

Persuading drivers of the dangers of hands-free phones

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Executive Summary

- 1) The use of hand-held phones while driving is known to be detrimental to driving safety due to distraction, and their use was made illegal in the UK in 2003. Hand-held phone use is still a problem, but many drivers accept that it is dangerous and tend to use hands-free communication instead.
- 2) Research studies have however demonstrated that hands-free calls can be just as distracting as hand-held calls while driving. The primary cause of the distraction appears to be having a conversation with a remote partner, rather than the manipulation of the phone *per se*.
- 3) Despite the evidence, drivers are reassured by car manufacturers, road safety campaigns, and even the police, that hands-free communication while driving is a safer alternative to using hand-held phones. Fortunately, one growing area of positive influence is the private sector, with an increasing number of companies bringing in policies to ban both hand-held *and* hands-free calls while driving for work.
- 4) Given the promotion of hands-free phone calls as a safe alternative, companies face an uphill task in convincing drivers to adhere to a ban on hands-free calls whilst driving for work. When asked, drivers may provide a variety of reasons why they think it is acceptable to continue engaging in hands-free calls at work. Most of these reasons do not hold up to scrutiny however and can often be refuted with research evidence or logical argument. The debunking of such misinformed beliefs is often called 'myth-busting'.
- 5) The aim of the current project was to identify current 'myths' that people who drive for work rely on to justify hands-free use while driving, and to then create a road safety video that debunks them. The resultant video was then evaluated in a study that compared mobile phone use, and attitudes towards mobile phone use (both hand-held and hands-free), for a group of drivers who watched the myth-busting video and a control group who watched a road safety video unrelated to phone use.
- 6) Study 1 was a survey designed to capture the myths that people who drive for work use to support hands-free phone use while driving. Questions concerning mobile phone attitudes and frequency of use were mixed in with questions on other aspects of road safety (speeding, overtaking etc.) to mask the aim of the study.
- 7) Over 680 drivers attempted the survey. Data cleaning reduced this to 429 valid responses. Survey evidence from free-text responses, agreement ratings with *a priori* attitudes chosen from the literature, and correlations between attitudes and self-reported phone use, provided converging evidence pointing towards a range of potential myths.
- 8) A focus group of experts in the road safety field were brought together to review the findings. Together they selected five myths from Study 1 that appeared key to supporting drivers' use of hands-free phones while driving:
 - i) *Hands-free is legal, so it must be safe* – If illegality implies that hand-held phones are unsafe to use while driving then drivers may mistakenly think that hands-free use is safe because it is not illegal.
 - ii) *Driving is 'dead time'* – Time spent driving is seen as 'wasted' time. Some people think that driving is easy to do and leaves a lot of spare capacity to multitask (such as engaging in phone calls), allowing the driver to make better use of their time.

- iii) *Hands-free is safe because your eyes are on the road and hands are on the wheel* – This myth is based on a misunderstanding that holding the phone or looking at the phone are the primary sources of distraction, thus prompting drivers to make hands-free calls rather than use hand-held phones.
 - iv) *Hands-free is no different to talking to a passenger* – This common-sense myth does not take into account key differences between passenger conversations and hands-free phone conversations that are likely to make the latter more distracting.
 - v) *I need to use hands-free communication for work* – This myth is based on the belief that drivers need to answer work calls while driving, especially from their immediate line manager. Such beliefs exist even in companies with policies banning hands-free phone use while driving due to a perceived disconnect between the policy setters who may reside high-up in the company, and the beliefs of lower and middle management who may expect drivers to disregard the policy when they call.
- 9) A script was written to bring evidence and argument to refute the myths in a brief, yet impactful, manner. Filming was undertaken with a presenter on various roadway locations, with expert interviews filmed indoors to provide talking heads. We employed behavioural change techniques including appeal to authority, provision of new knowledge, challenging current beliefs, detailing consequences, and the inclusion of concrete examples as counter arguments.
- 10) An intervention study (Study 2) was designed to assess the impact of the video on driver attitudes to mobile phone use (both hand-held and hands-free). To mask the focus of the study, drivers were presented with 5 road safety videos across 5 weeks. In Week 3, participants were randomly assigned to watch the hands-free intervention or a control video. None of the other videos included any reference to mobile phones. Attitudes towards mobile phone use and self-reported frequency of phone use were assessed at different points throughout the weeks of the study. These questions were also masked by other questions on attitudes to, and engagement in, other activities (e.g., speeding, overtaking, etc.). We hypothesised that drivers who saw the intervention video would have safer attitudes towards mobile phone use at the end of the study compared to a control group. We further hypothesised that self-reported mobile phone use might dip in the week immediately after viewing the video, and we hoped that the dip would still be evident at the end of the study.
- 11) The target sample was 200 drivers from a national construction company who provided access to potential participants. Unfortunately, despite offering lottery inducements for those who completed the study, recruitment fell far below the target, and we had to recruit from other sources (including a further 15 companies). Despite this we only reached a sample size of 68.
- 12) The results failed to show a change in attitudes towards hands-free mobile phones or their frequency of self-reported use. It is possible that the low sample size, and the relatively safe attitudes and low frequency of phone use noted in our sample at baseline may have contributed to our failure to reject the null hypothesis.
- 13) Given the potential sample problems noted in Study 2, we took an opportunity to piggy-back on an unrelated study to collect further data (Study 3). This study targeted average car drivers rather than people who specifically drive for work. To potentially improve the impact of the video, we split it into four smaller videos, each tackling a particular myth (with the myth ‘I need to use hands-free communication for work’ removed, as it wasn’t relevant for these drivers). The design of Study 3 did not allow us to collect self-reported usage of mobile phones, but we did

collect attitudes to mobile phones at the start and end of the study using 12 items taken from the survey in Study 1.

- 14) Attitude data was collected from 323 drivers who were paid for their time. Analyses demonstrated clear improvements in safety-related attitudes regarding mobile phone use while driving in the intervention group compared to the control group. When asked directly whether the four mini-myth-busting videos had changed their understanding of the dangers of mobile phones, 95% said that their knowledge of the dangers of mobile phone use had increased, while 80% said that they would limit or completely avoid hands-free mobile phone use while driving in the future.
- 15) In summary, we undertook a series of studies that identified current myths that drivers rely on to support their use of hands-free phones, and then designed a video to bust those myths. While Study 2 was inconclusive due to a small sample size and possible floor effects in usage and attitudes, Study 3 showed significant positive improvements in attitudes and future intended behaviours.
- 16) In the discussion we reflect on the differences between Study 2 and 3. Why was there such a difference in the results? Was it simply sample size, or might another factor have been at play? We consider whether the type of drivers in Study 3 (ordinary drivers rather than people who drive for work), or the shorter, snappier videos (each containing just a single myth), might have played a role in the dramatic shift in results between the two studies.
- 17) To conclude, the process of selecting the myths and creating the videos has provided a powerful protocol for future video-based interventions to follow. The results of Study 3 suggest this approach can be impactful, and we make recommendations for future research to build upon these findings.

Contents

Executive Summary	1
Contents	4
1 Introduction	7
1.1 Hand-held mobile phones & driving	7
1.2 The law on hand-held and hands-free phones whilst driving.....	7
1.3 Hands-free mobile phones and driving	8
1.4 Why do drivers continue to use hands-free mobiles?	9
1.5 What can we do with this knowledge to improve driver safety?.....	10
1.6 The current project	11
2 Study 1: Initial Survey	12
2.1 Introduction.....	12
2.2 Method	13
2.2.1 Participants	13
2.2.2 The Survey.....	13
2.3 Results	14
2.3.1 Driver demographics	14
2.3.2 Self-reported driving behaviours.....	16
2.3.3 Free-text responses to explain hands-free use.....	17
2.3.4 Agreement ratings for statements about hands-free mobile phones.....	22
2.3.5 Do attitudes relate to handsfree mobile phone use?.....	22
2.4 Discussion	24
2.4.1 A summary of potential 'myths'	24
2.4.2 Additional findings of note	25
3 Developing the intervention.....	25
3.1 The expert focus group.....	25
3.2 The scripts.....	26
3.3 Filming and editing	28
5 Study 2: The Intervention	29
5.1 Introduction.....	29
5.2 Method	30
5.2.1 Participants	30
5.2.2 Design.....	32

5.2.3 Materials	32
5.3 Results	35
5.3.1 Baseline behaviours and attitudes.....	35
5.3.2 Changes in driver behaviour across the study.....	35
5.3.3 Changes in driver attitudes across the study	36
5.3.4 Looking for relationships among the data.....	36
5.3.5 Thoughts on the videos	37
5.4 Discussion.....	39
5.4.1 Evaluation of the intervention video.....	39
5.4.2 Limitations of the study.....	40
6 Study 3: A second evaluation.....	40
6.1 Introduction.....	40
6.2 Method	41
6.2.1 Participants	41
6.2.2 Design, Materials, and Procedure	42
6.3 Results	42
6.3.1 Changes in driver attitudes to hands-free mobile phones	42
6.3.2 Video Evaluation	43
6.3.3 Self-reported benefits from watching the videos	43
6.4 Discussion.....	44
7 Discussion	46
7.1 An overview of the project	46
7.2 A protocol for future road safety videos	47
7.3 The final video	47
7.4 A conclusion	47
8 References	48
Appendix A: Frequency of self-reported behaviours in an average week (Study 1)	55
Appendix B: Correlations between mobile phone use, driving experience and attitudes (Study 1)	58
Appendix C: The intervention and distracter videos	59
Appendix D: Frequency of self-reported behaviours in an average week (Study 2).....	60
Appendix E: Agreement with attitudinal statements (Study 2)	61
Appendix F: Crashes and self-reported behaviour weeks 1-6 (driving for work)	62
Appendix G: Crashes and self-reported behaviour weeks 1-6 (personal reasons)	63
Appendix H: Mobile phone use of intervention and control group.....	64
Appendix I: Attitudinal changes between Week 1 and Week 6	65

Appendix J: Correlations of mobile phone use and attitudes (Study 2).....	66
Appendix K: List of intervention videos (Study 3)	67
Appendix L: Agreement with attitudinal statements (Study 3).....	68

1 Introduction

UK road safety experts often refer to the ‘fatal five’ causes of crashes as inappropriate speed, drink/drug driving, careless or risky driving, failure to wear a seatbelt, and distraction (e.g., BRAKE, Road Peace), though other countries may refer to different causes (cf. Salmon et al., 2019). Often, the distraction factor is referred to simply as the use of mobile phones while driving. Certainly, this form of distraction appears to be the main worry of UK drivers (RAC, 2019), though in the same survey 23% of drivers still reported using a hand-held phone while driving, despite this being illegal since 2003. But just how big a problem is talking on a hand-held mobile phone while driving?

