

CLIENT PROJECT REPORT CPR2254

'Drive Safe' Review

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1 Introduction

The rate of smartphone ownership in the UK continues to grow. Ofcom (2015) estimated that 66% of the population owned a smartphone in 2015 (up from 39% in 2012). Given the increase in ownership rates of these devices, the frequency of occasions where drivers may be inclined to use them during the driving task, either as a driving aid (such as for navigation) or for tasks which are unrelated to the driving task (such as messaging or social networking), is likely to also be on the increase. A 2015 survey of drivers by the Institute of Advanced Motorists found that 77% of respondents thought that driver distraction was a bigger problem than was the case three years ago, with 93% believing that text messaging or emailing was a ‘very or somewhat serious threat’ to their personal safety (IAM, 2015). It is undeniable that drivers are increasingly connected to the outside world, both through inbuilt vehicle technology and also the portable devices that they bring with them to the driving seat. The ever-increasing array of technology means that there is an increased risk of driver distraction, which has clear consequences for safety. Using data supplied by the Department for Transport, in 2015, distractions from inside the vehicle were a specific contributory factor in 2,920 accidents in Great Britain (a little under 3% of all injury accidents), including 61 fatal accidents (just over 4% of all fatal accidents). A 2015 study for the European Commission (TRL, TNO, Rapp Trans, 2015) estimated that distraction is a contributing factor in between 10% and 30% of road collisions in the EU.

A recent survey for the RAC Foundation revealed that *“most people want to do the ‘right thing’ when it comes to road safety – they just need some help from product manufacturers”* (Ben Marshall, quote from press release accompanying the report¹). The survey found that 69% of the British public agreed that technologies which connect the driver to the outside world could distract people from driving safely, and that there was *“a strong appetite for using a ‘vehicle safe mode’ on devices (such as a mobile phone) used in cars”* (Rigby et al., 2015, p.3); 60% of drivers stated that they would be happy to use such a device.

In response to the proliferation of handheld devices and the apparent desire to ‘stay connected’, many functions or applications (apps) have been brought to market which either are specifically designed to improve smartphone functionality whilst driving, or may be used to do so even if this was not their primary purpose.

Connectivity solutions such as MirrorLink, Android Auto and Apple CarPlay allow drivers to connect their smartphone to their vehicle via a USB cable, and to access certain apps. These technologies are designed to enable the use of such devices whilst driving, whilst at the same time stating that they adhere to regulations related to driver distraction.

While many vehicle-integrated systems exist which connect the driver to the outside world, these have generally been designed to be used by a driver while the vehicle is in motion. In contrast, most handheld devices and their features have not been designed for in-vehicle use by drivers, and are thus not constrained by guidelines intended to govern their performance in the driving environment. Whilst connectivity between vehicles and non-integrated devices is improving, there are still many challenges, *“with the dramatic*

¹ <http://www.racfoundation.org/media-centre/most-driver-back-car-safe-mode-for-mobile-phones-ipsos-mori-survey-shows-press-release>

mismatch between handheld consumer devices and automobiles, both in terms of product lifespan and the speed at which new features (or versions) are released” (Shelly, 2015, p.161).

Other apps exist which claim to simplify the phone interface for use while driving, while still others prevent texting or calling while the vehicle is in motion. Such apps are popular; for example, one app (SafeDrive), which rewards drivers for not using their phone at the wheel by accumulating points towards special offers, has been downloaded over 35,000 times from 140 countries; another app (Drivemode), which has a ‘no look’ interface relying on voice control, has been installed between 500,000 and 1,000,000 times. Such findings, and those from the recent RAC Foundation survey (2015), suggest that there is a level of desire amongst consumers to reduce their exposure to distraction from handheld devices while driving. It is less clear to what extent OEMs (original equipment manufacturers (OEMs), designers and data providers are keen to do the same.

A recent DfT consultation on penalties for the use of a handheld mobile phone while driving (analysis ongoing) sought opinions on proposals to change the fixed penalty notice, and on the desirability of ‘drive safe’ modes. To complement this consultation, the RAC Foundation asked TRL (the Transport Research Laboratory) to explore how ‘drive safe’ modes are being considered in the product design of both vehicles and devices. The overall aim of the research was:

“To establish to what extent OEMs, data/app providers and providers of network handheld devices are considering issues of distraction and ‘drive safe’ modes within their product design.”

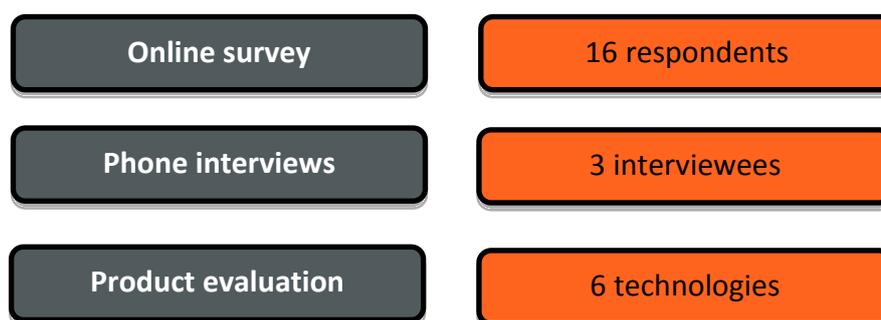
In order to address this aim, nine objectives were established:

1. to establish the importance and relative priority of the issue of ‘distraction in vehicle’ within product design;
2. to establish any design guidelines or standards that are adhered to on issues of human–machine interface design, with regard to minimising distraction;
3. to establish the extent to which organisations are investigating or building ‘drive safe’ products into their product lines;
4. to establish both manufacturer understanding of ‘drive safe’ options and easy-to-interpret/non-distracting interfaces, and also consumer attitudes and demand for them – and how these have changed over time;
5. to understand the extent to which connectivity whilst on the move is considered a key selling point, and to what market segments;
6. to establish views from manufacturers and data providers about how demand for connected services looks like developing over the next five years, and how the industry is seeking to respond;
7. to understand whether there are any regulatory barriers to developing safe connected services in this field;
8. to establish whether there are any areas of potential government intervention (regulatory or non-regulatory) that would assist with providing ‘drive safe’ mode systems; and

9. to establish areas in which related private, public or third-sector organisations could assist in the development of this field.

2 Method

A three-stage method was developed to respond to the objectives. First, an online survey was created and distributed by email to representatives from vehicle manufacturer/OEMs, mobile device manufacturers, telecommunications providers, app developers, and insurance providers and members of other relevant industries. Second, telephone interviews were carried out to further explore the issues identified during the survey. Third, a brief evaluation of popular handheld devices was conducted, with a focus on whether they have 'drive safe' features.



2.1 Online survey

An online survey was developed to address the research objectives (see Appendix A). This was disseminated to appropriate contacts and via a targeted LinkedIn campaign with a target audience of over 13,000. Respondents were offered entry into a prize draw to win a £50 donation to a charity of their choice, in order to encourage uptake. Sixteen respondents completed the online survey, as shown in Table 1.

Table 1. Respondents and roles²

No.	Respondent type	Respondent role
1	Automotive components supplier	Business Development
2	Component supplier	OEM Business Development
3	Connectivity platform provider – SHIELD	Marketing & Sales Director
4	Engineering consultancy	–
5	Independent road safety consultancy	Director – Research & Consultancy
6	Mobile device manufacturer	General Manager, Telecommunications R&D
7	Mobile device manufacturer	Product Management
8	Telecommunications provider	Vice President
9	Telecommunications provider	–
10	Vehicle manufacturer/OEM	Senior Engineer, Research & Advanced Engineering
11	Vehicle manufacturer/OEM	Project Engineer
12	Vehicle manufacturer/OEM	–
13	Vehicle manufacturer/OEM	Vehicle Homologation Engineer
14	Vehicle manufacturer/OEM	Chief Engineer
15	Vehicle manufacturer/OEM	–
16	Vehicle manufacturer/OEM	–

Source: Authors' analysis

2.2 Interviews

Telephone interviews were carried out with three of the survey respondents (participants 5, 7 and 8) who indicated their willingness to participate in this stage of the research. The interview guide can be found in Appendix B. The interviews explored some of the respondents' survey responses in more detail, and asked about other key issues. Interviews took around 40 minutes and were recorded and then transcribed. Verbatim quotes from the interviews are included in Section 3, Survey and Interview Findings, to support the conclusions (with quotes attributed to the respondents in Table 1, for example a quote from participant 2 would be attributed to 'P2').

