European Road Safety Observatory

Road Safety Thematic Report – Driver distraction

This document is part of a series of 20 thematic reports on road safety. The purpose is to give road safety practitioners an overview of the most important research questions and results on the topic in question. The level of detail is intermediate, with more detailed papers or reports suggested for further reading. Each report has a 1-page summary.

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Contents

Summary

Driver distraction

Driver distraction is a significant risk factor in traffic. It occurs when attention is diverted away from activities needed for safe driving towards a competing activity. Distraction can be visual, auditory, physical and/or cognitive in nature. Common sources are mobile phone/device use, interaction with passengers, eating, and adjusting in-vehicle technologies. Distracted driving is a frequent phenomenon. Large-scale research on everyday driver behaviour in natural contexts indicates that car drivers are involved in other activities for about half of driving time. The use of the mobile phone while driving is one of the most common sources of driver distraction. The self-declared prevalence of mobile phone use while driving a car in Europe is 47.7% for the use of hands-free devices, 28.6% for talking on a hand-held mobile phone, and 24.2% for text reading/checking social media. While the latter two of these mobile phone-related activities are illegal, hands-free phoning is generally not. A common finding in surveys and observational studies is that the use of mobile phones while driving is higher among younger drivers and lower among older ones. Distracted drivers generally tend to swerve more, have longer reaction times, and miss information from the traffic environment, but the effects and risks depend on the type of distraction. Large-scale naturalistic driving research indicates that activities that force the driver to avert his gaze from the road and/or require manual interventions are more risky than primarily mental activities. Hand-held phone use increases the crash risk for car drivers by a factor of 3.6, especially dialing (x12) and texting (x6).

Countermeasures

Road user based approaches to tackle distracted driving include legislation – on the use of handheld phones or electronic devices – and enforcement. The use of smart cameras can lead to increased enforcement. Further countermeasures include awareness-raising of the risks of distraction in public campaigns and through driver education during licensing.

New vehicle technologies are promising but the overall effects are still unknown. Advanced driving assistance systems (ADAS) such as forward collision warning and lane departure warning aim to prevent the consequences of distracted driving. The new EU Regulation on type approval requirements for motor vehicles makes a driver drowsiness and attention detection system and a distraction recognition system mandatory for all vehicle categories.

In terms of infrastructure, rumble strips can reduce the number of crashes caused by distraction or limit their severity. The placement roadside of potentially highly distracting advertising panels should be avoided.

1 Highlights

- Distracted drivers generally tend to swerve more, have longer reaction times, and miss information from the traffic environment. The impact and crash risk varies according to the distraction task, traffic context, and driver characteristics.
- Driver distraction can have many sources. Drivers often engage in potentially distracting activities, especially younger drivers. The self-declared prevalence of mobile phone use while driving a car in Europe is 48% for the use of hands-free devices, 29% for talking on a hand-held mobile phone, and 24% for text reading/checking social media.
- Tasks that require looking away from the road and/or performing manual actions have the greatest impact on driving behaviour and crash risk. Hand-held phone use increases the crash risk of car drivers by a factor of 3.6, especially dialling (x12) and texting (x6).
- For all drivers, automatic inattention detection, distraction recognition, and advanced driver assistance systems are promising technical countermeasures, but further research is needed.

2 What is the problem?

2.1 Definition

Safe driving requires sufficient awareness of the surroundings, constant monitoring of the road and traffic, and sufficient alertness to be able to react to unexpected events (Kinnear & Stevens, 2018). A widely accepted definition of driver distraction is the diversion of attention away from activities critical for safe driving toward a competing activity, which may result in insufficient or no attention to activities critical for safe driving (Regan et al., 2011). The nature of distraction can be visual (e.g. looking at a mobile phone screen), auditory (e.g. listening to loud music), physical/manual (e.g. typing a phone number), and/or cognitive (e.g. conversing). Its source may or may not be related to technology, to something inside or outside the vehicle, self-initiated or imposed, and may or may not be related to the driving task (Slootmans & Desmet, 2019; SWOV, 2020). Typical sources of distraction are: talking to passengers, mobile phone use, operating other mobile devices and built-in infotainment, looking at billboards, eating, and drinking.