1.1 Hand-held mobile phones & driving

Mobile phone distraction is internationally recognised as a road safety problem (Hancock et al 2003; Horrey et al 2008; Horrey & Lesch 2009; Liu & Ou 2011) that impairs attention, and decreases driver safety (Davis et al., 2019; Fuller et al., 2008; Onate-Vega et al., 2020). Specifically, mobile phone usage has been shown to have a significant negative effect on driving behaviour in terms of reaction time (Haque and Washington, 2014, Oviedo-Trespalacios et al., 2020), vehicle lateral control (Niu et al., 2019), headway (Saifuzzaman et al., 2015), speed variation (Wijayaratna et al., 2019), lane changing behaviours (Zhang et al., 2019), responding to pedestrians (Haque and Washington, 2014), braking behaviour on urban roads (Haque and Washington, 2015), drivers’ decisions to run yellow lights (Haque et al., 2016) and hazard perception (Weaver et al 2023). With all the negative impacts of mobile communication on driving, it has been estimated that 50-minutes of mobile chatter per month will increase your crash-risk five-fold (Violanti and Marshall, 1996). Other researchers have reported similar four-fold increases on crash-risk (McEvoy et al., 2005; Redelmeier and Tibshirani, 1997), while Burns et al., (2002) reported that mobile phone conversations could slow response times more so than the effects of alcohol or cannabis use (see also Strayer et al., 2006).

Despite the evidence, and the law, studies repeatedly show significant portions of the driving population are willing to engage in hand-held mobile phone calls. In one UK study, Sullman et al. (2018) reported 29% of a sample of UK drivers admitted to engaging in phone calls, while 30% read text messages, and 22% sent texts on at least a daily basis.

There are several subgroups of motorists who are more likely to use mobile phone usage while driving, including young drivers, and professional drivers such as van, truck, and bus drivers (Philips & Berge, 2023; Troglauer et al., 2006; Brusque & Alauzet, 2008; Young et al., 2010; ERSO, 2018). Truck drivers are known to be particularly exposed to distraction-related risk due to long driving hours and the job’s solitary nature (Ferreira et al., 2018, Claveria et al., 2019, Iseland et al., 2018). Among all the observed secondary tasks performed by truck drivers, mobile phone use while driving has been identified as one of the primary sources of distractions (Kong et al., 2021, Montuori et al., 2021, Wang et al., 2020, Trivedi et al., 2017). There is also a suggestion that increased time spent at the wheel for their job can cause professional drivers to become overconfident in their ability to drive safely while using a mobile phone (e.g., Choudhary & Velaga, 2019).

1.2 The law on hand-held and hands-free phones whilst driving

Since 2003, it has been a specific offence in the UK to use a hand-held mobile telephone or other hand-held device for the purpose of any interactive communication (such as messaging, making, or receiving calls, or accessing the internet) while driving or while supervising a learner driver. If caught, drivers

face a £200 fine and 6 points on their licence. In 2022, the UK laws were strengthened to also ban drivers from holding and using their phones to take photos or videos, scroll through playlists or play games.

Illegal mobile phone use requires the mobile phone to be 'held' for it to be an objective offence (although a police officer could still make the subjective call of Driving without Due Care and Attention). This means that touching (without holding) a mobile phone to accept a call whilst it is in a cradle or mount (and it is not blocking the view out of the window) remains legal. Even scrolling through playlists is considered legal if the phone is safely mounted.

Increasingly, however, drivers can interact with their phone via voice commands, through the car infotainment touchscreen, or through buttons on the steering wheel to accept incoming calls. While some of these options may still require the use of a hand to initiate or accept a call, these methods are still considered to be 'hands-free'.

The legality of using hands-free devices whilst driving is commonly misinterpreted as meaning it is safe to do so. The evidence does not suggest this to be case. There is little or no difference in the cognitive loads imposed by hand-held or hands-free conversations (Strayer et al., 2015, Wells et al., 2021). Likewise, they both have similar negative impacts on spotting hazards (Caird et al. 2008, 2014, 2018), and upon crash risk (Dingus et al., 2016).

1.3 Hands-free mobile phones and driving

There are clear reasons why hand-held mobile phones could be more distracting. Merely holding the phone in your hand can make it harder to steer, while navigating menus and selecting the right buttons may require a more eccentric diversion of gaze from the road ahead compared to a dashboard mounted device or infotainment system. An early study in this area monitored Event Related Potentials (electrophysiological measures of brain responses to stimuli), and indeed found an impact of physically holding a phone on the driver's 'readiness to respond'. However, the researchers also noted a more general decrease in attention to sensory inputs that was present with hand-held and hands-free phones, which they suggested reflected the "dual-task" nature of the activity (Garcia-Larrea et al., 2001).

Since then, many studies from around the world have demonstrated that the impact of hands-free communication can be as detrimental to driving safety as hand-held phone calls (e.g., Burns et al, 2002; Backer-Grøndahl and Sagberg, 2011; Holland and Rathod, 2012; Ishigami and Klein, 2009; McEvoy et al., 2006; Strayer et al., 2006). Numerous reviews of the literature have found that talking on the phone, regardless of phone type, has negative impacts on performance, especially in detecting and identifying events, and that performance while using a hands-free phone is rarely found to be better than when using a hand-held phone. Some studies have even found that drivers may try to compensate for the deleterious effects of hand-held phone usage, but neglect to do so when using a hands-free phone (Ishigami & Klein, 2009) presumably because they are less aware of impairment.

The reason that hands-free communication is often as dangerous as hand-held communication is that the demands associated with a meaningful conversation are the main cause of distraction. This is clearly demonstrated in a study by Just et al., (2008) who scanned the brains of 29 drivers while engaged in a simulated driving task. Driving performance deteriorated when making true/false judgements of (hands-free) auditorily presented statements. In the distraction condition, the researchers also noted an increase in temporal-lobe activation (where audition is initially processed), but apparently at the expense of parietal-lobe activation (the bit of the brain that, among other things,

integrates our visual experience with movements of the body, such as steering). In other words, listening to the statements appeared to reduce visual-motor processing, which was most likely a leading cause in the deterioration of driving safety. Thus, while hands-free phones might keep the hands on the wheel and the eyes on the road, they do not keep the brain focused on the road.

1.4 Why do drivers continue to use hands-free mobiles?

Hole et al (2019) outlined ten common excuses regarding the use of digital devices while driving. These included the need to carry out essential work tasks while driving (Bruyas & Evennou, 2018), a need to use the phone to communicate with colleagues, friends, and family; and relief from strain or boredom due to hours spent at the wheel (Durgamani et al., 2018).

A common finding is that driving time may be classified as 'wasted' time that punctuates meaningful periods of work activity (Lyons and Urry 2005). This may especially be the case for employees who use a vehicle to move between geographically separated appointments. This may tempt drivers to make driving time more productive, by engaging in secondary tasks that help to reduce the day's workload (Laurier 2004). Alternatively, some employees may see driving time as an opportunity to engage with friends or family, rather than wasting time on the road (Wajcman 2015). The perceived 'necessity' to multitask to remain constructive has been found in both males and females, although reasons for doing so differ between genders depending on attitudes towards risk perception and reward-seeking (Fraschetti et al, 2021).

Other researchers have similarly concluded that business-related activities are one of the most likely reasons for mobile phone-use while driving (Walsh et al. 2008; Shi et al. 2016). Phone-use appears to be a solution to demanding job roles and blurred boundaries between work and home. 'Missing out' on opportunities to be productive could be seen as problematic and puts the individual at risk of failing to 'keep up' with both work and societal pressures. Thus, accepting research findings on the dangers of utilising hands-free technology whilst driving would necessitate a change in behaviour that could be seen as unfavourable to their individual success, especially in jobs where employees see their roles as expendable (Wells et al, 2021). Furthermore, many individuals may have used hands-free technology whilst driving without suffering any negative consequences. Past experience is often used as 'evidence' to ease any cognitive dissonance regarding what is safe for the individual, compared with what is safe for others (Wells et al, 2021).