² Respondents were not required to state their role.

2.3 Product evaluation

The evaluation sought to investigate the smartphone market to identify the range of safe driving functions available, and then to examine how they perform. Particular emphasis was placed on the usability of the functions/apps and their potential impacts on driver performance.

The review comprised two stages. First, an initial market review was undertaken of the 'drive safe' functions and applications available to the public; second, the functions and apps were subjected to a detailed evaluation.

The evaluation stage adopted a systematic approach to reviewing the 'drive safe' functions. This approach was based on the methodology developed in the *Checklist for the assessment of in-Vehicle information systems* report, published by TRL (Stevens & Cynk, 2011). This adapted methodology comprised the following sections:

- General information regarding the name, manufacturer and OS (operating system) of the function/app
- Analysis of the function's/app's specification
- User experience
- Documentation and instructions

Defining 'drive safe' products

For the purposes of this review, 'drive safe' functions were considered to be either those which were specifically designed to improve how a smartphone performs whilst driving, or those which might improve driver safety by limiting the frequency or type of alerts delivered to the user whilst the function is activated.

Given the rapidity of change in the smartphone market, the review was limited to current-generation devices and functions.

Only functions or apps which are either preinstalled on smartphones by manufacturers, produced by manufacturers for optional user download, or likely to become standard in the near future were reviewed. 'Drive safe' apps produced by independent developers were not included in this review.

This review only considered functions/apps that are available on systems using Google's Android OS, Apple's iOS or Microsoft's Windows 8.1.

3 Survey and Interview Findings

The findings are organised by the research objectives. For each objective, quantitative survey results are provided in tabular format, followed by survey comments and interview quotes, to convey the key findings.

3.1 The importance and relative priority of the issue of ‘distraction in vehicle’ within product design

In order to address this research objective, respondents were asked the following questions; their average responses (and standard deviations) are shown in Table 2. Responses were provided on a scale of 0 to 10.

Table 2. Survey questions addressing objective 1

	Mean	Min	Max	SD	n
How important is the issue of in-vehicle distraction from handheld devices to your organisation, from a product development perspective? (0=not at all, 10=very)	6.2	1	10	2.6	16
To what extent does your organisation prioritise avoiding in-vehicle distractions from handheld devices? (0=not at all, 10=very much)	6.7	1	10	3.0	16
In your organisation’s opinion, is the distraction caused by in-vehicle handheld devices more or less important than the distraction from other non-handheld devices (i.e. radio, satnav, etc.)? (0=much less, 10=much more)	6.3	1	10	2.1	16

The issue of in-vehicle distraction is not a major priority area

The survey responses suggest that the issue of in-vehicle distraction in product design is not a priority area amongst most of the responding organisations, although two respondents said that the issue of in-vehicle distraction from handheld devices was ‘very important’ (P9, i.e. participant number 9 in Table 1). Participants were encouraged to provide comments along with their responses. One mobile device manufacturer representative explained that *“this is a low priority for us in honesty. We are not convinced that this is a responsibility that falls on us to restrict user behaviour, rather than on users to abide by the relevant laws in the country they are in”* (P7). However the opposite sentiment could be found in other participants, for example *“we would seek to eliminate the possibility of driver handheld devices being active while the vehicle is in motion”* (P5).

There is little distinction in the industry between distraction from handheld and non-handheld devices

In terms of the distraction caused by in-vehicle handheld devices compared with that caused by other (non-handheld) devices, the overall consensus was that the issue of distraction from handheld devices was slightly more important. The road safety consultant

(P5) stated that distraction from handheld devices is ‘much more important’ (a rating of 10), but the majority of vehicle manufacturers/OEMs gave a rating of 5, indicating no difference between the level of importance assigned to distraction from the two types of device. A mobile device manufacturer stated that:

“We recognise that handheld devices are more distracting, but there are limits on what we believe we should do about that.” (P7)

This indicates that the lines of responsibility for in-vehicle distraction are not clear – see Section 3.8 for further discussion.

The level of integration of handheld devices with the vehicle was felt to be an important factor by one participant representing a telecommunications provider, who felt that:

“Distraction may also be compounded by poor integration of devices within the vehicle... car manufacturers have a duty towards better HMI [Human Machine Interface] that works with modern ICT [information and communications technology] such as smartphones and tablets... without this, the bringing in of independent devices will continue.” (P8)

Section 4, which gives the findings of the product evaluation, is also relevant to this issue.

The distinction between the way handheld connected devices are used was also felt to be important. ‘Handheld’ devices (i.e. devices that are brought into the car and are typically used manually) can often be used in-vehicle without the requirement to manually interact with them (typically by voice activation).

“What you don’t want people to be doing is doing handheld mobile Internet searching or handheld texting or handheld video watching. What you want is a hands-free world, ideally in a cradle or fitted to the car as a modem.” (P7, interview)

“The majority of devices that will be fitted to cars [in five years] will not be in a handheld way, they will be either integrated in a modem-like way or hands-free. Therefore, I believe, in Europe at least, the issue will reduce.” (P8, interview)

“I think we need to be adopting a more pro-safety, pro-connected-car story where hands-free is the norm as opposed to handheld is the norm.” (P8, interview)

In-vehicle mobile device use is inevitable

There was a consensus that the use of mobile devices is now so ingrained in society that it would be a futile exercise to attempt to prevent their use in vehicles or when driving.

“I think if you don’t have a hands-free system available then people will be very much more likely to use a handheld device, because they’re not going to stop communicating.” (P5, interview)

“I do not expect the rising generations of new drivers to be easy to wean off their close involvement with interaction with devices of any sort, and older existing drivers are also getting more dependent on devices of all sorts.” (P5, interview)

“Most people have them [mobile phones] on display, quite a lot of people use them for streaming music or for navigating or for doing something else...then also quite

often and obviously errantly interact with them and make phone calls or read a text message while driving.” (P7, interview)

3.2 Design guidelines or standards that are adhered to on issues of human–machine interface design, with regard to minimising distraction

Table 3. Survey question addressing objective 2

	Mean	Min	Max	SD	n
To what extent does your organisation promote laws and guidance regarding the use of handheld devices whilst driving? (0=not at all, 10=very much)	6.6	1	10	3.1	16

In terms of the use of guidelines and standards in the *design* of handheld devices, there do not appear to be any that are specifically related to the use of devices whilst driving; therefore, to address this objective, the focus was more on the promotion of guidance relating to the *use* of handheld devices whilst driving, both within responding organisations, and in terms of communication to customers.

The extent to which the organisations promote laws and guidance about the use of handheld devices whilst driving varied greatly, with the components suppliers and connectivity platform provider all stating that this was ‘very important’ (a rating of 10), while five of the seven vehicle manufacturers/OEMs gave a rating of 5 or lower.

One mobile phone manufacturer representative indicated that they provide guidance to users about using their products while driving, while the other drew attention to the differing legal requirements between countries, and the difficulties this can cause.

“We treat the issue seriously and within our power as a CE [consumer electronics] vendor we give guidance to users about the use of products in all circumstances.” (P6)

“Legally, different restrictions apply in different markets so to avoid complexity; the temptation would be to apply features to attempt to force the most restrictive – but that, too, would have horrendous user experience implications. And, of course, it sets an uncomfortable precedent that a device manufacturer has responsibility to restrict users to ensure they obey the law.” (P7)

Responses were also provided in terms of the promotion of laws and guidance within organisations, with some respondents describing how their organisation encourages employees to avoid using mobile devices when driving, or to use them only within predetermined guidelines.

3.3 The extent to which organisations are investigating or building ‘drive safe’ products into their product lines

Table 4. Survey questions addressing objective 3

	% Yes				n
Does your organisation have any products with features which aim to help drivers to avoid distractions when driving?	70%				10
In your organisation’s opinion, how effective are the following methods of avoiding/reducing in-vehicle distraction from handheld devices while driving (please respond with respect to the ‘wider world’ rather than any initiatives within your organisation)? (0=not at all, 10=very)	Mean	Min	Max	SD	n
Education:	5.7	1	8	1.9	16
Enforcement:	6.0	2	10	2.5	16
Automatic disabling of functionality while driving:	6.8	2	10	2.9	16

Most of the participants who responded to the question stated that their organisation has products with features which aim to help drivers to avoid distractions, for example simplified user interfaces for interacting with apps while driving, haptic feedback (typically the use of vibration or motions to provide non-cisual feedback to the user), and safety warnings provided by satellite navigation systems before use. However, as discussed in Section 3.1, the issue of reducing in-vehicle distraction in product design is not currently an important one across the industry, and therefore little further information was provided in relation to this.