2.2 Effects of driver distraction on driving performance

When attention to the the tasks of driving becomes inadequate, (driving) performance decreases and crashes can occur. The MiRA (Minimum Required Attention) model offers a broad theoretical framework for driver attention. It looks at the extent to which sufficient information can still be processed to ensure safe driving performance. Carrying out another activity will or will not have an impact on traffic safety, depending on the traffic situation. In a quiet driving environment, sufficient information may still be processed, whereas this will not be the case in a busy traffic situation (Kircher & Ahlstrom, 2017; Slootmans & Desmet, 2019). A traffic situation (for example light traffic conditions) can however change rapidly. The extent of the negative impact of distraction depends on the type or source of distraction. The timing, intensity, resumability, complexity, duration, frequency and residual effects of the distracting activity also play a role, together with the traffic context, the type of road user, and personal characteristics such as age and driving experience (Kinnear & Stevens, 2018; SWOV, 2020). To measure the impact of distraction on driving performance (e.g. variation in speed, lane position, following distance; total eyes-off-road time; objective and subjective task load), experimentally designed studies with a simulator or on the road are often used. Another method is naturalistic driving in which everyday driving behaviour of road users in their own vehicles is continuously recorded. For this purpose, different systems are installed in the vehicle to register vehicle, driver and external data in an unobstrusive way. This method provides insight into how drivers cope with distraction in real-life conditions and has the general advantage that self-regulatory strategies in dealing with distraction can be identified (i.e. drivers can decide for themselves whether and when to engage in distracted driving).

3 How dangerous is driver distraction?

3.1 Proportion of distraction-related crashes

It is generally estimated that distraction plays a role in 5 - 25% of crashes in Europe. (Hurts et al., 2011 in: European Commission, 2018). This is mainly based on older studies and in-depth crash investigations in which extreme forms of distraction are documented. This is likely to be an under-representation since the impact of driver distraction on road crashes is difficult to estimate due to the difficulties in coding distraction as a contributory factor after the event. Recent naturalistic driving research suggests that the percentage of crashes related to distraction is higher than this estimate (Dingus et al., 2016, 2019).

3.2 Crash risk

Large-scale naturalistic driving research allows the crash risk (odds ratio) of different types of distraction to be calculated on the basis of crashes. Table 1 shows the estimated crash risk for different distraction activities based on two analyses of the US SHRP 2 naturalistic driving data in (Dingus et al., 2016, 2019). An odds ratio above 1 means that an activity is more risky than alert, attentive and sober driving, while an odds ratio below 1 signifies a lower risk. An odds ratio of 2 for “all distractions together” in the table means a 2-fold higher crash risk. The 95% CI (confidence interval) indicates that we know with 95% certainty that the odds ratio lies between the first number (1.8 x higher crash risk) and the second number (2.4 x higher crash risk). A percentage driving time of 51.93 means that the drivers in the dataset on average spent 51.93% of driving time doing this.

These results indicate that activities forcing the driver to avert their gaze from the road and/or perform manual actions significantly increase crash risk. Hand-held phone use increases the crash risk of car drivers by a factor of 2.05, especially dialling (x12) and texting (x6). A crucial factor is the increased time spent looking away from the road (Klauer et al., 2006). Consequently, the US Department of Transportation states that tasks that involve looking away from the roadway for more than 2 seconds at a time, or briefly several times with a total duration of 12 seconds, should not be allowed while driving (NHTSA, 2016). Purely cognitive tasks, such as holding a hands-free conversation or talking to a passenger, have a low risk based on this analysis. The combination of all mainly cognitive tasks does lead to a significant but limited (odds ratio: 1.25) crash risk increase.

Table 1 Crash risk of secondary activities among car drivers based on naturalistic driving research data (95 % confidence interval) and % driving time spent on the activity.