Perceived social norms also play a role in easing this cognitive dissonance, with the common belief that "everyone does it, so it must be safe". This is a significant predictor of self-reported mobile phone-use, particularly for young drivers (Wells et al, 2021). Significant differences have also been found in the behavioural, normative, and control beliefs of frequent and infrequent users of both types of handsets while driving. As expected, frequent users reported more advantages, more approval from others, and fewer barriers that would prevent them from using a hands-free (or hand-held) mobile phone while driving compared to infrequent users (White et al, 2010).

Unfortunately, the 'invisibility' of cognitive distraction can lead drivers to supposedly 'common sense' comparisons with other distractions, such as talking to passengers. Drivers frequently liken talking on a hands-free device to talking to a passenger, which to an extent holds true. However, the content and complexity of the conversation will determine the impact on information processing capacities including visual search behaviour, speed control, detection, and decision-making capacities (Nunes, 2002). Beyond the cognitive demands, emotional conversations may also be more harmful than more mundane conversations between drivers and passengers (Dula et al, 2011; Strayer et al, 2013). Given that it requires more effort to initiate a mobile phone conversation than chatting with a passenger, it

seems likely that mobile conversations will also be more complex, intense, or even emotional.

Another important difference between driver-passenger conversations and mobile phone conversations is that the latter does not benefit from *shared visual space* (Crundall et al., 2005). Parkes (1991) suggested that phone conversations can be more dangerous than conversations with passengers, because passengers are aware of the traffic demands and can adapt the rhythm of the conversation accordingly. The lack of information about the traffic demands via telephone creates an expectancy in the remote partner of a continuous conversation with no interruptions (McKnight & McKnight, 1993). Even if the driver pauses the conversation to deal with a particularly demanding instance on the road, the person on the other end of the mobile phone is likely to keep the conversation going.

1.5 What can we do with this knowledge to improve driver safety?

We know that hands-free mobile communication while driving is dangerous, but how can we reduce this danger? First, we might consider whether hands-free phone calls could be made illegal while driving. There does not seem to be a legislative appetite for this, despite the Transport Select Committee making this recommendation in 2019. There is also the problem of how one might enforce a ban. While hand-held users can be caught on camera or be spotted by a police officer holding and talking on a phone, hands-free communication could be difficult to distinguish from singing along to a song or talking to a passenger (or even oneself).

Alternatively, we may seek to prevent mobile communication through technology in the car or via apps that limit phone functions when driving. For instance, GPS can be used to calculate that the phone is moving above walking speed and thus shut down functionality. This can however prevent passengers from using their phones. To overcome this, such apps often include a 'passenger mode'. This could be a simple toggle switch, or the app could require some form of attention verification test to be undertaken to prove that one is a passenger. A toggle switch would essentially make use of the app voluntarily, which reduces the likelihood that drivers will make use of its features (Oviedo-Trespalacios et al, 2019). This is however perhaps preferable to an attention verification test which may make it very difficult for a driver to access phone functionality while driving but will not necessarily stop them trying.

Increasingly, however, more and more companies are bringing in policies to ban the use of hands-free phone calls while driving for work, including high-profile organisations such as Ocado and the Post Office. While this is an important step in reducing the perils of distraction, companies must then ensure that drivers adhere to a ban. In recent research conducted by one of the current authors (Groeger, Crundall & Formby, 2022), it was found that some drivers in one company with a policy banning hands-free calls reported breaching the policy for a variety of reasons (usually centred on the drivers' assumptions that the ban was unnecessary or unreasonable). This demonstrates the need to educate drivers in the dangers of hands-free phone calls, to combat the reasons they rely on to justify continued hands-free use. The current project is an attempt to develop one such educational resource, in the form of an informative and persuasive video, and to evaluate its impact on drivers' attitudes towards hands-free mobile phones, and their subsequent use of them while driving.

1.6 The current project

This project seeks to ‘myth-bust’ or debunk professional drivers’ reasons for continued use of hands-free mobile phones while driving. Many studies have examined methods of debunking misinformed beliefs, with the field taking on renewed importance during the COVID-19 pandemic (Challenger, et al., 2022). Research has considered the format, medium, and content of myth-busting attempts, and the nature of the population whom one is trying to influence. Evidence suggests that a format whereby one simply states the myth and then refutes with the fact can actually result in a ‘backfire’ where misinformation persistence is strengthened (e.g., Schwarz et al., 2007). This may be due to the myth and fact receiving equal salience in the myth-busting presentation; unfortunately, if the myth is well-established in the recipient, the factual element of the presentation must work far harder to outshine the myth.

Schwarz et al., (2016) suggest that when people are presented with evidence that tries to counter their current beliefs, they may implicitly ask themselves 5 key questions: Do others believe it? How much evidence is there? Does the evidence fit my general views? Do the facts offer a logical and believable reality? Does the evidence come from a credible source? These criteria overlap with principles put forward by Heath and Heath (2008) to ensure that messages stick with the recipients. They suggest “sticky facts” are *simple* (recipients may not listen to your message if it requires significant effort to understand), *unexpected* (counter-intuitive facts can stand out in memory), *credible*, *concrete*, *emotional*, and provide a *story*. If these 6 criteria are met, then your message may have the power to replace the prevailing belief.

Before applying these principles however, we must first identify the common myths held by our population of drivers. Given that the current project was prompted by research into fleet van drivers, we have opted to remain focused on this population (who also have the dubious accolade of being the biggest killer of other road users when distance travelled is accounted for; Webster and Davies, 2020). Thus, the first stage of this project was to identify what reasons van drivers have for using hands-free phones, especially if their company has an explicit policy against their use. This was achieved in Study 1 with a survey distributed to over 680 van drivers who rated their agreement with a list of *a priori* myths and added their own thoughts via free-response boxes (see Figure 1 for a schematic overview of the intended project).

These data and thematically-grouped free responses were then taken to an expert focus group which assisted in identifying the key myths to be tackled in our myth-busting video. Scripting, storyboarding, filming, and editing then followed, leading to a finished video of 9-minutes duration. The final video aimed to include many of the points raised in the debunking literature, with credible sources (expert talking heads), simple narratives, concrete examples, and emphasis on evidence over myths.

Following video development, we undertook a study to assess the impact of our video on fleet drivers’ attitudes towards, and use of, hands-free communication while driving. We compared the self-reported attitudes and mobile phone use of an intervention group to that of a control group, both before and after seeing the video (or control) intervention. We hypothesised that our myth-busting video would foster more safety-oriented attitudes in our intervention group, and possibly reduce self-reported use compared to the controls.

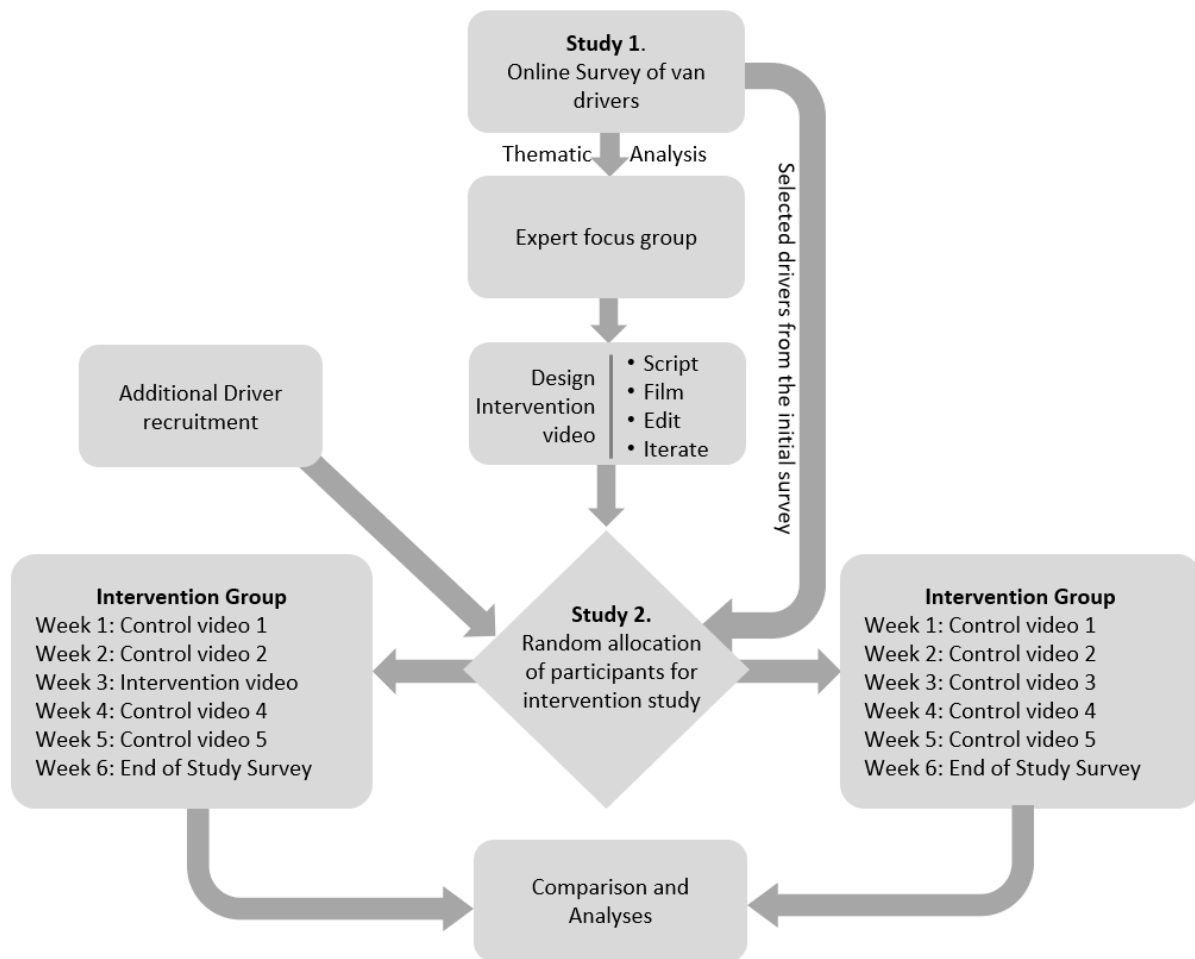


Figure 1. An overview of the project including Study 1 (Survey), intervention design, and Study 2 (evaluation).

