Road Safety Factsheet

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Infotainment Systems

Over the last ten years, there has been a huge increase in the digital technology available to motorists, allowing them to perform tasks that are unrelated to driving while they are behind the wheel. One of the biggest developments in this period has been the rise of infotainment systems.

What is an infotainment system?

In-vehicle infotainment refers to vehicle systems that combine entertainment and information delivery for drivers and passengers. These systems typically use audio and video interfaces, touchscreens and keypads[1]. Currently, these systems are only available in selected vehicles, however, it is expected that by 2020, up to 80% of new vehicles will feature these systems and will be connected to digital services[2].

The systems typically use Bluetooth technology and or smart phones to help drivers control the system. Some of these systems are controlled by pressing traditional buttons on the steering wheel or around the screen. However, many vehicles are now equipped with a screen and voice command system that allow motorists to push a button and speak to facilitate an interaction[3]. Most screens are now touch sensitive and use haptic buttons, which vibrate or offer other feedback to let the user know that the command was received[4]. Some vehicles also include other features, such as heads up displays, gesture controls, rotary dials and write pads.

Infotainment can allow a driver to perform a number of tasks, such as standard radio and CD players to listen to music, hands-free phone connections to make phone calls, vehicle voice commands and other types of interactive audio or video. Some systems include rear-seat DVD capability, which allows passengers to view movies and video[1]. Vehicles with built in satellite navigation are becoming the norm on newer vehicles, with some also incorporating features such as: reverse camera display, ability to listen to incoming and outgoing text messages and access internet or smartphone enabled content such as traffic conditions, sports results and weather forecasts[5]. Some vehicles even have a range of systems that allow passengers with smartphones and laptops to connect to the vehicle[1].

Many of these systems involve a complex multimodal interaction to perform a task. For example, to select a music option, a driver might push a button on their steering wheel, issue a voice-based command, view the options presented on an LCD screen and select an option via touch using the touch-screen display[3]. However, some systems have safety features that disable drivers from using some services while driving, such as viewing video or adjusting the in-built satellite navigation system[1].

Infotainment systems as a driver distraction

In 2017, there were 2,823 road crashes in Britain in which distraction in the vehicle was deemed a contributory factor, making up 3% of all road accidents. This included 79 fatal accidents and 469 accidents in which someone was seriously injured[6].

Some tasks, such as listening to car radio while driving, have long been considered socially acceptable, despite driver distraction becoming an area of focus for road safety professionals. However, there is a concern that radio usage, in its ever-changing context, as it becomes part of increasingly complex infotainment systems, remains a relatively low risk activity to perform while driving. This is because vehicles now often have larger information screens and high information functions, such as the ability to use satellite radio or listen to music through a device such as a smartphone. The larger number of controls being introduced in current production and aftermarket radios are becoming an additional source of distraction to the driver[7]. Distraction from these systems arises from a combination of three sources: visual processing (when the driver takes their eyes off the road), manual interference (when the driver takes their hands off the steering wheel) and cognitive (when attention is drawn away from information processing necessary to operate the vehicle safely) [3].

One study examined how often 17 drivers with access to advanced infotainment systems for four weeks were involved in collisions and near misses. The study also determined whether the use of the in-vehicle infotainment system was related to the crash or near-crash event and documented driving behaviours. The analysis of potential crash and near-crash events recorded 0 crashes and 46 near crashes. Further analysis showed that the infotainment system was a causal factor in three near misses and a mobile phone in two cases. Although the number of near misses caused by the driver's use of the infotainment system is low, the number is not trivial, since the percentage of time participants spent manipulating system controls was approximately 2%. Therefore, there seems to be an overrepresentation of infotainment system manipulations in near crash events. However, a larger dataset would be needed to assess the magnitude of this effect[7].

The study also found that participants glanced away from the road in 28% of cases, but failed to see all relevant events in around 35% of near misses, suggesting that in some cases drivers were 'looking but not seeing'. However, statistically significant results were only observed in a small number of eye glance metrics. Seen as a whole, the data suggests that there is some visual demand placed upon participants when they are interacting with infotainment systems. This demand was met at the expense of peripheral glances, which could decrease participants' situational awareness and longer glances at the forward roadway[7].

However, some research has suggested that not all kinds of infotainment systems are equally distracting. Tasks may be performed using an auditory or vocal command, or a visual or manual demand. A perceived advantage of voice inputs compared with manual inputs is that they eliminate the competition for visual and manual resources between the secondary activity (operating the infotainment system) and the task of driving. Therefore, voice interfaces have often been seen as an appealing approach for giving drivers access to a range of entertainment and connectivity options while minimising the potential impact on driving performance and safety[8].