Automatic disabling of functionality is seen as being effective in reducing distraction from handheld devices, but there are customer satisfaction and technological issues

Respondents were also asked how effective they felt education, enforcement and automatic disabling to be in reducing distraction, and how this might influence their motivation to develop products with features to help drivers avoid distractions.

Of the three options provided, automatic disabling of functionality while driving was seen to be the most effective method for reducing in-vehicle distraction, with six participants rating this as ‘very effective’ (a rating of 10). Currently, the technology to effectively disable handheld devices while driving is either not available or problematic:

“Automatic disabling is the least effective today, as poor automotive ICT integration goes back years.” (P8)

“Automatic disabling is a classic case of ‘it’s secure but not useful’ or ‘it’s useful but not secure’.” (P5)

“Within the electronics of the car, there are means of disabling certain power supply or certain connectivity should that be desirable. In practice, most car companies do not do that, because they believe that it’s not their responsibility. They believe they need to leave the phone connected in the car for a range of reasons, but also to make sure that the passengers have right of taking the call, even if the driver doesn’t.” (P8, interview)

“The only thing you can do is rely on people defining themselves as a passenger or as a driver, so that you’re putting it firmly back on the end user; and obviously it wouldn’t take them very long to work out that if they wanted to disable a restriction they just say that they’re a passenger.” (P7, interview)

“There could be areas that are ‘blacked out’ within a car, so around the kind of driving position you could have tags that mobile devices could detect or that you could try to dampen the signal in a particular area of a car – but how effective that would be? I suspect pretty light.” (P7, interview)

Another key issue with the concept of automatic disabling is the potential impact on passenger journeys and overall customer satisfaction, as well as potential sales, as described by a number of participants:

“Disabling functionality is yet to be achieved for the driver without also preventing passenger usage.” (P5)

“If you were able to devise an Internet system which could distinguish between driver and passenger, and disable driver handheld devices while the vehicle is in motion, I think that would help enormously; but I’ve yet to see a system – and I’ve seen quite a few – that propose to disable the device while the vehicle is in motion. But then you say, ‘Well what about the passenger?’” (P5, interview)

“It will be difficult to find a way to prevent improper use of handheld devices by drivers during driving, but not prevent the passenger, for example, using them.” (P14)

“We could disable certain features if a mobile device detects it is likely to be in a car, but then the user could be a passenger, resulting in a negative experience.” (P7)

“Automatic disabling of functionality presents serious user experience challenges, and implies a responsibility on the device manufacturer that should sit with the user. Frustratingly, a manufacturer who took action to implement something like this in the interests of safety would likely face a backlash from frustrated users.” (P7)

“Disabling would need to be a cross-car agreement. You risk losing sales if you disable and another does not.” (P12)

“Automatic disabling of features needs to be accompanied by facilities for these features to be made available ‘hands-free’ by systems within the vehicle.” (P6)

It was also felt that automatic disabling of features had implications for consumers’ perceived level of freedom:

“Anything where you add additional restrictions and remove people’s ultimate free will in the way that they use a product typically drives them crazy... the more restrictions we put on the freedom that someone has to use the product they’ve purchased, the more frustrated that makes customers – and that certainly would

extend to a scenario where we were blocking functionality if there were kind of safety restrictions on how it was used.” (P7, interview)

Education was, overall, perceived to be slightly less effective than automatic disabling of features, but with potential scope for improvement in the future.

“Education only works on those who accept being educated.” (P14)

“You can educate people, but they may just be paying lip service to the training.” (P5)

Current enforcement and knowledge of the law is perceived to be poor, with a need for improvement

A common theme among respondents was that, whilst laws governing the use of handheld devices while driving do exist, the enforcement of these laws is poor.

“Enforcement is more effective, but the likelihood of detection is critical... active police patrols are essential.” (P5)

“What’s the point of having the law if nobody’s taking any notice?” (P5, interview)

“Enforcement appears to me, at least so far, to have failed quite miserably to change peoples’ behaviour.” (P7, interview)

“Enforcement is rudimentary, and many people consider themselves ‘able to handle it’.” (P14)

The level of knowledge amongst the public regarding current laws and potential consequences of disobeying them is also seen to be low.

“They should raise greater awareness of what the actual restrictions are; I don’t think enough people know, that is the first thing. They also, of course, could look at introducing additional regulations and legislation.” (P7, interview)

“You could add a level of enforcement onto that [the requirement for passengers in a moving vehicle to declare themselves as so]. So, for example, someone was found to have disabled the restrictions on their device by saying they’re a passenger and they’re actually a driver, that could become an offence. But communicating that would be horrendous.” (P7, interview)

3.4 Manufacturer understanding of ‘drive safe’ options and easy-to-interpret/non-distracting interfaces, and also consumer attitudes and demand for them – and how these have changed over time

Table 5. Survey questions addressing objective 4

	Mean	Min	Max	SD	n
In your organisation’s opinion, to what extent is there consumer demand for features which help them to avoid distractions when driving? (0=not at all, 10=very much)					
Leisure drivers:	3.8	0	8	2.6	16
Business drivers:	5.7	0	10	3.3	16
Fleet/safety managers:	7.2	0	10	2.6	16
In your organisation’s opinion, to what extent will there be consumer demand for features which help them to avoid distractions when driving five years from now? (0=not at all, 10=very much)					
Leisure drivers:	4.7	1	10	2.4	16
Business drivers:	6.5	1	10	2.5	16
Fleet/safety managers:	7.8	5	10	1.9	16

Fleet and safety managers create a demand for features to avoid distracted driving; business drivers, and leisure drivers even more so, do not create as much demand

When it comes to features to help avoid distractions when driving, a clear difference emerged in perceptions of demand for this from leisure and business drivers on the one hand, and demand from fleet/safety managers on the other. Participants felt that leisure drivers generally do not demand such features (average 3.8 out of 10), while fleet/safety managers (at 7.2 out of 10) presented a fairly high level of demand. Responses in relation to business drivers were between the two (average 5.7 out of 10).

Reasons for this perception were explained by some respondents:

“Drivers themselves do not want features locked down, although they do welcome intelligently designed user interfaces that present less cumbersome and less distracting visuals and controls to drivers. Fleet managers would welcome fewer distractions to reduce accidents, but many have drivers use mobile devices for dispatch, telematics, etc.” (P7)

“Leisure drivers will have poor motivation, business users will balance risk against utility for work purposes, and fleet/safety managers will have broader moral and legal responsibility for multiple drivers – and the possibility of corporate negligence charges.” (P5)

It was generally felt that fleets can represent the current ‘gold standard’ (albeit one with room for improvement) in terms of reduction of in-vehicle distraction:

“I think [reducing driver use of handheld devices] is increasing in fleet managers’ requirements, and this is where there’s quite a lot of these companies that provide this intermediary service to inhibit [use of devices]. It’s getting, obviously with health and safety corporate liability, etc.... becoming more [important].” (P5, interview)

“There’s been a lot of publicity through the media, specialist media, for fleet managers and for health and safety managers on this particular subject and there’s quite a strong push... to ensure that responsibility is taken by the employer as well as the driver.” (P5, interview)

“I think more lessons should be taken from the fleet owners and their policies today. I think the bigger problem with those using handhelds tends to be private drivers rather than fleet drivers or corporate drivers... clearly a lorry driver has a livelihood and doesn’t want to either lose his licence or lose his livelihood, whereas maybe a personal driver might run a risk by taking the call, and that’s unnecessary. Again, in the fleet arena, they’re ahead of the typical driving car because they’ve had connected vehicles, connected lorries, for many more years.” (P8, interview)

Respondents indicated that demand for features to help avoid distracted driving amongst the three consumer groups would be higher in five years’ time.

3.5 The extent to which connectivity whilst on the move is considered a key selling point, and to what market segments

Table 6. Survey questions addressing objective 5

	Mean	Min	Max	SD	n
To what extent is connectivity whilst on the move considered to be a key selling point for vehicles ? (0=not at all, 10=very much)	7.2	5	10	2.2	6
To what extent is it expected that connectivity whilst on the move will be a key selling point for vehicles five years from now?	6.8	5	10	2.0	6
To what extent is connectivity whilst on the move considered to be a key selling point for mobile devices?	9.0	8	10	1.0	2 ³
To what extent is it expected that connectivity whilst on the move will be a key selling point for mobile devices five years from now?	9.5	9	10	0.5	2

Connectivity whilst on the move is already considered to be an important selling point for vehicles, and even more so for mobile devices, at present (although consider also Rigby et al.’s 2015 survey findings that ‘connected driving technologies’ are of low importance to

³ This question was only asked of respondents which self-identified as mobile device manufacturers, of which there were two

consumers considering buying a vehicle). Respondents indicated that they expect its importance as a selling point for mobile devices to have increased in five years' time, but to have decreased slightly by then for vehicles. This suggests, admittedly on the basis of on a small sample, that it is expected that in the future the onus will be on mobile devices to have the ability to connect to vehicles.