2 Study 1: Initial Survey

2.1 Introduction

As noted in Section 1.4, researchers have proposed a range of reasons that drivers may cite regarding their willingness to engage in hands-free mobile conversations while driving. However, these reasons are likely to change over time and it seemed prudent to assess current reasons for using hands-free mobile phones within our target population of van fleet drivers. Furthermore, given our intention to make a short informative and persuasive video to challenge drivers' beliefs, plus the need for the factual evidence to greatly outweigh any screen time given to the myth, we decided that no more than 5 myths could be busted in a video of less than 10 minutes. This required us to informally rank the myths to select the most pertinent ones to address during the intervention. The frequency with which current fleet drivers report different reasons for hands-free use can support this informal ranking. The survey also provided the opportunity to assess the levels of social desirability in our target population.

To gather these data, we created a survey that included questions on hands-free phones and the reasons drivers relied on to justify their use. The survey was primarily distributed among van drivers in a large UK construction company, though other drivers from other companies with driving roles were recruited to bolster the sample size.

2.2 Method

2.2.1 Participants

A total of 682 drivers started the survey, though only 449 professional drivers completed the online questionnaire. Out of those 449, 20 were excluded from the final analysis as they reported that they did not currently drive for work. The remaining 429 participants (350 males, 77 females, 2 preferred not to say) had an average age of 47.3 (ranging from 19 years to 72 years). Participants drove (for work purposes) an average of 12,035 miles per year (ranging from 50 to 90,000 miles). Participants were recruited through a large UK construction company and its subcontractors, and a smaller road freight company. These companies were chosen due to their policy against the use of hands-free mobile phones while driving. Invites to participate were distributed by fleet managers to their drivers, though the voluntary nature of participation and the anonymity of their data was stressed.

2.2.2 The Survey

The survey consisted of 5 main blocks of questions (see Figure 2), starting with demographics to gauge the participants' age, gender, and driving history (e.g., average miles driven, driving offences, collision history, etc.). The second block contained 16 items of the Social Desirability Scale (SDS-17; Stöber, 2001) to measure the tendency for respondents to attribute socially desirable behaviours to themselves. It includes items such as 'I sometimes litter' and 'In traffic I am always polite and considerate of others.' The SDS-17 originally consisted of 17 questions, however one item that referred to the use of illegal drugs was omitted. Given that the survey asks drivers to report their frequency of engagement with illegal hand-held phones and hands-free phones (which are banned by their companies), and that this survey was passed to respondents by fleet managers, it seemed appropriate to

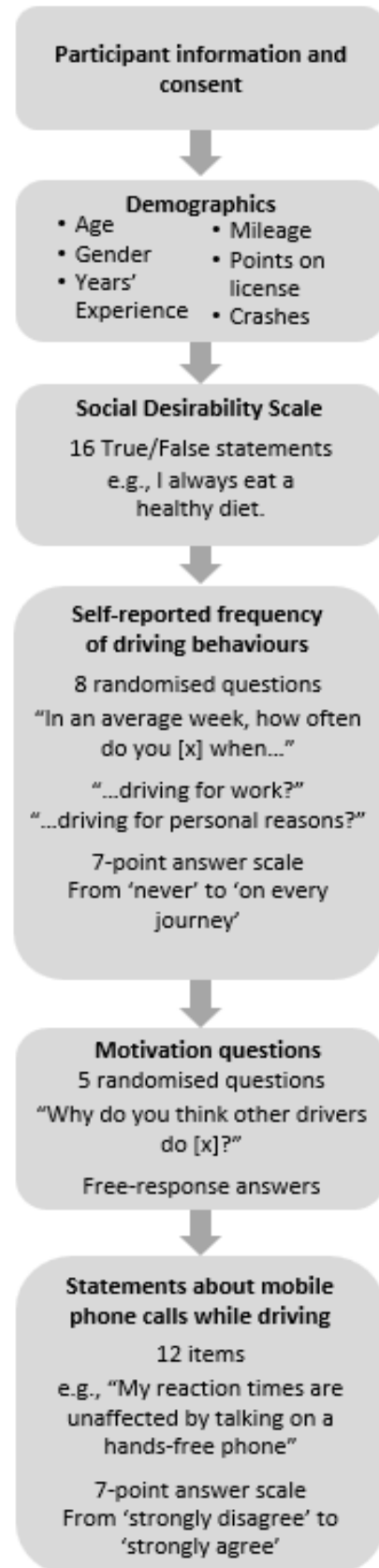


Figure 2. An overview of the structure of the survey (Study 1)

estimate the level of social desirability in our target population to understand what effect it might have on the data.

The third block included eight questions on self-reported behaviour (see Figure 4 for the questions) including the key questions “How often do you make hands-free calls ...?” and “How often do you make hand-held calls ...?” Other questions probed their frequency of speeding, overtaking, and using caffeinated drinks to get through a journey, in an effort to mask the primary focus of the survey. Responses were made using a 7-point Likert scale, ranging from ‘Never’ to ‘On every journey’. Two responses were required for each question: one which focused on “...while driving for work,” while the other asked for frequencies related to “...driving for personal reasons.” The eight questions were randomly presented within this block.

Block 4 of the survey consisted of free response questions asking why they think other drivers might behave in a certain way. There were five free-response items that probed a subset of the behaviours that were introduced in block 4 (e.g., speeding, driving tired, engaging in hands-free calls while driving). These questions were also randomised.

In the final block, all pretence was discarded, and we asked participants to rate how strongly they disagreed or agreed (on a 7-point scale) with a series of twelve statements regarding hands-free mobile phone use (e.g., “I need to use a hands-free phone for my work”; see Figure 7 for the statements). These items appeared in a set order. Importantly, once respondents progressed from one block of questions to another, they were not able to return to a previous block and change their answers. The online survey was launched using Qualtrics survey software (Qualtrics.com) and data were collected between October and December 2022.

2.3 Results

The primary aim of the survey was to collect reasons that fleet drivers use to defend their use of hands-free phones during driving, even though their companies explicitly ban them. The most important sections of the survey were therefore Block 4 (free-response questions that ask for motivations behind hands-free phone use) and Block 5 (ratings of agreement with *a priori* motivations and beliefs about hands-free calls). Before considering our drivers’ motivations and beliefs we first look at our driver demographics (2.3.1) and whether our drivers reported engaging in hands-free (and handheld) calls while driving (2.3.2).

2.3.1 Driver demographics

Of the 429 included responses (77 female) the mean number of years since passing their initial on-road driving test was 27.8, ranging from 1 to 55 years. None of the sample passed their test within 12-months prior to the study. The average number of test attempts for our respondents was 1.5.

Fifty-four drivers reported having live endorsement points on their license, ranging from 3 to 12, while 22% of respondents reported having attended a National Driver Offender Retraining Scheme course (NDORS). The most frequently attended course was the National Speed Awareness course, accounting for 87% of all courses attended by our drivers.

The annual mileage of our drivers was greater, on average, when driving for work compared to personal driving (with mean mileages of 12,035 and 6,856, respectively). The number of reported collisions in the last three years was relatively low. Only 29 drivers reported one or more collisions while driving for work, and 33 drivers reported being involved in a collision while driving for personal reasons. The maximum number of collisions reported by our drivers was 3 collisions while driving for work (1 driver) and 2 collisions while driving for personal reasons.

Social desirability was measured to ascertain how likely our drivers were to manipulate their answers to reflect positively on themselves. When asking questions about the frequency of engaging in illegal behaviours (hand-held calls) and behaviours in breach of company policies (hands-free calls), some drivers may be less candid than others. The SDS-17 scale offers a method to identify them. The frequency distribution of scores (with a possible maximum score of 16) can be viewed in Figure 3. The median and modal response is 5 out of 16 (with a mean of 5.06) with a positively skewed distribution reflecting the small percentage of drivers who responded in a highly socially desirable way. The interquartile range (IQR) is 2. Upper and lower boundaries for outliers were constructed by multiplying the IQR by 1.5 and deducting this from the first quartile and adding it to the third quartile, producing a range of 1-9. Thus the 13 respondents (3%) who produced scores above 9 can be considered outliers displaying levels of social desirability beyond the rest of the sample.

Tran et al., (2012) analysed datasets from 5 separate samples (with American, Canadian, and Austrian respondents). Across the 5 samples they reported means of 3.3, 8, 9.2, 9.3, and 9.6. The mean of the current sample is lower than 4 out of 5 of Tran et al.'s samples. Though Tran et al. warn of potential cultural differences in SDS-17 scores, the current respondents seem to have little motivation to put socially desirable responses. Given the overall low levels of social desirability, and the small number of drivers we can consider outliers, we argue that social desirability should not pose a particular problem for the survey.