Activity	Odds ratio (95% CI)	% driving time
Grouped activities		
All activities* [1]	**2.0** (1.8-2.4)	51.93 %
All primarily cognitive activities [2]	**1.25** (1.01-1.54)	20.0 %
All hand-held phone activities* [3]	**3.6** (2.9-4.5)	6.40 %
Combination of hand-held texting, browsing and dialling	**2.56** (1.68-3.88)	1.8 %
All activities related to in-vehicle devices*	**2.5** (1.8-3.4)	3.53 %
Primarily cognitive activities		
Hand-held phoning (talking/listening)	1.27 (0.79-2.04)	2.7 %
Hands-free phoning (talking/listening)	0.4 (0.10-1.63)	0.9 %
Talking/singing alone	1.44 (0.99-2.08)	4.2 %
Interacting with passengers	1.26 (0.98-1.62)	12.2 %
Activities with in-vehicle devices		
Adjusting radio	1.57 (0.85-2.91)	1.3 %
Controlling temperature/air conditioning*	**2.3** (1.1-5.0)	0.56 %
Interacting with vehicle device (other)*	**4.6** (2.9-7.4)	0.83 %
Mobile phone activities		
Purely holding a phone in the hand	**2.05** (1.13-3.73)	1.1 %
Reaching for phone*	**4.8** (2.7-8.4)	0.58 %
Dialling (hand-held)*	**12.2** (5.6-26.4)	0.14 %
Reading/writing text messages (texting)*	**6.1** (4.5-8.2)	1.91 %
Browsing (e.g. read email, check internet)*	**2.7** (1.5-5.1)	0.73 %
Other activities		
Reading/writing (also tablet)*	**9.9** (3.6-26.9)	0.09 %
Reaching for an object (no phone)*	**9.1** (6.5-12.6)	1.08 %
Prolonged looking at external object*	**7.1** (4.8-10.4)	0.93 %
Eating*	**1.8** (1.1-2.9)	1.90 %
Drinking (no alcohol)*	1.8 (1.0-3.3)	1.22 %
Personal hygiene (e.g. make-up)*	1.4 (0.8-2.5)	1.69 %
Child in rear seat*	0.5 (0.1-1.9)	0.80 %

*Source: Dingus et al., 2019 and *2016; Odds ratios significantly different from 1 are in* ***bold*** *(p≤0.05).*

[1] All activities with * + hand-held talking* (OR 2.2; 1.6-3.1) and in-vehicle radio* (OR 1.9; 1.2-3.0) (Dingus et al., 2016).
[2] All activities under the subtitle “primarily cognitive activities” (Dingus et al., 2019).
[3] All activities with * under the subtitle “mobile phone activities” + hand-held talking (OR 2.2; 1.6-3.1) (Dingus et al., 2016).

4 What is the impact of the main distraction sources?

4.1 Phoning

Hand-held phone calls involve various actions (contact search, dialling, call answering, holding a conversation, ...). These cause cognitive, auditory, physical and/or visual distraction. There is scientific consensus that hand-held phoning has a negative impact on driver behaviour (Caird et al., 2018; Dingus et al., 2016; Simmons et al., 2016; Ziakopoulos et al., 2016a). This includes more time spent looking away from the road, higher reaction and detection times, delayed braking, and a narrowing of the visual field. Visual-manual actions especially increase crash risk significantly (e.g. entering a telephone number: 12x higher risk; see Table 1). **Hands-free** telephoning requires less physical and visual actions, but the cognitive distraction is the same as in hand-held phoning (e.g. Strayer et al., 2013). Many studies find negative effects, such as significantly delayed reactions, less attention to traffic signs, other vehicles and the speedometer, and more on the roadway (Caird et al., 2018; Desmet & Diependaele, 2017). Sometimes, on the other hand, there are ambiguous or even positive effects (e.g. increased headway distance, reduction of potentially critical driving situations), though without sufficient verification (e.g. Metz et al., 2015 in: Ziakopoulos et al., 2018). It is therefore concluded that hands-free phoning is 'probably risky' (Ziakopoulos et al., 2018).

Based on naturalistic driving research, it appears that the mainly cognitive component of phoning (conversing) does not lead to significantly increased (near-) crash risk (see Table 1) (Dingus et al., 2019). It is possible that the negative effects that are found in experimental research are not always reflected in naturalistic driving research, where drivers can themselves adjust their behaviour (Singh & Kathuria, 2021; Wijayaratna et al., 2019). Some drivers change their driving behaviour to compensate for the effects of the telephone (Choudhary & Velaga, 2017). For example, they drive more slowly and keep greater distance. Drivers also decide if and when they use the phone as a function of the traffic context (e.g. more on motorways, at standstill) (Christoph et al., 2019; Oviedo-Trespalacios et al., 2018). Having a phone conversation does increase the crash risk for young drivers (Guo et al., 2016). Moreover, it appears that starting a hands-free conversation often still requires visual-manual actions (Fitch et al., 2013).