As discussed previously in Section 3.4, fleet managers are seen as an important market segment, as they have a greater motivation to improve safety amongst their drivers. In particular, those operating in certain private sector organisations are seen as key:

“In the private sector... you have more businesses that are focused on transportation, logistics, haulage – there is more of an investment in technology... in the private sector you see a lot of telematics solutions, free-managed solutions, all of this use of technology in vehicles.” (P7, interview)

3.6 Views from manufacturers and data providers about how demand for connected services looks like developing over the next five years, and how the industry is seeking to respond

Table 7. Survey questions addressing objective 6

	Mean	Min	Max	SD	n
Does your organisation believe that in five years from now the issue of avoiding in-vehicle distraction from handheld devices while driving will be more or less important than now... (0=much less, 10=much more)					
To my organisation:	6.3	3	10	2.4	15
To my industry in general:	6.1	3	10	2.1	15
	% Yes				n
Is your organisation investigating or otherwise planning to provide any features which aim to help drivers to avoid distractions when driving?	83%				12

Participants overall felt that the issue of in-vehicle distraction would be slightly more important in five years than it is now (although only one vehicle manufacturer/OEM felt that it would be more important – the remainder felt that it would remain the same, i.e. gave a rating of 5). Two respondents felt that the issue would be less important in five years, with one stating that *“driver distraction does not have proper international ‘ownership’, whether in relative risks, standards, spokespersons or policy”* (P8), thereby implying that without international ownership, the issue will not become any more prominent.

Another respondent explained that they *“do not foresee practical solutions to segregating drivers from passengers in terms of device misuse as emerging to a significant extent in five years. Enforcement may be the only effective measure in this timescale”* (P5).

The expected advancement in technology was also referred to by one participant, who felt that *“Driving should get safer with accident avoidance technologies reducing the risks of*

minor human errors and distractions causing serious accidents. In five years, these technologies will be starting to show up in more mainstream vehicles” (P7).

When asked about future plans for features to help drivers avoid distractions when driving, the majority of responding participants stated that their organisation was investigating or planning this. Features mentioned generally involved optimisation of current systems, rather than disabling their use whilst driving:

“Journey optimisation information systems.” (P4)

“Simplified apps and experiences that can run on the mobile device but be shown and interacted with more simply and easily via in-car displays.” (P7)

“Better HMI generally – better designed menus.” (P11)

“Geofencing, speed tracking to disable use; N.B.: laws on blocking may make these very difficult to implement.” (P8)

3.7 Regulatory barriers to developing safe connected services in this field

Table 8. Survey questions addressing objective 7

	Mean	Min	Max	SD	n
To what extent are there any regulatory barriers to developing safe connected services? (0=not at all, 10=very much)	5.1	0	10	2.2	15
To what extent are there any commercial barriers to developing safe connected services?	6.2	3	9	1.8	15

Regulations can present a barrier to developing safe connected services (but are not always perceived to do so)

Regulatory barriers to the development of safe connected services were not generally perceived amongst the survey respondents. However they did emerge as somewhat of an issue amongst the interviewees. One survey respondent/interviewee gave a rating of 10, indicating that regulations are a great barrier to the development of safe connected services, stating that:

“Regulatory understanding about possible solutions needs a wider debate, but data protection and conflicting EU Directives do not help innovation in this space. In turn, the uncertainty of whether there is a market inhibits innovation in this space. What is really needed is pro-safety innovation incentives – for example, would insurance-led business models change attitudes, rather than simply legal enforcement?” (P8)

The differences between various markets were seen as a regulatory issue, with regulatory differences between different countries being perceived as a barrier to the potential development of products which are designed to reduce driver distraction:

“The primary regulatory issue is the inconsistencies and complexities market-to-market.” (P7)

“There are different regulations, restrictions on the use of products of the kind that we produce in vehicles in different countries around the world. That myriad of different regulations would be a burdensome thing for us to spend too much time worrying about, so we pretty heavily follow the view that it is of course the user who has the primary responsibility for ensuring safe use of the product.” (P7, interview)

The rate of change of regulations was mentioned as another concern facing product developers:

“The degree to which the regulations change. I mean, if you have regulations changing frequently, any technology will then have to change with it – and that’s a painful experience. So I think it’s mostly complexity and change, those are... most obviously a problem.” (P7, interview)

Privacy is a key issue

One participant expressed concerns that privacy issues could arise when it comes to distinguishing between drivers and passengers (see also Section 3.3), and using apps to reduce distracted driving:

“Privacy would seem to be the main regulatory barrier, particularly in differentiating driver and passenger usage of devices.” (P5)

“I think the biggest [regulatory issue] is the privacy issues... sort of civil law around the privacy, people being well aware that if you have sufficient information being processed to make these systems operable then they’re also collecting a lot of other information, or a lot of the information they collect can have other uses... I don’t see any sort of real regulatory obstacle other than the privacy issue.” (P5, interview)

Commercial barriers were perceived to be a greater issue than regulatory barriers amongst the survey respondents. There was a perceived lack of desire amongst consumers for technologies which prevent distraction:

“The chief commercial barrier is that the mobile industry knows, from experience, that restricting or locking features is not something consumers welcome.” (P7)

In terms of marketing ‘drive safe’ modes, the perceived preference for such modes amongst business drivers and fleet managers was again mentioned:

“Commercial incentive for development is limited to business and fleet/safety management financial cases. This is a growing factor, but other consumers will not be affected unless fear of detection is increased.” (P5)

3.8 Areas of potential government intervention (regulatory or non-regulatory) that would assist with providing ‘drive safe’ mode systems, and areas in which related private, public or third-sector organisations could assist in the development of this field

Table 9. Survey question addressing objectives 8 and 9

	% Yes				n
Are there any other bodies or organisations which have responsibility in terms of reducing in-vehicle distraction from handheld devices while driving?	71%				14
In your organisation’s opinion, how much responsibility do the following have in terms of reducing in-vehicle distraction from handheld devices while driving? (0=none, 10=total)	Mean	Min	Max	SD	n
Government:	6.4	3	10	1.8	16
Designers:	6.1	1	10	2.3	16
Consumers/drivers:	7.9	5	10	2.1	16

Although the majority of participants felt that drivers (with the exception of business drivers) presented little demand for features to help them avoid distractions when driving, they also felt that this group have greater responsibility than the government or designers in terms of reducing in-vehicle distraction from handheld devices. All respondents provided a rating of at least 5 for consumer/driver responsibility, and six felt that consumers/drivers had ‘total’ responsibility for this (providing a rating of 10).

Drivers are seen as being ultimately responsible for their own safety

The idea that drivers are responsible for avoiding distraction from handheld devices was a common theme. The consensus appears to be that drivers have ultimate responsibility for ensuring their safety and complying with the law:

“The driver is always responsible; the designer can make the device more difficult to use, but that can increase the distraction if the driver is determined to use it; governments have reduced police presence on the back of speed camera usage... handheld devices, like vehicle defects, failure to use lights, and driver behaviour go undetected.” (P5)

“Designers should be mindful of the capacity of their product to cause distractions and, where possible, make choices that could reduce this risk. But the ultimate responsibility has to sit with the end user to abide by the law, and their elected representatives to ensure sensible and science-led regulations are imposed, educated on, and enforced.” (P7)

However, it was acknowledged that other stakeholders, including designers and OEMs, have responsibilities in this area, but also that they are faced with considerable barriers:

“OEMs have considerable responsibility to motivate avoidance of handhelds, but besides the idea-to-deployment timescale for consumer electronics being a fraction of [the] OEM integrated devices/features timescale, the two options – effectively jamming handhelds which would include those of passengers, or providing the same (distracting) functionality on integrated hands-free devices – are likely to be contentious.” (P5)

It was suggested that the government could effectively force designers and OEMs to take greater responsibility for reducing distraction, but again this could cause difficulties for the organisations and for their customers:

“They [the government] could, if they chose to, pass more of the responsibility for ensuring that products are safer onto companies such as ours...for example, if they wanted to stop devices being able to make calls if the device detects that it’s moving at a certain speed, that’s something they could choose to do. Now from a technology standpoint that’s a disaster, because we’d then be restricting people...it needs to be intelligently deployed, but the government has the opportunity to choose to go there if it wants to.” (P7, interview)

One participant summed up the issue of responsibility as follows:

“I think the thing is, it’s not network providers’ responsibility or employers’ responsibility or a driver’s responsibility or device designers’ responsibility or vehicle designers’ responsibility. It has to work together.” (P5, interview)

The government has an important role to play

The government’s role was typically seen as relating to improved enforcement of the rules surrounding handheld device use in vehicles (see also Section 3.3):

“I think the government’s action really is down to enforcement, whether it’s... more police patrols with the instructions that they are to look out [for] and apprehend people who are using hands-free phones, whether it’s to give them a talking to or whether to issue a summons is down to them, but I think they have to be there and they have to be out doing it.” (P5, interview)

It was also suggested that the government’s role includes improved education and communication, as well as clarifying roles and responsibilities in the whole area of reducing driver distraction:

“Better education is still needed; that means the government... has a role.” (P8, interview)

“I think the way the government could do more would be to have stronger communication plans about the importance of hands-free.” (P8, interview)

“You need to give clear responsibility to central government, because you can’t have different rules for different public-sector organisations. I think I’d rather start with central government and they should then ask the public-sector organisations beyond central government to take action, based on their action.” (P8, interview)

Other proposals for government involvement included:

- a government-designed/approved checklist for distraction-reducing software and apps (P11);
- a standard measure of distraction (P11);
- signing the EU's eCall Memorandum of Understanding (MoU) to demonstrate an interest in using connected vehicle technology to improve safety (P8);
- increased penalties for driving while using handheld devices, for example increased insurance, licence revocation (P8); and
- requiring all civil servants to follow stringent guidelines relating to mobile device use while driving (P8).

Change and standardisation is required at the European level

At an EU level, one participant suggested that, as well as signing the eCall MoU, there is a need to update the regulations on the use of mobile devices in vehicles. Current relevant regulations (the Radio Equipment Directive and the Automotive Directive) are reported to offer inconsistent guidance relating to the use of mobile devices in vehicles:

"It would be quite reasonable to say how do we make these two Directives work together on a European basis for safe driving? ...it would be quite logical to say to the EU, 'Why don't you make sure the Automotive Directive and the Radio Equipment Directive work together?' That way, you could lead towards a more common certification process, so connected cars would be certified within either the Automotive Directive or within the Radio Equipment Directive." (P8, interview)

Improved collaboration between the UK government and other European countries was recommended, leading in turn to greater standardisation of vehicles and improved requirements controlling the use of handheld devices whilst driving:

"I think it's clear that the first thing they could do is look at... broader co-operation between governments in different nation states to ensure that regulations are more closely aligned, because the technology and automated industries are more likely to co-operate if there is an agreement between different governments about how regulations are going to affect the requirements or the technology." (P7, interview)

"Why would we want to invest significantly into thinking how we can play a more substantial role in forcing users to obey particular rules and regulations in the UK, when we then also have to invest in understanding the rules and regulations in France or in Germany or in Italy and Spain and everywhere else we do business?" (P7, interview)

"I do think in mainland Europe you get more adoption of Directives, whereas the UK tends to argue against some of these... even if we drive on the left, there aren't many other differences between us and the rest of the Europe." (P8, interview)

"An updated ESoP [European Statement of Principles] on human-machine interface (taking into account NHTSA [National Highway Traffic Safety Administration] and

JAMA [Japan Automobile Manufacturers Association] guidelines) might help global companies design one basic system.” (P11)

There is scope for greater involvement from other organisations

Public, private and third-sector organisations were all recognised as having a role to play in reducing in-vehicle distractions. It was suggested that all organisations, in both the public and private sectors, have a significant role to play in reducing the acceptability of using handheld devices while driving, as opposed to using technologies to reduce the practice. A number of survey respondents and interviewees mentioned this:

“The public sector needs to first and foremost ensure that they are putting policies in place with effective repercussions – or as best they can come up with, effective repercussions – to ensure that the drivers or people that drive vehicles for their jobs within public sector roles are abiding by safe practices... until we get to those kind of basic steps, the bigger steps that they can then take in terms of trying to put out greater awareness campaigns for the general public, all that kind of stuff seems, you know, seems like trying to run before we can walk.” (P7, interview)

“Ultimately the other thing that governments could do is, you know, they are huge employers, and many of those employees in the public sector drive vehicles as part of their job... so ensuring that policies within the Council and local government and civil service organisations are enforcing those safe practices there as well, that would, you know, help to breed a better level of understanding and a greater level of a culture of safety that could pervade wider in society.” (P7, interview)

“No public sector employees [should be] allowed to take calls at the wheel unless it is hands-free. That’s a condition of contract for an employee.” (P8, interview)

It was felt that charities could have a role to play in encouraging the government to make changes, and in educating the public on the dangers of distracted driving:

“I tend to think they [charities] might be supporters or activists, communicators maybe, in support of a government- or corporate-funded campaign. So I don’t think they would be leaders, I think they might be partners or message deliverers.” (P8, interview)

When asked whether there are any bodies which have, or could have, responsibility in terms of reducing in-vehicle distraction from handheld devices when driving, a number of suggestions were made (Table 10), along with the level of responsibility that the organisation in question was perceived to have (10 being total responsibility). Suggestions ranged from schools to the DVLA (Driver and Vehicle Licensing Agency).

Table 10. Organisations with (potential) responsibility for reducing in-vehicle distraction from handheld devices

Organisation	Perceived level of responsibility (0–10)
Technology organisations	9
DVLA (Driver and Vehicle Licensing Agency)	9
Law enforcement agencies	8
Employers (e.g. having policies against employees using devices while driving for work)	8
OEMs	8
Thatcham Research	7
SMMT (Society of Motor Manufacturers and Traders) via members' responsibility	7
App providers/designers	7
NCAP (New Car Assessment Programme)	6
Standards bodies, trade associations, testing houses	5
Communications network providers	5
ERTICO – ITS Europe (a partnership of around 100 companies and institutions involved in the production of Intelligent Transport Systems)	5
Schools	2

4 Product Evaluation Findings

4.1 Brief overview of the 'drive safe' function/app market

A review of the different types of 'drive safe' functions/apps revealed that they can be considered as falling into four broad categories:

- Non-driving-specific, but useful as a driving aid
- Driving-specific – produced by handset manufacturers
- Driving-specific – produced by OS manufacturers
- Driving-specific – produced by independent developers

4.1.1 *Non-driving-specific, but useful as a driving aid*

These functions are usually a core feature of an OS and are typically designed to prevent a handset from relaying alerts to a user under certain defined circumstances.

They usually allow a user to customise what alert types are blocked, for example by creating a list of priority users whom the function will not block.

These functions also frequently have a timer facility whereby the user can choose specific periods of the day where the handset will block alerts. This could be useful to a user who drives as part of a regular routine.

Three common versions of these functions are 'Do Not Disturb' (both Android and Apple use the same name for their versions of the function) and 'Quiet Hours' (Microsoft).

4.1.2 *Driving-specific – produced by OS manufacturers*

This type of 'drive safe' function/app is a comparatively recent development. These functions/apps are developed by OS manufacturers and are designed to integrate with a vehicle's on-board in-vehicle information systems (satellite navigation, radio, etc.). This can be achieved through Bluetooth (such as Microsoft's Driving Mode) or by means of a wired connection (such as Android's Android Auto, or Apple's CarPlay).

These functions/apps are only available on recent car models.

4.1.3 *Driving-specific – produced by handset manufacturers*

These apps are produced by the handset manufacturers themselves, and are designed to function with a particular handset model or family of models. They typically do not come pre-installed on the handset – instead, a user must download them and complete the install manually. Some technical knowledge can be required to install them successfully. These apps appear to be becoming less common as the systems produced by OS manufacturers become more widely used.

Examples of these apps are Samsung's Car Mode and HTC's car mode.

4.1.4 *Driving-specific – produced by independent developers*

Finally, there are numerous ‘drive safe’ apps available for download which have been produced by independent manufacturers. Whilst these apps share many of the characteristics of those developed by handset manufacturers, they can offer a much broader range of functions (e.g. collision avoidance warning through use of a handset’s camera).