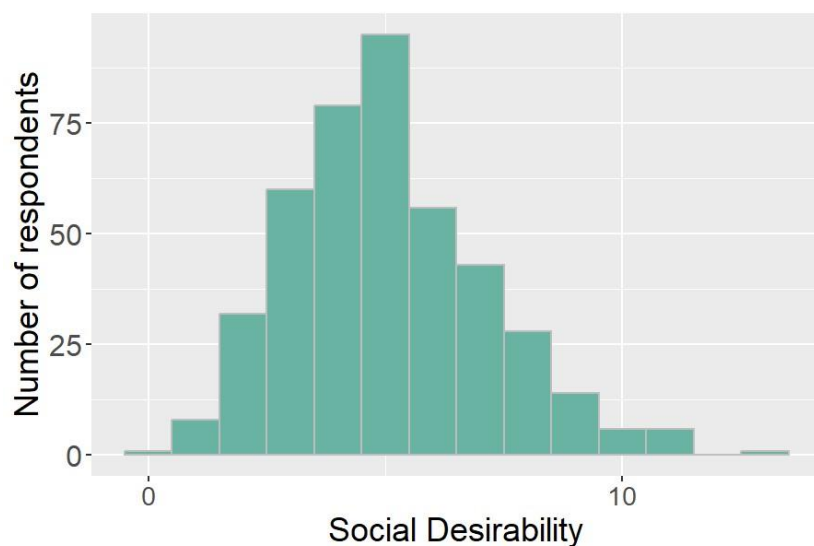


Figure 3. A frequency distribution of social desirability scores from the SDS-17 produced by participants in Study 1.

2.3.2 Self-reported driving behaviours

Block 3 of the survey required drivers to estimate the frequency they engaged in certain behaviours during the average week, both for work driving and personal driving. Responses were made on a 7-point scale from 'never' to 'on every journey'. The breakdown of participant responses for each question can be viewed in Figure 4 (driving for work) and Figure 5 (driving for personal reasons). The frequency tables on which these figures are based can be seen in Appendix A (Tables A1 and A2). When responses are recoded into the corresponding numbers for the points on the 7-point scale, median responses ranged from 1 to 4.

As can be seen in the comparison of Figure 4 and 5, although the overall pattern of responses appears similar, there appears to be some potential differences in how drivers respond depending on whether they are thinking about driving for work or driving for personal reasons. Responses to questions were compared across the two types of driving using Wilcoxon signed-rank tests (see Appendix A, Table A3 for all details). Drivers reported less frequent phone use (both hand-held and hands-free), less speeding, and less overtaking when driving for work compared to driving for personal reasons. Respondents were also more likely to check their lights and clean their vehicle when driving for work. These all represent a positive shift in safe behaviours from personal driving to work driving. However, driving for work also resulted in a greater tendency to use caffeinated drinks, and more instances of driving while angry, stressed, or frustrated. Thus, while some self-reported risky behaviours decrease when driving for work compared to personal driving, some risky behaviours might increase.

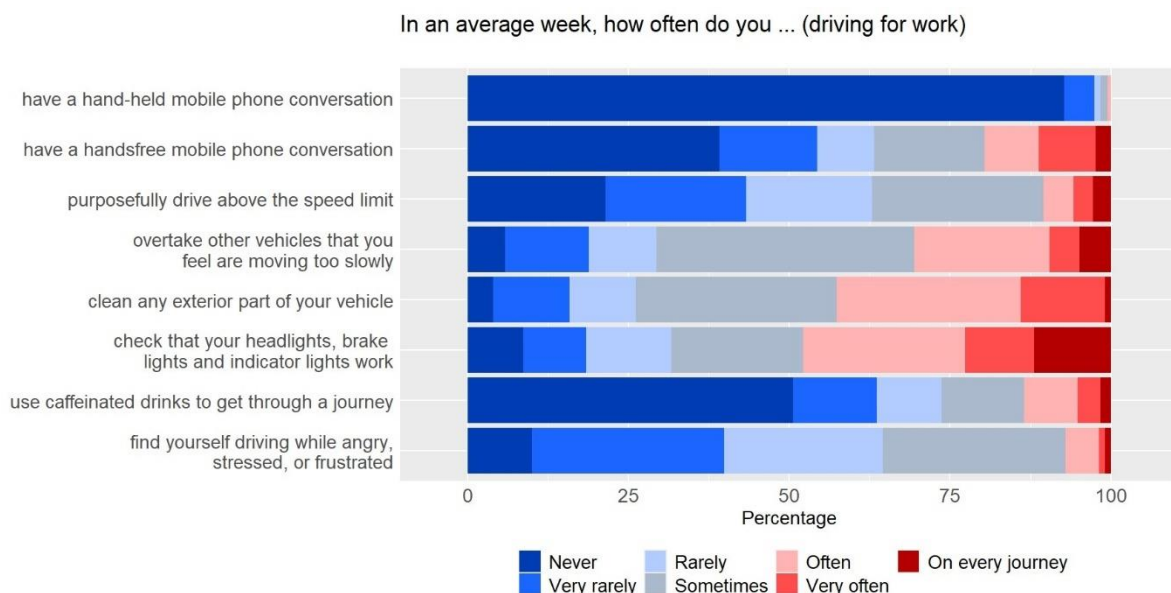


Figure 4. Self-reported frequency of behaviours in an average week when driving for work.

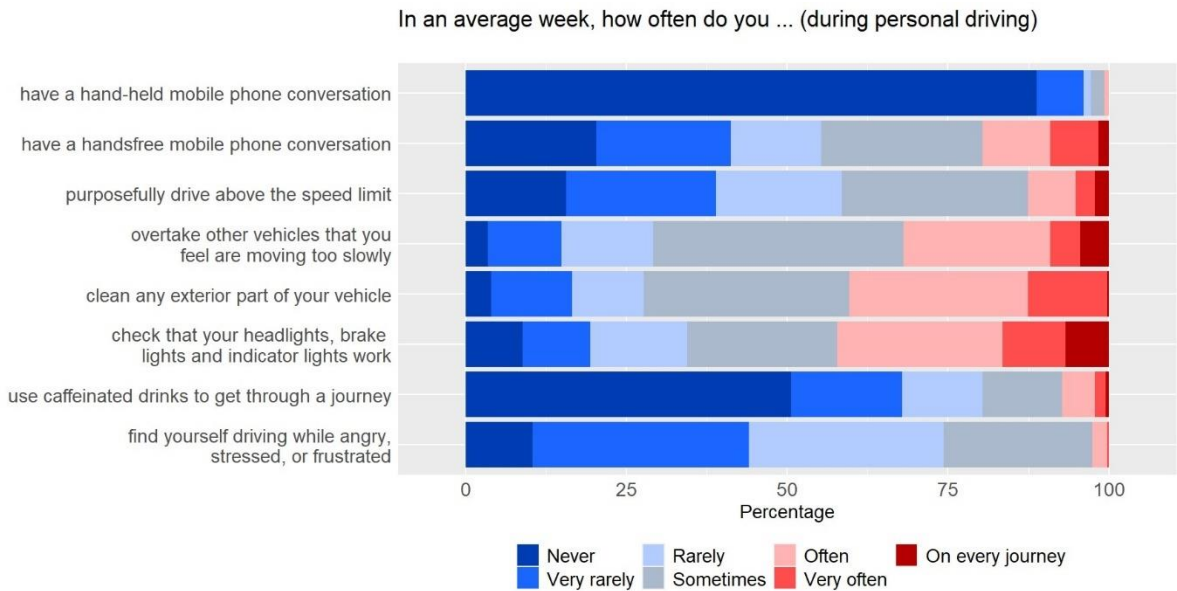


Figure 5. Self-reported frequency of behaviours in an average week during personal driving.

Additionally, self-reported hand-held phone use while driving appeared to be lower than that of hands-free phone use for both driving at work and personal driving. Further Wilcoxon comparisons confirmed that this is the case (handheld/work vs hands-free/work: $z = 13.69, p < .001$; handheld/personal vs hands-free/personal: $z = 15.52, p < .001$).

2.3.3 Free-text responses to explain hands-free use

Free-text responses were recorded for five questions regarding the reasons that drivers engage in certain behaviours (speeding, failing to make vehicle checks, driving while tired, driving aggressively, and engaging in hands-free phone calls while driving). Only the hands-free question is relevant to the study aims, and this was subjected to a thematic analysis. We extracted the top ten main themes from 570 distinct responses (with some respondents giving two or more reasons) to the question “Why do you think people have hands-free mobile phone conversations while driving?”. The frequency of occurrence of the different reasons is shown in Figure 6. These are discussed in descending order of frequency.