Despite this, some research indicates that some voice interactions affect driving performance in ways that could increase crash risk. Speech generation, comprehension and simple cognitive tasks can affect driving performance in terms of speed variability and lane maintenance. This is particularly the case when information

is complex or poorly implemented in the vehicle. User interfaces for voice input often present information on a console display, which inherently provides a reason for the driver to look at the screen and take their eyes off the road. At the same time, there is a concern that performing any secondary task can increase crash risk, as even the easiest to use interfaces do raise the total amount of attention that the drivers give to secondary non-driving tasks. Some voice interactions, compared to manual interactions can reduce visual demand as intended, but they may not necessarily eliminate it[8].

Voice systems are also not equal in complexity. One study found that the differences between a menu based voice interface where a task is completed over several steps and a one-shot voice interface in which the driver completes the task in one step are not negligible. Drivers completed a music retrieval task using an iPod using a multiple turn voice interface and a single turn voice interface. The task took longer to complete using the multiple step interface. The single turn interfaced reduced the average time that drivers had their eyes off the road and was deemed less demanding than the multiple voice command interface[9].

If the workload associated with one form of interaction differs from another, the differences might be offset by the amount of time it takes to perform the interaction. For example, a visual or manual interaction might take the driver's eyes off the road, however, if an audio command keeps the driver's eyes on the road but takes much longer to perform, any benefits might not be realised. In addition, just because the driver keeps their eyes on the road during an auditory/vocal interaction does not mean that drivers will see what they are looking at. This is known as inattention blindness, where motorists look at something but fail to 'see' it because their attention is diverted by a secondary task that is cognitive in nature[3].

One study found that interactions using a centre stack (LCD display) were significantly less demanding than auditory vocal interactions, which were less demanding than using a central console (dial to scroll through items/ writing pad). By design, auditory communications allowed the driver to keep their eyes on the road while interacting with their vehicle; however, the driver is less likely to see what they are looking at. The benefits of reduced visual distraction were also offset by longer interaction times with the system. Auditory interactions took significantly longer than any other type of interaction[3].

Finally, not all tasks performed using the infotainment system are equally distracting. This is because tasks differ in outcome, such as playing a song or sending a text. They also vary in the amount of time taken to complete the task. Greater task duration is associated with greater distraction[10]. Research found that tasks such as text messaging and navigation tasks were more difficult for drivers to perform. Texting took an average of 30 seconds and entering a destination into the navigation system 40 seconds. Clearly, this distraction is too long. At 25mph, drivers using the infotainment system to enter a destination would travel just under 1,500 feet, and in several of the vehicles used in the study, entering a destination took significantly longer than 40 seconds[3]. More concerning is that drivers may well not believe that tasks such as programming music and entering a destination into their navigation system vary much in terms of visual and cognitive demand, despite the navigation system taking typically twice as long to set up as playing music.

The workload experienced by drivers vary as a function of different tasks, modes of interaction and vehicles. However, some features could be too distracting for drivers when the vehicle is in motion. This could be an issue as many motorists could assume that because features are enabled while driving, they are safe and easy to use. Therefore, it needs to be considered what interactions should be available to a driver while they are operating a vehicle rather than what could be available[3].

RoSPA's position

RoSPA recognises that while using these systems, drivers may take their eyes off the road for a sustained period of time to look at the screen and select which icons they should touch, devoting significant mental resources to this task, when screens are often well below the driver's eye-level. Drivers may also become distracted by interacting with the system vocally or manually.

Therefore, RoSPA believes that the law and the Highway Code, governing in-vehicle driver distraction, should be reviewed and updated. The first step to this is to conduct a research programme to assess the type and level of driver distraction caused by new vehicle technology, such as infotainment systems, and to identify potential countermeasures to this distraction. This could include certain infotainment touchscreen functions being prevented from operating while the vehicle is in motion. Manufacturers should also be encouraged to install 'head-up' displays in new vehicles, which are currently an expensive option on selected new vehicles. Regulations limiting the screens that a driver can see while the vehicle is in motion could also mitigate some of these risks.

Finally, education is key to combating the risks of in-vehicle infotainment. The importance with all new technology is to understand and address unintended risks they pose and not be blinded by the benefits. If the implementation of in-car technology continues at a rapid pace, proper management of associated risks is essential to safeguarding individuals[11].

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