4.2 Talking to passengers

Talking to passengers can have negative effects on road safety, such as slower reactions and increased injury severity (Consiglio et al., 2003; Donmez & Liu, 2015; in: Theofilatos et al., 2018). The role of passenger age (teenagers and children) deserves special attention. Naturalistic driving research shows that young drivers are more likely to talk to passengers and this may lead to higher crash risk in this group (Guo et al., 2016). However, the risk is greater during a conversation on the phone. This may be because the passenger can see the traffic situation and can adjust the complexity and pace of the conversation accordingly (Gaspar et al., 2014).

4.3 Interacting with mobile devices

Mobile phones are also often used to send messages, surf, navigate, etc. Operation of the mobile phone and by extension of all mobile technological devices leads to a high degree of visual-manual distraction. This has clear negative effects on driving performance: longer and more frequent looking away from the road, slower reactions and detections, more variation in lane position and following distance, speed reduction, and leads to significantly increased crash risk (see Table 1: e.g. texting: 6.1 x higher risk) (Caird et al., 2014; Dingus et al., 2016, 2019; Ziakopoulos et al., 2017). A study by Doumen et al. (2019) also shows that manual operation of a phone in the hand or in a holder has - in terms of visual behaviour - the same negative effects on driving. A smartwatch while driving leads to more visual distraction than a smartphone (Brodeur et al., 2020).

4.4 Interacting with built-in systems

Experimental studies show that interaction with built-in infotainment technology can have moderate to strong adverse effects on workload, driving and visual behaviour. A naturalistic driving study found indications of self-regulation to cope with this (e.g. longer system interactions when the vehicle is stationary) (Perez et al., 2015). Effects differ strongly though according to the actual task (e.g. navigation set-up, music search), the interaction mode (e.g. buttons, touchscreen, voice control), and system (brand). Older drivers in general experience more adverse effects (Cooper et al., 2019). The negative effects can also persist for a relatively long time after the interaction with a system (e.g. up to 27 seconds in Strayer et al., 2015). Naturalistic driving research also shows that interaction with vehicle systems leads to significantly increased (x2.5) crash risk (see Table 1) (Dingus et al., 2016). Possible ways of reducing visual-manual distraction are the use of voice control and head-up displays (Vlakveld, 2018). However, there are still drawbacks with these, particularly in terms of cognitive distraction. Research indicates that voice-based interactions can have negative effects on driving behaviour (Simmons et al., 2017): the cognitive load remains, and poorly executed voice systems can still give rise to negative effects on visual behaviour (e.g. long glances away from the road for confirmation/status checking) (Cooper et al., 2014). In order to reduce or prevent distracted driving, infotainment systems in cars can make it impossible to perform certain tasks while driving (e.g. typing a destination into the navigation system) (Vlakveld, 2018).

4.5 Roadside advertising

Roadside advertising billboards can cause drivers to behave less safely. Possible effects include: looking away from the road more often, slower reaction to sudden braking of the car in front and to road signs, shorter following distance, and less fixed lane position (Vlakveld & Helman, 2018). In particular, signs with moving images, emotional charge or in the central visual field are more difficult to ignore. The moment a sign switches to another advertisement is the most distracting. Naturalistic driving research shows that looking at an external object for a prolonged period (e.g. advertising billboards) strongly increases crash risk (x7.1) (see Table 1) (Dingus et al., 2016).

4.6 Other distraction sources

Eating and drinking while driving can also affect driving performance, leading to greater deviations in lane position and longer reaction times (Irwin et al., 2015). Naturalistic driving research indicates that eating is associated with a limited but significant increase in crash risk. Drinking does not appear to significantly increase risk (Table 1) (Dingus et al., 2016). The effect of listening to **music** while driving is unclear as it can have both negative and positive effects (Ziakopoulos et al., 2016b). Naturalistic driving research shows that observable **emotions** such as anger, sadness, crying, and emotional stress increase crash risk 9.8 times (95% confidence interval: 5.0-19.0) compared to alert/sober driving (Dingus et al., 2016).