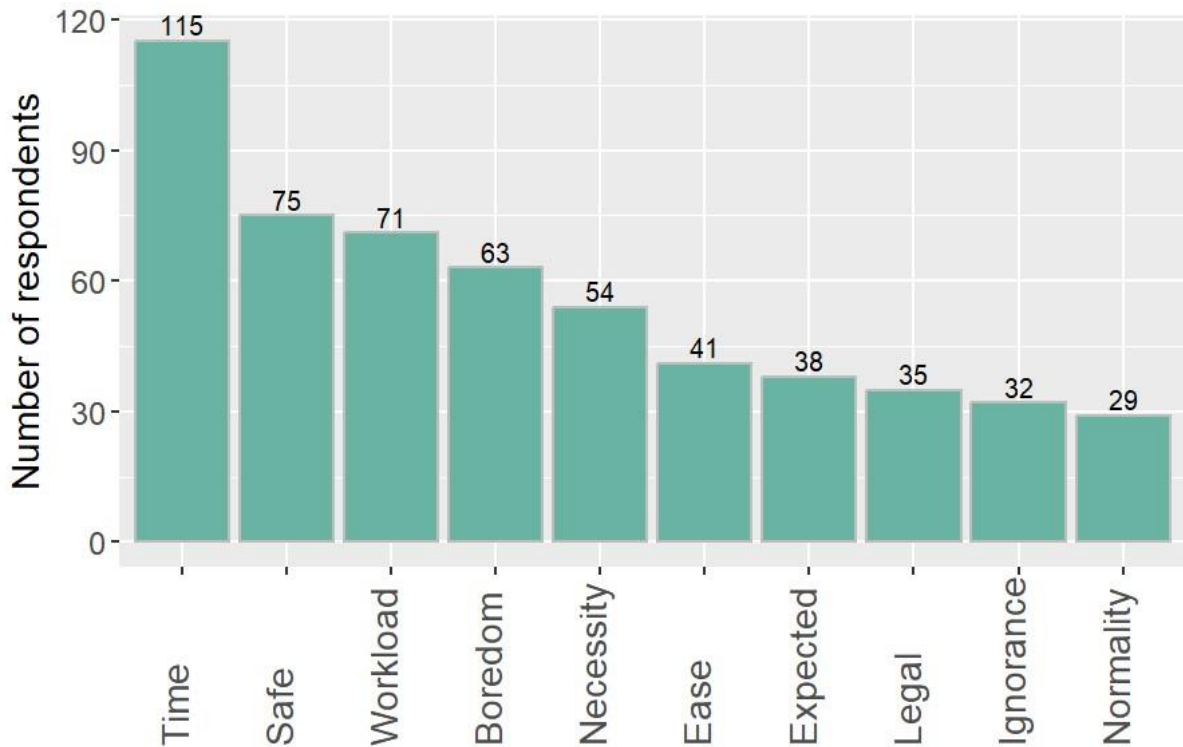


Figure 6: Reasons that participants gave for using hands-free mobiles whilst driving, and number of times those reasons were mentioned. An explanation of each category with examples is given below.

1. Managing time in the work-life balance

The most-often quoted reason from our drivers was that there wasn't enough time available to fit everything they need to or want to do into a day ("*...life is so busy...*"). Their responses referenced conversations with people in their personal life which otherwise might not happen ("*...catching up with friends and family that you've not had time to speak to...*"), and emphasised the perceived benefits of using driving-time to have such conversations so as not to impinge on non-driving time ("*...having a conversation whilst on the road means that you can speak to people whilst driving, so you aren't having to use time when you have stopped...*").

Implicit in many of these comments (and occasionally explicit) was the feeling that driving time is unproductive, or is considered 'wasted' time ("*...driving time is otherwise dead air time...*"), and that, as driving does not require one's full attention all of the time, hands-free communications allows one to multi-task and meet familial and friendship obligations.

This is a particularly difficult reason for fleet managers to overcome. Drivers are likely to be using their own phones for such calls, and there is no way for managers to monitor the frequency of such communications to assess whether they are a large problem. Even following a collision, managers may not have any evidence that a private hands-free call was taking place.

2. It's perfectly safe

The second highest category of justifications for engaging in hands-free calls while driving was that it was a safe secondary activity (“*It is safe to have a hands-free mobile phone conversation*”). While there have been two decades of campaigns telling drivers of the dangers of handheld phones, there has been very little public acknowledgement of the dangers of hands-free calls. The status of handheld phone calls was used as a comparator when some drivers made safety judgements (“*It is safer than using your [handheld] mobile phone*”, “[*drivers use hands-free*] because it is illegal and very dangerous to hold a mobile”).

An alternate perspective focused on the low demand of driving rather than the ease of making a phone call (“*It's time when [drivers are] not busy doing other things... it's easier to multi-task...*”). Such views may underestimate the demands of driving, or how quickly demands may escalate due to the presence of a hazard.

Arguments for hands-free safety were sometimes followed by misguided justifications, such as the fact that you can keep your hands on the wheel instead of holding a phone, or its legal status (“*...[it's] perfectly safe... if it was dangerous, it would be against the law*”). Some participants made a direct comparison with having a conversation with a passenger (“*They think it is relatively safe [to] drive and talk at the same time – as if to a passenger*”, “*...it's no different to talking to a passenger*”, “*... no more [risk] than having passengers in the car*”). Where several participants gave the same sub-justifications, their quotes were assigned to their own category (though the ‘passenger’ theme did not make it into the top ten).

‘Safety’s status as only the second-most reported reason for using hands-free communication suggests that either some drivers think that the *managing time* justification is sufficient even though hands-free calls are unsafe, or they simply do not consider the safety aspect of hands-free calls (possibly because hands-free calls appear so demonstrably safe that it doesn’t require arguing for).

This mistaken justification also poses problems for fleet managers to overcome, as there are likely to be several reasons underpinning these drivers’ safety assumptions, with each one requiring a different approach.

3. Workload is demanding

This justification is similar to the first theme, though the current theme reflects the time pressures of the job rather than achieving a work-life balance. Phone calls may help with immediately pressing issues (“*...to reduce workload when you reach your destination...*”) or more general work loading issues (“*...to stay on top of business requirements...*”, “*I need to drive to a meeting but have to continue working*”). The necessity of using phone calls to manage workload is no doubt dependent on the requirements of the job (e.g., client-facing drivers may have greater opportunities to reduce workload through mobile communications), but those who reported this justification clearly feel the pressure to engage in mobile communications is significant (“*...there's not enough time in the day not to use this time to speak with people on business matters...*”).

This justification is one that companies should be able to overcome. Indeed, one might argue they should have overcome it at the same time they banned hands-free calls during work driving.

However, an individual's workload is subject to many pressures that might not show up on paper, and drivers may be loath to admit this in case it is perceived as a sign of inefficiency on their part.

4. Reducing boredom and tiredness

Drivers who are on the road a lot, or engage in long journeys without interpersonal interaction, often report boredom. This can lead to internal distraction (mind-wandering), or seeking out external distraction (e.g., listening to the radio). Some drivers prefer to engage in hands-free calls to reduce boredom ("*...[it's] distraction from the journey...*"; "*...it passes the time...*"; "*...to break the monotony of a long journey...*"). Some drivers acknowledge the interpersonal dimension as important ("*...just need some company...*"). Implicit in some of these responses, is a belief that talking to someone might keep you alert, thus having a positive impact on your road safety. This is most obvious when drivers engage in hands-free calls not just out of boredom, but because it staves off tiredness ("*...to keep from driving tired...*"). There are however safer ways to deal with boredom (regular breaks) and tiredness (taking a break for a nap). These need to be stressed to drivers, and the safety myths of hands-free calls should be debunked.

5. Necessity

Sometimes events might conspire to force a driver to engage in a hands-free call ("*...needs must...*"). Some drivers clearly identified such instances as emergencies ("*...necessity, urgency & emergency...*") where time is of the essence ("*...to speak to someone urgently...*"). Other drivers had a broader view of what constitutes a necessity (e.g., "*...to get instructions...*"). All comments in this theme reflected an exceptional reason for hands-free communication rather than a reason to allow more general communications. While this seems the least problematic use of hands-free phones (use is very infrequent and potentially justified dependent on the nature of the emergency), using hands-free phones at times of urgency may be particularly dangerous. If the emergency has raised cognitive workload, increased stress, and evoked emotions, then the extent of free resources available for a secondary task may be greatly diminished. In such situations, a mobile phone conversation will have a greater impact on road safety.

It is also clear that some drivers perceived minor inconveniences to be urgent necessities or emergencies. Re-scheduling a meeting due to traffic congestion cannot be equated to a call to the police to report debris in a motorway lane. Without guidelines on what constitutes an emergency, drivers are likely to devise their own threshold criterion, beyond which they believe they are justified in making a hands-free call. Drivers' individual thresholds might however fall short of what the fleet manager believes to be a suitable level of justification.

6. Ease of use

Some drivers commented on the ease with which hands-free phone calls could be initiated using voice commands or buttons on the steering wheel. Connectivity between phones and in-car systems was perceived to have improved ("*Apple Car Play and Bluetooth connectivity makes it very easy...*") removing some of the previous technological blocks to hands-free use (such as trying to ensure that your phone is paired with the vehicle while driving).

The very presence of Bluetooth connectivity in the vehicle can prime use ("*If someone has a hands-free system to use, they'd use it if someone called, no matter the reason...*"). When drivers are given

vehicles with Bluetooth connectivity this can be perceived as an endorsement of hands-free communication (*"The car is fitted with the kit which is subconsciously giving permission..."*). However, Bluetooth connectivity is now standard on newer vans and cars, and its presence should not be viewed as active promotion of its use by management. Managers should stress that though Bluetooth functionality might be present in the vehicle, it should not be used for hands-free calls. Alternatively, they could seek ways to disable it in new vehicles.

7. It's expected

This differs to *workload* as the motivation is not driven by the amount of work one must complete, but rather the perceived expectations of clients, colleagues, and line management regarding the driver's availability (*"...[drivers] think that it is important to be available at all times..."*, *"... [it is] part of their job to instantly respond to contact"*). While a company may have a policy in place that bans hands-free use, such safety-positive views may not fully extend throughout the organisation. If a line manager insists that a driver take their calls (*"...pressure from the employer..."*) they may feel they immediate negative perceptions are a worse alternative to the increased risk or flouting of company policy (*"...managers may think you are not doing your job..."*).