Examples of these apps include:

- Drive Safe – This puts a user’s phone on silent when driving, and automatically replies to messages to inform whoever sent it that the user is driving.

<https://play.google.com/store/apps/details?id=westport.andrewirwin.com.drivesafe&hl=en>

- iOnRoad – This is described as transforming a smartphone into a personal driving assistant; it includes a dashcam function to record the forward-vehicle view.

www.ionroad.com

- DashDroid – This app was created for drivers who “know we shouldn’t use our phones while driving but [...] still do”. It is designed to improve safety by using an improved user interface. Functions include identifying when a user is driving and automatically blocking messages and calls.

<http://dashdroid.com/>

- Car Dashboard – This alerts a driver when they are speeding.

<https://play.google.com/store/apps/details?id=net.mandaria.cardashboardpro&hl=en>

4.2 Scope of the review

This review was limited to two categories of apps/functions: those which are non-driving-specific, but useful as a driving aid, and those which are driving-specific and also produced by OS manufacturers.

Apps/functions which were produced by handset manufacturers were not considered, as the number of manufactures offering them has declined sharply with the increasing availability of those offered by OS manufacturers.

Apps/functions produced by independent developers were also excluded – this is due to large number of them available (with no readily available information on which are commonly used) and the very wide range of functions which they offer. A review of this market sector would be complex and lengthy, and would risk reviewing apps which have a small user base.

4.3 Technologies reviewed

A human factors researcher spent time with each system, working through a specific procedure to assess the app/functions performance from a user’s perspective. A summary of each assessment was produced, and these are described below.

4.4 Summaries of ‘non-driving-specific, but useful as a driving aid’ apps/functions

Function/app name	Quiet Hours	
Manufacturer	Microsoft	
OS	Windows 8.1	
Summary of function/app		
<p>This function is included within Windows 8.1 and can be used to block a handset from displaying alerts (incoming text messages, requests from apps to give permission to update, etc.) which may distract a user when they are driving. It can either be scheduled to activate during a specific time or activated manually. It allows the user to choose to allow some types of alerts, or not to block incoming calls or messages from specific contacts.</p> <p>It is not designed specifically for driving, but it could be used by a driver to prevent him or herself from becoming distracted when behind the wheel. A user would either have to manually activate it, or set it up to automatically switch on during a specific period in the day, such as normal commuting times.</p>		
Specification and functionality		
<p>Not specific to driving, but potentially useful.</p> <p>Users can choose which alerts are blocked.</p> <p>Does not automatically activate whilst driving.</p> <p>Can be voice activated (requires Internet connection).</p>		
User experience		
<p>No significant user experience problems.</p>		
Documentation		
<p>User guide available through online help website.</p> <p>Information on system moderately difficult to obtain.</p> <p>Is not marketed as being useful for driving, therefore no guidance on appropriate use when driving.</p> <p>No recommendations given on safe use, as not designed for driving task.</p>		

Function/app name	Do Not Disturb	
Manufacturer	Google	
OS	Android 6.0.1	
Summary of function/app		
<p>This function is included within Android 6.0.1. It filters which alerts are delivered to the handset user and can be configured to activate at specific times of the day.</p> <p>Due to the customisability of Android, the function can appear cosmetically different from one handset to another, and hence require slightly different actions to operate it.</p> <p>In common with other examples of non-driving-specific apps with a safety application for driving, Do Not Disturb is not designed specifically for driving, but it could be used by a driver to prevent him or herself from becoming distracted when behind the wheel. A user would either have to manually activate it, or set it up to automatically switch on during a specific period in the day, such as normal commuting times.</p>		
Sample screenshot ⁴	Specification and functionality	
	<p>Not specific to driving, but potentially useful.</p> <p>Users can choose which alerts are blocked.</p> <p>Does not automatically activate whilst driving.</p> <p>Can be voice activated (requires Internet connection).</p>	
	User experience	
<p>No significant user experience problems.</p>		
Documentation		
<p>User guide available through online help website.</p> <p>Is not marketed as being useful for driving, therefore no guidance on appropriate use when driving.</p> <p>No recommendations given on safe use, as not designed for driving task.</p>		

⁴ Screenshot taken from author's own phone

Function/app name	Do Not Disturb	
Manufacturer	Apple	
OS	iOS 9.3.2	
Summary of function/app		
<p>This function can be configured to block alerts from being displayed on the handset. The type of alerts blocked can be customised, and it can be scheduled to activate at specific times of the day.</p> <p>It is intuitive to use, although handset users who are less knowledgeable may not be aware of its presence.</p> <p>In common with other examples of non-driving-specific apps with a safety application for driving, Do Not Disturb is not designed specifically for driving, but it could be used by a driver to prevent him or herself from becoming distracted when behind the wheel. A user would either have to manually activate it, or set it up to automatically switch on during a specific period in the day, such as normal commuting times.</p>		
Sample screenshot⁵	Specification and functionality	
	<p>Not specific to driving, but potentially useful.</p> <p>Users can choose which alerts are blocked.</p> <p>Does not automatically activate whilst driving.</p> <p>Can be voice activated (requires Internet connection).</p>	
	User experience	
<p>No significant user experience problems.</p>		
Documentation		
<p>User guide available through online help website.</p> <p>Is not marketed as being useful for driving, therefore no guidance on appropriate use when driving.</p> <p>No recommendations given on safe use, as not designed for driving task.</p>		

⁵ Screenshot taken from author's own phone

4.5 Summaries of ‘driving-specific – produced by OS manufacturers’ apps/functions

Function/app name	Driving Mode	
Manufacturer	Microsoft	
OS	Windows 8.1	
Summary of function/app		
<p>This function is a standard feature of Windows 8.1 and is designed to reduce driver distraction from handset alerts. It functions as an alert filter, blocking incoming alerts. Incoming text messages can be read aloud if this option is activated in the function configuration. The function automatically activates when it recognises a vehicle’s Bluetooth signal.</p> <p>It is designed to be operated by touch or voice. If operated by voice it requires an Internet connection and uses Window’s virtual assistant, Cortana.</p>		
Specification and functionality		
<p>Specific to driving.</p> <p>Users can choose which alerts are blocked.</p> <p>Automatically activates whilst driving.</p> <p>Can be voice activated (requires Internet connection).</p>		
User experience		
<p>No significant user experience problems.</p>		
Documentation		
<p>User guide available through online help website.</p> <p>Information on system moderately difficult to obtain.</p> <p>Is marketed as useful for driving.</p> <p>Recommendations on appropriate use available.</p>		

Function/app name	Android Auto	
Manufacturer	Google	
OS	Android 5.0 or later	
Summary of function/app		
<p>This is a sophisticated set of apps/functions which can either cast its screen onto a vehicle's integrated control interface, or if the handset is in a cradle, can use its native screen (a useful feature, as only recent car models tend to be fitted with a suitable screen).</p> <p>The control interface appears significantly different to the normal handset touchscreen interface and is designed to minimise driver distraction by increasing icon size, limiting the functions which are available, and simplifying their layout.</p> <p>It relies on both manual and voice control; however, the voice control requires an Internet connection. The range of available functions is limited: a user cannot access all of the apps/functions that their phone typically possesses. Once connected to the vehicle's display/control screen, it disables the handset, requiring drivers to interact only with the vehicle's control interface. It is compatible with a wide range of new models which are supplied with their own in-vehicle information screen, or would require a user to fit an aftermarket one.</p>		
Specification and functionality		
<p>Designed for driving.</p> <p>Disables access to the controlling handset whilst it is paired with a vehicle's control interface. This prevents/discourages a driver from interacting with the handset itself whilst on the move.</p> <p>Automatically activates if connected, blocks apps/functions likely to distract from the driving task (e.g. video playback).</p> <p>Includes a limited range of default apps/functions; however, this can be expanded as third-party app. Manufacturers produce versions of their apps which are designed to be compatible.</p> <p>Possesses a simplified interface and enlarged target zones for manual control.</p> <p>Can be voice activated (requires Internet connection).</p> <p>Connects through micro-USB cable.</p>		
User experience		
<p>Users familiar with the Android user interface may find navigating Android Auto more intuitive than a manufacturer's native system, potentially reducing distraction.</p> <p>No significant user experience problems evident.</p>		
Documentation		
<p>User guide available through online help website.</p> <p>Specifically recommended for driving.</p> <p>Clearly warns drivers regarding appropriate use at each start-up.</p>		