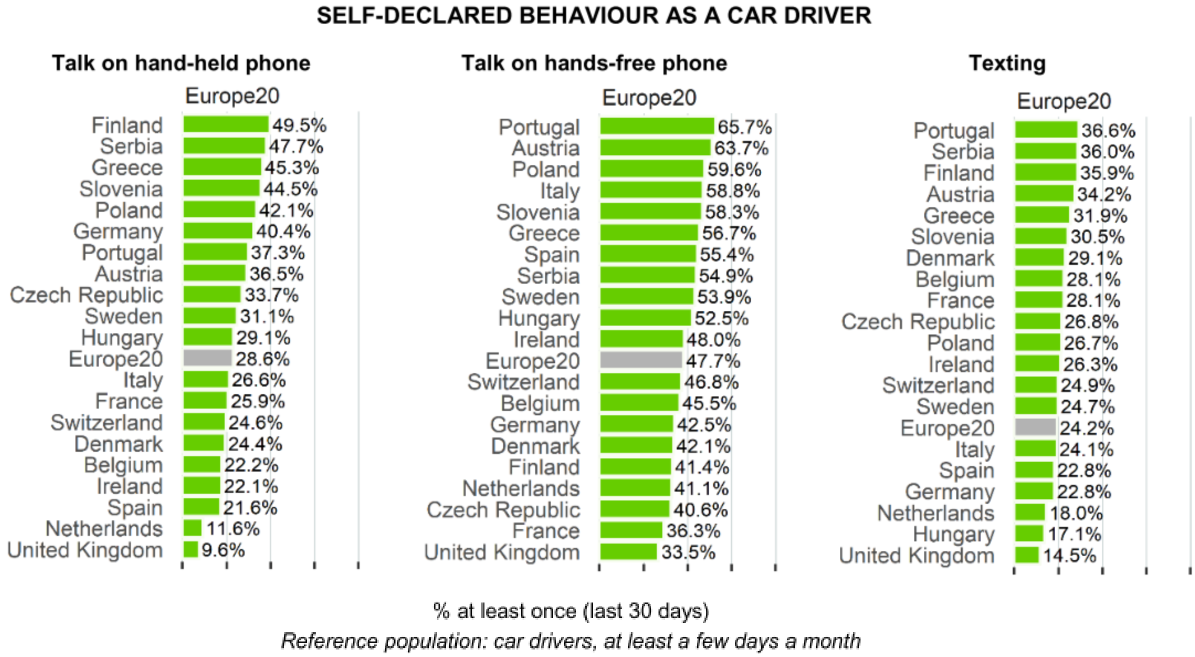
5 What is the prevalence of driver distraction in traffic?

Large scale naturalistic driving research in the USA shows that car drivers are engaged in observable distraction activities for about half of driving time and in primarily cognitive activities for 20% of driving time (Dingus et al., 2016, 2019 see Table 1: column 3). The top three comprise: interaction with passengers (12.2%), all hand-held phone activities (6.4%), and operation of vehicle systems (3.5%).

Another method used to estimate the presence of distraction in traffic is direct observation studies, which look at how many and which 'additional tasks' road users are performing. As these study methods have differed widely over the years as well as between countries, it is impossible to consolidate the results. It is clear though that smartphone use has increased over the years, not only for phoning while driving but also for using apps and texting (Huemer et al., 2018). Comparable recent figures between European countries will become available in 2022 through the BASELINE EC project (https://www.baseline.vias.be/).

Recent self-reported figures on distraction while driving in Europe come from the ESRA-project (E-Survey of Road users' Attitudes) (Pires et al., 2019).

Figure 1. Self-reported mobile phone use while driving.