8. Legal

The legal status of hands-free phones was mentioned several times as a justification for use (*"Because the law allows it..."*, *"...legal, so okay..."*) and as evidence that it must be safe (*"If it was dangerous, it would be illegal"*). Some respondents were however not quite sure of the legal status (*"...because it is convenient and still legal-ish"*).

It was interesting to note that responses varied in how they referred to the legal status, including "it's not illegal" (i.e., the law does not prohibit it), "it is legal" (with the implication of a positive legal view towards hands-free use), and the even stronger stance of *"[drivers use hands-free] because it's the law,"* which suggests that one *must* use hands-free (and implies no consideration of alternatives, such as pulling over to take a phone call). It is clear from responses in this theme that drivers use the illegality of handheld phone use to justify engagement with hands-free phone calls.

9. Ignorance

A number of comments referenced the ignorance of some drivers regarding the safety of hands-free calls, citing a lack of knowledge of how distracting hands-free calls can be and a poor understanding of the consequences. Some responses, however, were less charitable (*"...because they are idiots"; "because they are too lazy to pull over"; "... because they are stupid", "...because they have a low IQ", "...[they are] selfish"*). This suggests that a minority of drivers have taken on board the company policy and understand why it is in place. There were no moderate comments however, suggesting that converts to the dangers of hands-free technology may feel antagonism towards colleagues who persist in flouting company policy.

10. Normality

The tenth theme was that phone use whilst driving is a social norm, and that hands-free use is socially acceptable to some, and a societal problem to others who recognise the norm but view it negatively. Habit also plays a perceived role, with some respondents mentioning habitual use, and a mobile-phone culture, borne from the modern 24/7 world, that instils a fear of missing out.

Changing a social norm may seem very daunting, though rather than changing the norm *per se*, we can try to persuade individual drivers to reject the norm. The possibility of changing norms is not without precedent, however. The introduction of seatbelt legislation in the UK was preceded by a decade of deliberation, during which the police and august organisations such as the RAC argued against a seatbelt law (Bates, 2008). Despite this, the law was passed in 1983, and as of 2021, official figures suggest that 95% of front seat passengers now comply with the law (DfT, 2022a).

2.3.4 Agreement ratings for statements about hands-free mobile phones

Following the free-text responses, respondents were exposed to 12 statements about hands-free mobile phone beliefs and asked to provide their level of agreement with the statement on a 7-point scale. These statements were based on 12 *a priori* justifications for using hands-free phones that were extracted from the literature.

Figure 7 displays the responses to the 12 statements. The categories reflect the proportions of the sample who agreed (to varying extents) with the statements. Red categories reflect levels of agreement which suggest negative attitudes towards road safety. Blue categories reflect responses that suggest safer attitudes towards road safety.

The statement that recorded the greatest agreement compared hands-free calls to drink-driving and drug driving. While the evidence is clear that mobile phone distraction is commensurate with driving under the influence, it is still possible that some respondents thought that disagreement with this statement might reflect endorsement of drink/drug driving rather than dismissal of the negative impacts of hands-free phone use. Accordingly, we should interpret responses to this item with caution.

The item with the second greatest level of agreement was the argument that hands-free phones are safe to use because the driver's hands remain on the wheel. Forty-seven percent of drivers agreed with this statement. This was closely followed by the belief that hands-free use has no greater demands on attention than talking to a passenger (with 47% agreeing).

2.3.5 Do attitudes relate to handsfree mobile phone use?

The primary goal of Study 1 was to gain insight into the reasons that drivers use to justify their use of hands-free phones despite a ban on such communication by their companies. This was achieved through the free-text responses and ratings to *a priori* beliefs (sections 2.3.3 and 2.3.4). However, we also had the opportunity to assess whether levels of agreement with attitudes (section 2.3.4) relate to hands-free mobile phone use (taken from section 2.3.2).

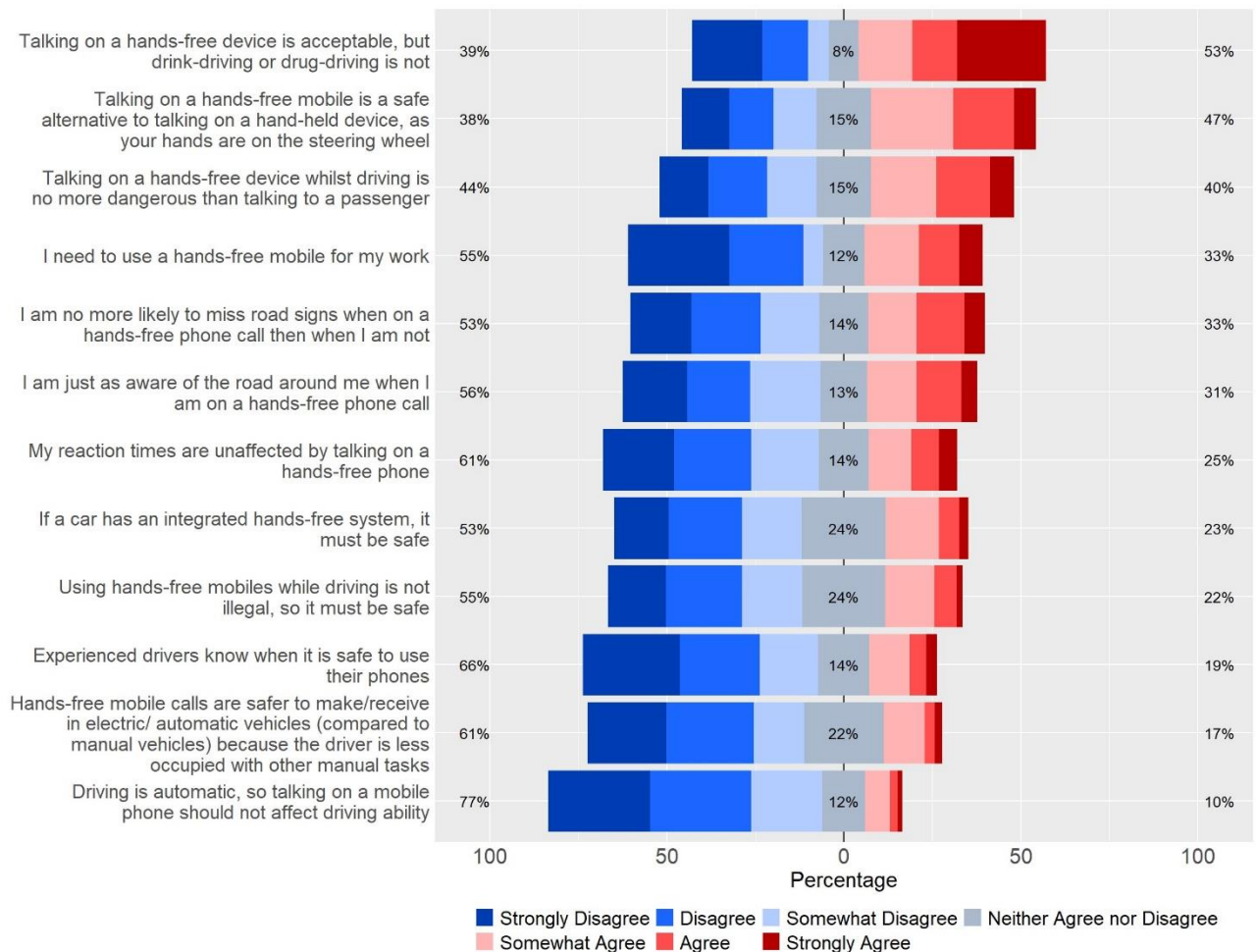


Figure 7. Drivers' agreement with belief statements regarding mobile phones. Percentage numbers reflect the number people who disagreed with the statement (number to the left; the sum of all blue categories), the number of people who were undecided or ambivalent (central number; grey category), and those drivers who agreed with the belief (number to the right, the sum of all red categories). Red categories reflect levels of agreement that are likely to coincide with risky behaviour on the road.

We conducted a series of Spearman Rank correlations seeking relationships across the four measures of mobile phone use, and a range of other variables including driving experience (years since passing their driving test), and attitudes towards mobile phone use (see Appendix B).

The majority of mobile phone use measures correlated positively with each other, with the exception of hand-held/personal with hands-free/work. The strongest correlations were between hands-free/personal and hands-free/work ($R_s = .691$) and between hand-held/personal and hand-held/work ($R_s = .705$). Understandably the largest relationships are between the closest types of phone use, while the types of phone use that are most different from each other do not produce a significant correlation.

Experience negatively correlates with 3 out of 4 of the types of phone use suggesting that more experienced drivers are less likely to use all phone modes except hands-free/work. All 12 of the attitude items correlated positively with hands-free/work (and also with hands-free/personal). The

strongest correlations were with 'it's no more dangerous than talking to a passenger', 'it's acceptable, but drink/drug driving is not', and 'it's not illegal so it must be safe'. The pattern and strength of correlations was much reduced when the attitude items were correlated with handheld phone use (neither work driving nor personal driving).

2.4 Discussion

2.4.1 A summary of potential 'myths'

The aim of the survey was to identify the reasons that drivers use to justify hands-free communication while driving, especially when driving for work for a company that bans hands-free calls. The free-text responses revealed a number of themes including the need to manage time to ensure a work-life balance (i.e., keeping in touch with family and friends), the perceived safety of hands-free calls, meeting the workload demands of the job, offsetting boredom, necessity/emergency, the ease and availability of using hands-free in modern vehicles, the expectations of others regarding drivers' availability, and the legal status of hands-free providing a patina of safety. Several of these themes reflect a feeling that driving is typically undemanding and that drivers can make use of this 'dead time' to engage in personal or work calls. The belief that hands-free phones are safe is another pervasive reason, yet it is based on a variety of assumptions, including the legal status, the passenger comparison, and the widespread nature and ease of use of modern Bluetooth technology.