Function/app name	CarPlay	
Manufacturer	Apple	
OS	iOS 9.3.2	
Summary of function/app		
<p>CarPlay is a set of apps and functions which are designed to allow a user's handset to display through a vehicle's in-dash screen. In effect, it can supersede the in-vehicle information systems which come with the vehicle (and perform tasks such as navigation, placing calls, playing music, etc.).</p> <p>Once connected, it disables the handset and displays a simplified user interface designed to minimise distraction. Furthermore, applications which are likely to distract from the driving task (e.g. video playback) are disabled.</p>		
Specification and functionality		
<p>Designed for driving.</p> <p>Disables access to the controlling handset whilst it is paired with a vehicle's control interface. This prevents/discourages a driver from interacting with the handset itself whilst on the move.</p> <p>Automatically activates if connected.</p> <p>Blocks apps/functions likely to distract from the driving task (e.g. video playback).</p> <p>Includes a limited range of default apps/functions; however, this can be expanded as third-party app manufacturers produce versions of their apps which are specifically designed to be compatible.</p> <p>Possesses a simplified interface and enlarged target zones for manual control.</p> <p>Can be voice activated (requires Internet connection).</p> <p>Connects through Lightning cable.</p>		
User experience		
<p>Users familiar with the Apple user interface may find navigating CarPlay more intuitive than a manufacturer's native system, potentially reducing distraction.</p> <p>No significant user experience problems evident.</p>		
Documentation		
<p>User guide available through online help website.</p> <p>Specifically recommended for driving.</p> <p>Clearly warns drivers regarding appropriate use at each start-up.</p>		

5 Summary and Discussion

5.1 Survey and interviews

Table 11 summarises the key points relating to each of the nine objectives as established through the survey and interviews.

Table 11. Summary of key points

1	To establish the importance and relative priority of the issue of 'distraction in vehicle' within product design	The issue of in-vehicle distraction is not a priority area
2	To establish any design guidelines or standards that are adhered to on issues of human-machine interface design, with regard to minimising distraction	There do not appear to be any design guidelines and standards specifically related to the use of devices whilst driving
3	To establish the extent to which organisations are investigating or building 'drive safe' products into their product lines	There is very little such investigation or development – possibly because current technology to automatically disable mobile devices is flawed and has a negative effect on customer satisfaction
4	To establish both manufacturer understanding of 'drive safe' options and easy-to-interpret/non-distracting interfaces, and also consumer attitudes and demand for them – and how these have changed over time	Consumer demand is perceived to be low amongst leisure and business drivers, but higher amongst fleet/safety managers; respondents felt that demand would be greater five years from now
5	To understand the extent to which connectivity whilst on the move is considered a key selling point, and to what market segments	Connectivity whilst on the move is considered to be a more important selling point for mobile devices than for vehicles; fleet managers are seen as an important market segment
6	To establish views from manufacturers and data providers about how demand for connected services looks like developing over the next five years, and how the industry is seeking to respond	Respondents indicated that the issue of avoiding in-vehicle distraction will only be slightly more important in five years, both to their organisation and to their industry in general
7	To understand whether there are any regulatory barriers to developing safe connected services in this field	Regulatory and commercial barriers can create obstacles to developing safe connected services (for example inter-market differences, conflicting EU Directives, changing regulations, and the overall perceived lack of desire amongst consumers for 'drive safe' modes)

8	To establish whether there are any areas of potential government intervention (regulatory or non-regulatory) that would assist with providing 'drive safe' mode systems	The government is seen as having multiple roles to play (including improving education and communication about the dangers and penalties associated with distracted driving, and clarifying roles and responsibilities with regard to reducing driver distraction) in assisting with the provision of 'drive safe' mode systems, but drivers are seen as being ultimately responsible for their own safety
9	To establish areas in which related private, public or third-sector organisations could assist in the development of this field	The key role of private, public and third-sector organisations was felt to be in relation to changing the culture that has built up around the acceptability of distracted driving, rather than through the direct development of technology and product design

5.2 Product review

The analysis of the current market for safe driving apps/functions and the review of products conducted for the product evaluation revealed a considerable degree of convergent design between the systems reviewed. Given that all manufacturers are attempting to achieve a similar aim – to reduce the risk associated with using a mobile phone whilst driving – this could be expected.

Overall, the apps/functions could be divided into two types: those which reduce a user's exposure to distraction from their handset by managing which alerts are displayed, and those which reduce distraction by simplifying the handset's control interface.

Many of the systems share a similar list of strengths and weaknesses. Common strengths include:

- simplified control interfaces;
- larger target areas and increased icon size;
- the limiting of access to non-driving-related (and potentially distracting) apps/functions; and
- interface designs which are more familiar to users who already experience them as part of their handset functions than native vehicle manufacturer designs.

Common weaknesses include the facts that:

- most apps/functions allow users to provide exceptions to 'blocked' lists, or provide similar functionality which could water down the reduction of risk;
- users can still use devices for voice and text communications;
- apps/functions often rely on voice interfaces which do not function without Internet access; and
- they are an immature technology which may occasionally function in ways which users do not prefer or do not expect (e.g. sending a text message may force them to send using an SMS application, when they would prefer to use an Internet messaging service).

Some of these design decisions appear to be driven by a desire on the part of operating system (OS) manufacturers for their OS to be adopted by vehicle manufacturers as their default for interacting with their vehicle's systems. Therefore, both Android Auto and Apple's Car Play use control interfaces which are similar to both their usual handset interfaces, and the control interfaces already found on modern vehicles with touchscreen interfaces (or similar).

Unfortunately, despite a widespread awareness amongst the driving population of the safety, legal and moral risks of using a handset whilst driving, drivers continue to do so, with at least 3,611 reported accidents involving at least one driver using a mobile phone during the period 2009–14 (DfT, 2016; see also RAC, 2014). Given the difficulty of eliminating these behaviours altogether, it seems that driving-related apps/functions may be able to play a role in reducing their riskiness.

5.3 Conclusions

Recent research by Rigby et al. (2015) found that the majority of the public surveyed (69%) felt that information from outside the car (text messages, phone calls etc.) could distract from driving safely; most people (says Ipsos MORI, who undertook the survey) "just need some help from product manufacturers" in order to "do the right thing". However the findings of this study indicate that 'drive safe' modes are not currently a priority for original equipment manufacturers.

Device manufacturers are working to ensure that their OSs possess the potential for connectivity with vehicles. This presents an opportunity for building in 'drive safe' modes, but there is a nervousness associated with limiting functionality for consumers. Instead, manufacturers tend to see the driver as being responsible for safety when on the road, with the government seen as the key route through which drivers should be made aware of their responsibilities.

Whilst the technology exists for mobile phones to detect that a vehicle is in motion, and to 'block' use accordingly, there are numerous barriers to the use of such technology, including practical barriers (the driver would need to have the option to override the 'drive safe' mode, and could claim to be a passenger in the vehicle), barriers associated with freedom of choice (compulsory use of 'drive safe' modes could be seen as restrictive and frustrating), and regulatory and commercial barriers (different markets create different demands, and enhancing connectivity while on the move is considered important).

Apps designed to reduce driver distraction may, at this point in time, have a greater potential role to play in the reduction of distraction than is currently the case, but their use is entirely voluntary. Unfortunately we do not know what kinds of drivers are likely to make use of these options (for example, whether it will tend to be inherently safe or unsafe drivers who are more likely to use them).

In summary, given the tension between consumer choice and the changes that would need to be made to build 'drive safe' modes 'into the system', it seems unlikely that they will become a priority without changes to laws, standards and regulations.

5.4 Limitations

Despite best efforts, engagement in the survey and interviews was low. Therefore the findings are based on a very limited number of viewpoints, and as such are prone to bias and should be treated with caution. Nevertheless, some valuable insights were revealed, and whilst the responses are not representative of all relevant industries, the insights should be considered as a useful indication of the current status of 'drive safe' modes and approaches to connectivity in vehicles using mobile devices.

6 References

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Appendix A: Online Survey

What is the purpose of this survey? This research is looking at driver distraction and 'drive safe' modes.

Who is conducting the research? This research is being carried out by TRL (the Transport Research Laboratory) on behalf of the RAC Foundation.

Will my answers be confidential? All of your responses are anonymous. They will be kept confidential and stored securely. You and your organisation will at no point be individually identifiable to anyone outside of the research team; you do not need to provide your name or that of your organisation. You will not be contacted by anyone who does not work at TRL, and you will only be contacted by TRL if you provide permission. You are free to stop the survey at any time if you do not wish to continue.