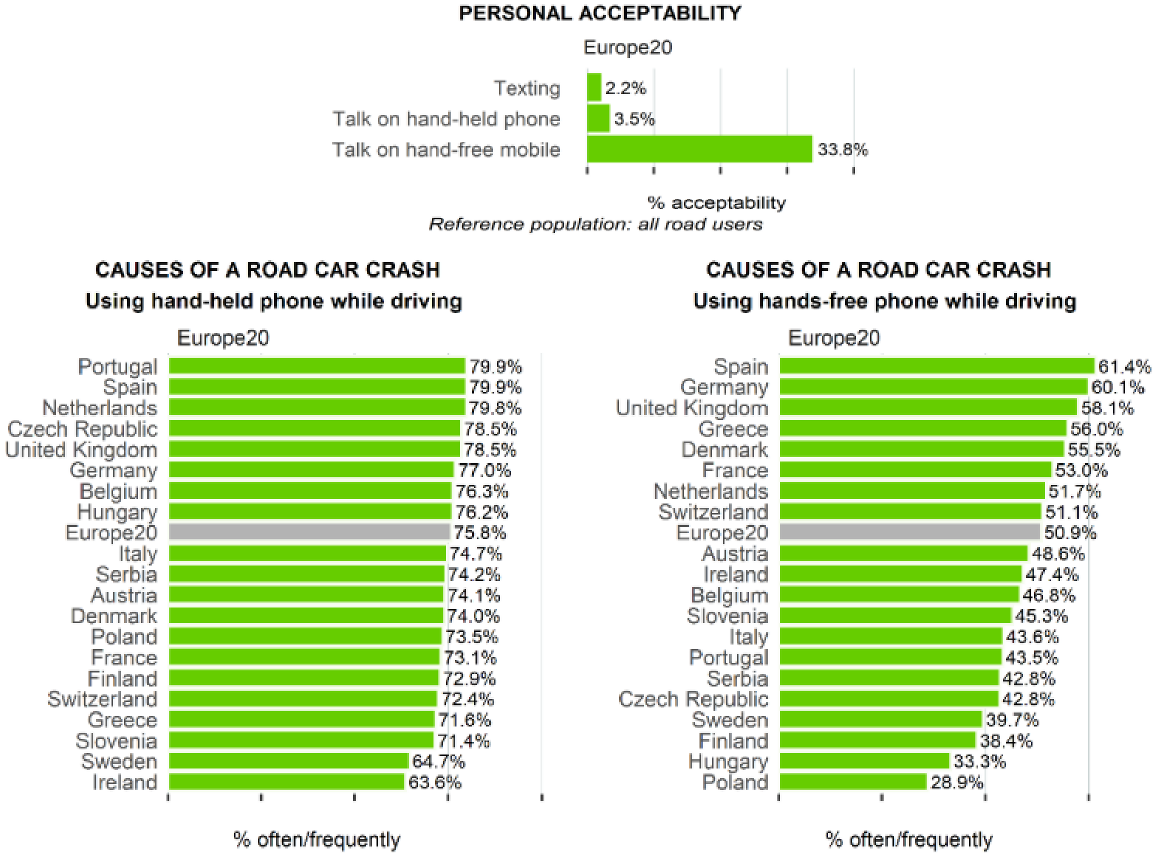
Source: ESRA Survey, Pires et al., 2019.

The EU mean percentages of car drivers self-reporting different mobile phone uses at least once while driving in the past 30 days are: 47.7% talked on a hands-free mobile phone, 28.6% talked on hand-held mobile phone, and 24.2% texted. Countries show substantial differences in self-reported prevalence (see Figure 1). The percentages generally increase with lower age and decrease with higher age, especially for texting (18-24: 43% vs. 65+: 7.7%), and are significantly higher for male drivers (p-value < 0.01).

6 Why do road users drive distracted?

Factors contributing to distracted driving, especially among young drivers, include: risk-taking willingness, attitudes, social norms and influences (e.g. observed behaviour of parents and peers), and perceived behavioural control (e.g. confidence in own ability to engage) (e.g. Carter et al., 2014; Gauld et al., 2017). Figures on opinions behind distracted driving can be derived from the international ESRA survey, specifically for mobile phone use (Pires et al., 2019 - see figure 2). The vast majority of road users in Europe seem to acknowledge the danger of hand-held phone use while driving. Only a small proportion (EU mean: 2.2% for texting and 3.5% for hand-held phoning) consider this acceptable and around 65 - 80% consider 'using a hand-held phone while driving' to (very) often be the cause of a road crash. A higher percentage of respondents consider it personally acceptable to talk on a hands-free mobile phone (which is also a legal activity) and consider it less risky than hand-held phoning, but the percentages differ more between countries.

