).

Effectiveness of legislation

Although the ban on the use of handheld mobile phones while driving is the most frequently used type of legislation, there still is very little data about the effectiveness of this measure or of other measures aimed at mobile phone use while driving. Regarding the effectiveness of the ban on the use of handheld mobile phones, some studies show short-term effects of up to a 50% reduction of use, but the long-term effects are far less positive. One year after the introduction of a ban, the use in the State of New York went back to the same level as before the law (McCartt et al., 2003; McCartt & Geary, 2004).

Since April 2002, when the ban on use of handheld phones was introduced in the Netherlands, the number of fines for using a handheld mobile phone while driving has risen substantially. At this moment the number of fines seems to have stabilized at just below 120,000 fines per year. It is not known whether this number reflects the level of enforcement or the actual mobile phone use while driving.

Period	Number of fines in period	Number of fines per month
April-December 2002	25 000	2778
January-August 2003	55 000	6875
January-December 2004	100 000	8333
January-December 2005	116 792	9733
January-December 2006	117 343	9779

Table 2. *The number of fines issued in the Netherlands for using the handheld phone during driving (source: Bureau Traffic Enforcement of the Public Prosecution Service BVOM; Central Fine Collection Agency CJIB).*

Acceptance of legislation

Public support is important for the success of certain legislation. Several surveys about public opinion and attitudes toward mobile phone legislation (see Dragutinovic & Twisk (2005) for an overview) show that there is general public 'feeling' that it is dangerous to use a mobile phone while driving and that it is necessary to restrict their use. However, the public seems to consider the use of handsfree phones in traffic to a large extent to be 'danger-free'. It is possible that this opinion has been formed as a consequence of current mobile phone laws.

In addition to the various types of legislation, the mobile phone industry also has a responsibility in helping to diminish certain negative effects of mobile phone use. They can take human factors into account when making new mobile phone designs or even provide technological solutions that make it impossible to use a phone while driving.

Recently, it has also been recognised that a broad educational effort is necessary to promote the responsible use of mobile phones while driving; some of the wireless providers and automobile manufacturers have even been launching campaigns to increase the awareness of the risks of driver inattention. To this end driver education should also address the issue of driver distraction and the use of a mobile phone while driving.

Conclusions

Based on the results of behavioural studies we conclude that the use of mobile phones has negative effects on driving performance. These negative effects are caused by both physical and cognitive distraction. Although physical distraction can be reduced or even limited by various aids (e.g. handsfree phones, speed dialling, voice activation), cognitive distraction remains the crucial problem of mobile phone use while driving. Therefore, handsfree phones do not have significant safety advantages over handheld phones. The magnitude of the negative effects of mobile phone use while driving depends on the complexity of both mobile phone conversation and the driving situation. The more difficult and complex the conversation, the larger are its effects on the driving performance. Similarly, phone use during undemanding driving periods seems to be easy, but with increasing complexity and difficulty of the driving situation, the effects of mobile phone conversation become more pronounced.

Although current research focuses on the effect of mobile phone conversation on the performance of car drivers, the matter of mobile phone use in traffic by other road users such as cyclists and pedestrians should also be raised. For example, recent research suggests that talking on a mobile phone is associated with cognitive distraction that may also undermine pedestrian safety (Hatfield &

Murphy, 2007; Nasar et al., 2008). Although the demands on traffic tasks of these categories of road users may be far lower than those of drivers of motorised vehicles, everyday experience and the nature of interference caused by mobile phone conversation lead to the conclusion that the mobile phone conversation could also have a detrimental effect on road behaviour of these road users. Campaigns should make all road users aware of the dangers.

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