How long will it take? Most people take around 10–15 minutes to complete the survey. You can select the 'save and continue' option at the bottom of each page if you would like to complete the survey later. If you choose 'save and continue' you will receive an email containing a link to your survey.

Is there an incentive for taking part? Survey respondents will be entered into a prize draw to win a £50 donation to a charity of their choice.

How long will the survey be available for? The survey will close on 31 May 2016.

Will I have the opportunity to talk to someone to provide my opinion on this subject? TRL is also carrying out interviews as part of the research. Towards the end of the survey you will be asked if you would like to be contacted regarding taking part in an interview.

Who can I contact if I have any questions? If you require any further information please contact TRL on contact@trl.co.uk

There are no right or wrong answers so please respond honestly.

Before we can begin the survey we need to check a few things with you. Please state whether you agree with the following statements:

- 1. I have read and understood all of the information above (if you have any questions, please email contact@trl.co.uk)*
- 2. I feel sufficiently informed as to the survey's purpose*
- 3. I am aware that I am free to withdraw from the survey at any time*

- Yes, I agree with these statements (this will start the survey)
- No, I do not agree with these statements (this will end the survey)

Which of these best describes the type of organisation you represent?

- Vehicle manufacturer/OEM
- Mobile device manufacturer
- Telecommunications provider
- App developer
- Insurance provider
- Other (please specify):

If you are happy to, please state your job role

How important is the issue of in-vehicle distraction from handheld devices to your organisation, from a product development perspective?

(0=not at all important, 10=very important)

To what extent does your organisation promote laws and guidance regarding the use of handheld devices whilst driving?

(0=not at all, 10=very much)

Do you have any comments on your responses to the above questions?

To what extent does your organisation prioritise avoiding in-vehicle distractions from handheld devices?

(0=does not prioritise at all, 10=prioritises greatly)

In your organisation's opinion, is the distraction caused by in-vehicle handheld devices more or less important than the distraction from other non-handheld devices (i.e. radio, satnav, etc.)?

(0=much less important, 10=much more important)

Do you have any comments on your responses to the above questions?

In your organisation's opinion, how effective are the following methods of avoiding/reducing in-vehicle distraction from handheld devices while driving (please respond with respect to the 'wider world' rather than any initiatives within your organisation)?

Education

(0=not at all effective, 10=very effective)

Enforcement

(0=not at all effective, 10=very effective)

Automatic disabling of functionality while driving

(0=not at all effective, 10=very effective)

Do you have any comments on your responses to the above questions?

In your organisation's opinion, how much responsibility do the following have in terms of reducing in-vehicle distraction from handheld devices while driving:

Consumers/drivers

(0=no responsibility, 10=total responsibility)

Designers

(0=no responsibility, 10=total responsibility)

Government

(0=no responsibility, 10=total responsibility)

Do you have any comments on your responses to the above questions?

Are there any other bodies or organisations which have responsibility in terms of reducing in-vehicle distraction from handheld devices while driving?

Yes

No

Please state the body/organisation and the level of responsibility you/your organisation feel they have in terms of reducing in-vehicle distraction from handheld devices while driving:

(0=no responsibility, 10=total responsibility)

Does your organisation believe that in five years from now the issue of avoiding in-vehicle distraction from handheld devices while driving will be more or less important than now...

To my organisation:

(0=much less important than now, 10=much more important than now)

To my industry in general:

(0=much less important than now, 10=much more important than now)

Do you have any comments on your responses to the above questions?

In your organisation's opinion, to what extent is there consumer demand for features which help them to avoid distractions when driving?

Leisure drivers

(0=not at all, 10=very much)

Business drivers

(0=not at all, 10=very much)

Fleet/safety managers

(0=not at all, 10=very much)

Do you have any comments on your responses to the above questions?

In your organisation's opinion, to what extent will there be consumer demand for features which help them to avoid distractions when driving five years from now?

Leisure drivers

(0=not at all, 10=very much)

Business drivers

(0=not at all, 10=very much)

Fleet/safety managers

(0=not at all, 10=very much)

Do you have any comments on your responses to the above questions?

To what extent is 'connectivity' whilst on the move considered to be a key selling point for vehicles?

(0=not at all, 10=very much)

To what extent is it expected that 'connectivity' whilst on the move will be a key selling point for vehicles five years from now?

(0=not at all, 10=very much)

Do you have any comments on your responses to the above questions?

To what extent is the ability to use ‘communication’ type apps (e.g. social media, messaging) whilst on the move considered a key selling point?

(0=not at all, 10=very much)

In your estimation, to what extent will the ability to use ‘communication’ type apps (e.g. social media, messaging) whilst on the move be a key selling point five years from now?

(0=not at all, 10=very much)

Do you have any comments on your responses to the above questions?

To what extent is ‘connectivity’ whilst on the move considered to be a key selling point for mobile devices?

(0=not at all, 10=very much)

To what extent is it expected that ‘connectivity’ whilst on the move will be a key selling point for mobile devices five years from now?

(0=not at all, 10=very much)

Do you have any comments on your responses to the above questions?

Does your organisation have any products with features which aim to help drivers to avoid distractions when driving?

- Yes
- No

Please describe any features:

Is your organisation investigating or otherwise planning to provide any features which aim to help drivers to avoid distractions when driving?

- Yes
- No

Please describe any features:

To what extent are there any regulatory barriers to developing safe connected services?

(0=not at all, 10=very much)

To what extent are there any commercial barriers to developing safe connected services?

(0=not at all, 10=very much)

Do you have any comments on your responses to the above questions?

We would like to gather as many views as possible in response to this survey. Please feel free to share the link with others who may be able to contribute.

Do you have any other comments on the issues covered in this survey?

Survey respondents will be entered into a prize draw to win a £50 donation to a charity of their choice. If you would like to be entered into the prize draw, please provide an email address so we can contact the winner. This information will not be used for any other purpose.

As part of this research we are also conducting phone interviews (around 30 minutes) to further explore the issues. Would you be interested in contributing further to the research?

Interviewees will be entered into a prize draw for a £100 donation to a charity of their choice.

If so, please provide a name and contact email address, and a TRL researcher will be in touch.

If not, please click 'next page'.

Name:

Email:

Appendix B: Interview Guide

Introduction

- Introduce yourself, explain that you're from TRL and that we've been commissioned by the RAC Foundation to undertake this research.
- RACF would like to understand to what extent OEMs, data/app providers and providers of handheld devices are considering issues of distraction and 'drive safe' modes within their product design.
- We are talking to various stakeholders to understand their views on this.
- We are really keen for you to be open and honest in your views. There are no right or wrong answers.
- All of your responses will be completely anonymous, and there will be no direct reference to you or your organisation in the final report.

If consent form received:

- Thank you for sending the consent form. Can I check whether you have any questions before we begin?

If consent form not received:

- I just need to check a few things with you before we begin:
 - Are you happy that your participation is voluntary and that you are free to withdraw at any time, without giving a reason?
 - Do you agree to take part in the study?
 - Do you agree to the interview being audio recorded? You and your organisation will remain completely anonymous.
- **Confirm that you will begin recording the conversation.**

-
1. Please could you confirm the type of organisation you work for, and your roles and responsibilities?
 2. *Begin interview by asking for clarification on survey responses, e.g. why they do/do not focus on reducing in-vehicle distractions, exploring further any open text comments made during the survey.*
 3. Respondents to the survey generally felt that consumers (i.e. drivers) had more responsibility in terms of reducing distraction from handheld devices than product designers. What are your views on this?
 4. Passengers may wish to use their devices while travelling, while drivers may prefer not to have the option of using theirs when driving. What are the possible methods of addressing this issue?
-

5. Are there any regulatory barriers to the development of safe connected services for car drivers?
6. Could the government do anything to assist with providing safe connected services for car drivers? If yes, please describe.
7. Could any public sector organisations do anything to assist in the development or provision of safe connected services for car drivers? If yes, please describe.
8. Could any private sector organisations do anything to assist in the development or provision of safe connected services for car drivers? If yes, please describe.
9. Could any third-sector organisations (i.e. charities, associations, other not-for-profit organisations) do anything to assist in the development or provision of safe connected services for car drivers? If yes, please describe.
10. To what extent are differences in attitudes and regulations around driver distraction and safety in different countries an issue?
11. To what extent do you target your marketing towards fleet managers? How do you think their attitudes towards distracted driving would differ from general drivers, if at all?
12. How do you target your marketing to the public in terms of reducing driver distraction, if at all?

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