Figure 2. Driver opinions about distracted driving.



Source: ESRA Survey, Pires et al., 2019.

In general, the EU ESRA data show that women, in comparison to men, think that using the phone while driving is riskier and less acceptable and they use it less often in traffic. Furthermore, with increasing age, risk perception increases, and acceptability and self-declared behaviours decrease.

According to an extended analysis of the ESRA-data, personal acceptability and trust in one's own skill in using the mobile phone while driving are the factors that most increase the likelihood of talking on a hand-held mobile phone and texting while driving.

7 Which rules and legislation exist to combat distracted driving?

All European countries prohibit hand-held mobile phone use while driving a motor vehicle. In some countries it is also prohibited for cyclists (e.g. Denmark, Germany and Austria) (Stelling-Kończak et al., 2020). In 2019 in the Netherlands, the original reference to mobile phones in the legislation was extended to a ban on holding "all mobile electronic devices that can be used for communication" (including mobile phone, tablet computer, media player) (Ministerie van Infrastructuur en Waterstaat, 2019). These devices may only be used if they are fixed in a holder. In some countries, the ban not only applies to vehicles in movement (e.g. the Netherlands), but also to vehicles standing still in a traffic jam or in front of a red light (e.g. Belgium, Germany). Hands-free use of the mobile phone is generally permitted for drivers in Europe(https://ec.europa.eu/transport/road_safety/going_abroad/search_en.htm). In some countries there are some additional rules though (e.g. in France this is only allowed through a car kit, not with headphones/ears). In the US, many states ban all forms of phone interaction (including hands-free) for school bus drivers and young drivers (Governors Highway Safety Association, 2021).

8 Countermeasures

8.1 Road user

Increasing **enforcement** and the subjective chance of being caught for hand-held mobile phone use while driving can stimulate reduction of this risky behaviour (Vlakveld, 2018). Almost 80% of European respondents in the ESRA survey agreed that traffic rules are not sufficiently monitored for phone use while driving (Pires et al., 2019). The use of smart cameras to carry out checks, as in Australia and the Netherlands, could lead to more and better enforcement of the ban on hand-held phone/device use (Stelling-Kończak et al., 2020).

A main aim of public **campaigns** is raising awareness about the dangers of distraction in traffic (Kaiser & Aigner-Breuss, 2017; Vlakveld, 2018). To increase impact, these are best conducted regularly, with target group-specific messages and, in the case of prohibited distraction, linked to increased enforcement (Delhomme et al., 2010). Special attention should be given to young people who have a 'natural' reflex to reach for their phone when receiving a call or text message. Raising awareness should also be included in driver **education** and continuing training for professional drivers (European Commission, 2018a). Drivers should also be aware that built-in information and entertainment systems can be a source of distraction. Harms et al. (2017) drew up specific guidelines for users of such systems. The impact of awareness-raising strategies can be limited, however, because research shows that many drivers use the mobile phone while driving even though they are aware of the risks (Pires et al., 2019).

General **training programmes** for combatting distraction and learning to deal with it as safely as possible can lead to behavioural change. However, there is a risk that drivers will perform more distracting tasks while driving because they feel able to do so after the training (Vlakveld, 2018). Encouraging **companies** to implement a safety policy on distracted driving can also contribute to road safety (Vlakveld, 2018). One study showed that drivers in trucking companies with a clear safety culture report less use of the phone while driving (Huang et al., 2013). Organisational safety culture was determined by the shared perception of the drivers of the safety climate. The authors concluded that “safety climate can be a strong indicator of safe driving behaviour and objective safety outcomes in the trucking industry”.

Drivers can activate apps on their mobile phone which aim at reducing mobile phone use while driving, but these appear to be fairly easy to circumvent (Vlakveld, 2018).

8.2 Road infrastructure

8.2.1 Reducing the prevalence of distracted driving

One measure against distraction by roadside advertising is to avoid roadside placement of boards that are potentially highly distracting (mainly luminous, digital ones) (Vlakveld, 2018). The European CEDR project ADVERTS (https://www.cedr-adverts.eu/) provides recommendations to road administrations for minimising distraction from roadside advertising (van Schagen et al., 2018; Weekley & Helman, 2019).

8.2.2 Mitigating the consequences of distracted driving

One measure to prevent running off the road due to distraction involves the implementation of longitudinal rumble strips to warn drivers, with sound and vibration, that their vehicle is about to run off the road. Rumble strips are considered a cost-effective countermeasure with an estimated reduction of single vehicle crashes by 25%, with a 95% probability that the actual reduction is between 5 and 41% (Elvik et al., 2009).

8.3 Vehicles

Advanced Driver Assistance Systems (ADAS) support the driver in performing primary driving tasks. Depending on the level of automation (https://www.sae.org/standards/content/j3016_202104/), they can inform or warn the driver, partially take over the driving task from the driver, and/or intervene in critical situations.

ADAS can contribute to reduction in the number of distraction-related crashes, by warning about danger (e.g. lane departure warning, forward collision warning) or by intervening (e.g. lane keeping assist, advanced/autonomous emergency braking). Such systems assist in limiting the consequences of distracted driving by preventing running off the road or driving into a vehicle in front. Little crash data is available to allow the evaluation of the effectiveness of warning systems (Vlakveld, 2019). Nevertheless, a recent analysis of US crash data did find that forward collision warning reduces by 20% the number of front-to-rear crashes with injuries, based on a comparison of the same type of vehicles with and without this system (IHHS/IIHS, 2019). The combination of forward collision warning and autonomous emergency braking seems to be highly effective (Vlakveld, 2019). With the new EU Regulation on motor vehicle type approval (European Commission, 2019) several safety features became mandatory for new passenger cars and light commercial vehicles/vans from 2022, including lane keeping assist and advanced emergency braking.

Automatic distraction detection systems are part of the driver monitoring ADAS. Distraction detectors measure the driver's gaze-off-road time and give a warning when a certain threshold is reached. These systems are continuously evolving, and their accuracy in particular requires further improvement (Vlakveld, 2019). Also, the effect on crash involvement requires further investigation. An accurate system can increase road safety, especially if the driver tries to avoid the warnings. The new EU Regulation on type approval requirements for motor vehicles makes Drowsiness and attention detection and Distraction recognition / prevention mandatory for all vehicle categories (European Commission, 2019). The Impact Assessment of the General Safety Regulation provides further detail on this (European Commission, 2018b). Both systems aim at reducing the risk of a (frontal) collision.

Possible drawbacks of ADAS that inform and/or warn drivers are that they can distract the driver when continuous information about the broad driving context is given or when the human machine interface leads to increased workload (Bates et al., 2021). One study also showed that too many perceived unnecessary alerts of distraction can lead to a “cry wolf” effect, resulting in drivers ignoring the alarms (Cabrall et al., 2020). It is therefore recommended that prerequisites for HMI design are better followed and that accuracy of ADAS is further improved (Tsapi et al., 2020). In the Netherlands specific human factor guidelines for the development of traffic information services in cars have been drawn up (Kroon et al., 2019). Another possible drawback is that ADAS and (partly) automated driving can increase the likelihood of drivers’ performing more distracting tasks because they feel 'protected' while driving (Vlakveld, 2018). One driving simulator study showed that drivers were occupied with non-traffic-related activities more often when driving was partly automated, and even more frequently when driving was highly automated (Carsten et al., 2012). In the situation of increasing automation in vehicles, distraction can lead to delays in taking back control and in emergency reactions. These effects, and the feeling of confidence in these systems, may increase in line with increasing automation (Cunningham & Regan, 2018). This underlines the importance of driver awareness of the limitations and possible deficiencies of in-vehicle systems (Hungund et al., 2021). Training in taking over manual control in automatic cars can be effective (Payre et al., 2017). Tsapi et al. (2020) provide a number of policy recommendations for maximizing the road safety benefits of ADAS.

9 Further reading

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