The levels of agreement to the *a priori* reasons for using hands-free phones while driving identified further beliefs as possible contenders for inclusion in the video. Two of the top three statements that were agreed with focused on the arguments that hands-free phones are safe because the drivers' hands are on the wheel and that the demands are no different to talking to a passenger. Both beliefs were mentioned in regard to the safety theme extracted from the free-text responses, though neither occurred frequently enough to make it into themes of their own. However, when these beliefs were made explicit in Block 4 of the survey, sizable minorities of the sample agreed with them (47% and 40%, respectively). The most agreed-with statement compared hands-free use to drink/drug driving, though, as noted in the results section, it is possible that respondents agreed with this to demonstrate their belief against drink/drug driving, rather than to imply that hands-free use is safe.

Finally, the correlations supported all *a priori* attitude items, though the strongest relationships with self-reported hands-free use were the comparison with a passenger conversation, and the legal status of hands-free phones. The drink/drug item also had a strong correlation with hands-free use while driving for work, but we have already noted the problems with this item.

Study 1 provided rich data on the potential reasons, or myths, that drivers may use to justify hands-free use while driving despite company policies against such communication. The analyses did not however provide five clear myths to be busted. Instead, we found a range of beliefs that are linked together, with some overlapping more than others (e.g., *managing time* and *workload*), and some beliefs acting as potential precursors to other beliefs (e.g., the perceived undemanding nature of

driving, the passenger comparison, and the legal status of hands-free phones may lead one to believe that hands-free communication is safe and desirable when compared to hand-held phones). Accordingly, these data were taken to an expert focus group for discussion, in an effort to reach consensus on the five myths to be included in the intervention video.

2.4.2 Additional findings of note

In addition to gathering hands-free myths, Study 1 provided insights into other aspects of driving risk. For instance, regarding the self-reported frequencies of behaviour, it was interesting to note in which direction reported behaviours differed according to whether one is driving for work or personal reasons (Appendix A). If social desirability was influencing responses, one might expect that all negative behaviours would be reported less frequently at work. While phone use, speeding, vehicle checks and cleaning, and overtaking follow this pattern, the use of caffeinated drinks and driving while angry, stressed, or frustrated *increased* while driving for work. The most obvious difference between the reasons that improve and the reasons that degrade behaviour when driving for work is that the former behaviours require a conscious decision while the latter are outcomes that are caused by driving for work. The two increases in risky behaviours should be investigated further to ascertain the causes and seek mitigation strategies.

The negative relationship of driving experience and the self-reported use of handheld phones while driving for work is also interesting (see Appendix B). The Department for Transport reported a recent observational study that found younger drivers (and therefore less experienced) were more likely to be spotted using a handheld phone compared to drivers at the other end of the age spectrum (17 to 29-year-olds vs. >60-year-olds; DfT 2022b), while a recent survey by an insurer found 17-24-year-olds were almost twice as likely to engage in a handheld call than older drivers (GoCompare, 2019). This is a typical pattern across a range of risk-taking behaviours, and handheld mobile phone use fits the template of a typical high-risk behaviour (illegal, with a risk of severe consequences).

3 Developing the intervention

Following Study 1, the intention was to select five 'myths' that were relevant to our cohort and create a persuasive and informative video to debunk these misconceptions. This was done in three stages. First, an expert focus group was convened to review the evidence from Study 1 and to help select the best myths to address within the video. The second stage was to write the scripts and select the approaches that we would use to get the messages across. Finally, we undertook filming and editing to create a finished 9-minute video. These three stages will be briefly reported in this section.

3.1 The expert focus group

Six participants (plus 3 researchers) took part in the focus group. Two were long-standing academics with peer-reviewed publications in the field of Traffic and Transport Psychology, two came from industry (one from a company specialising in mobile phone safety, and a senior manager with responsibility for fleet safety in a national company), and two worked in vehicle insurance.

The group was presented with the results from Study 1 and engaged in a series of exercises and discussions to hone the list of potential myths to five. The criteria for selecting the five myths were as follows:

- There must be sufficient evidence from Study 1 to demonstrate that the myth is relevant to our target population of drivers;
- The myth and its refutation must be easy to state in lay terms;
- The refutation must be based on evidence or logical argument.

The final list of myths was:

1. *Hands-free is legal, so it must be safe* – If illegality implies the action is unsafe (e.g., handheld calls) then drivers may erroneously think that legality implies safety. Humans are notorious for making errors in similar deductive reasoning tasks (because we don't tend to use deductive reasoning in everyday contexts, Evans, 2002). This misconception was identified in both the free-text responses and in agreement ratings. It also played an interesting role in predicting hand-held use, suggesting that targeting this myth could also have implications for hand-held phone use while driving.
2. *Driving is 'dead time'* – A constant assumption underlying several themes (such as *managing time* and *workload*) is that time spent driving is considered as wasted. This appears linked to the assumption that driving is undemanding, which therefore allows multi-tasking to make better use of driving time.
3. *Hands-free is safe because your eyes are on the road and hands are on the wheel* – This myth is an underlying assumption that supports the view that hands-free calls are safe. While only mentioned in passing in the free-text responses to Study 1, it received considerable support when provided as an *a priori* statement.
4. *Hands-free is no different to talking to a passenger* – While this rationale did not reach threshold to be included in the top ten themes extracted from the free-text responses, it was cited as an explanation for safety beliefs by some respondents. When given as an *a priori* statement however, it ranked third in terms of respondents' levels of agreement and was strongly correlated with hands-free phone use.
5. *I need to use hands-free communication for work* – This was selected as a separate myth, independent of the 'dead time' multi-tasking myth, to counter any pressure that drivers may feel to answer calls from work colleagues or their immediate boss. This last myth also draws the attention of line managers to the commitment that they need to show towards their drivers in support of a hands-free policy.

3.2 The scripts

Several key approaches were adopted when writing the script:

1. A connection needs to be made with viewers to keep them engaged throughout the video, and to provide a consistent and authoritative voice across the different myths. To this end, we opted to have a presenter. While this is more difficult to achieve than providing a disembodied voice-over (as audio must be collected 'on the set') and is less flexible

regarding future content updates (it is easier to change voice-overs to update facts without changing the visuals), the interpersonal connection was deemed worth the additional effort.

2. Evidence must be a priority, but it must be given in a way that is comprehensible to the average viewer. Accordingly, we ran through several iterations of the script to achieve a balance between the level of information provided and the parsimony of the message.
3. Video allows for a range of approaches to support the audio message. We employed a variety of approaches across the five myths to ensure engagement was maintained, including interviews, animation, and driving footage.
4. The credibility of the message is vital. Experts were therefore used to explain some points in more detail or to reinforce their importance.

The content included to debunk each myth is provided below:

1. *Hands-free is legal, so it must be safe* – We question the assumption that ‘legal’ means ‘safe’. Example footage is shown of driving on a rural single lane with passing places. Tight bends and high foliage hide potential oncoming traffic. The narrator questions whether we would want to drive at the 60-mph legal speed limit. An expert interviewee reinforces the argument that ‘legal’ does not mean ‘safe’. He also explains that one of the reasons hands-free calls are not illegal is that police would find this almost impossible to enforce (as noted in the Government’s response to the Transport Select Committee recommendations in 2019). He goes on to explain that, following a collision, the police could however check whether you were on a call. This could lead to a charge of Driving Without Due Care and Attention or worse. This section involves several behavioural change techniques (BCTs) such as posing questions to the viewer (where we know the answer will support our message), an appeal to authority (with our expert speaker), and details of potential consequences that counter the view of legality.
2. *Driving is dead time* – The narrator explains that some drivers feel that driving is an unproductive use of time. Coupled with the view that driving is easy, this may prompt drivers to multitask by making hands-free calls. This allows them to achieve an additional goal other than just travelling from A to B. The narrator challenges the idea that driving is easy. She demonstrates how we look around the visual scene by donning eye tracking glasses while driving, and explaining how complex visual processing is, and how easily it can be disrupted. An example is given about driving while trying to give someone directions over the phone: When giving directions we may imagine a map or other visual analogue to help us. Unfortunately, even imagining visual spatial information can interrupt current visual processing of the scene. An expert interviewee reinforces this point. BCTs include the provision of knowledge, a concrete example, and an appeal to authority.
3. *Hands-free is safe because your eyes are on the road and hands are on the wheel* – The narrator explains how 2-seconds gaze off the road can increase crash-risk. She draws attention to the fact that some processes involved in even hands-free communication (e.g., scrolling through contacts) can keep the eyes off the road for even longer. Viewers are then told that while hands-free calls might keep the eyes on the road and hands on the wheel, the *mind* is no longer on the road. A brain animation is used to explain how brain activation related to the auditory processing of a conversation appears to decrease activation in the part of the brain responsible for integrating visual information with our motor movements

(e.g., how visual information affects the way we steer). This in turn increases the risk of a crash. BCTs include knowledge provision, challenging common assumptions with evidence, and details of potential consequences.

4. *Hands-free is no different to talking to a passenger* – An expert interviewee explains how mobile phone conversations differ to passenger conversations in that they do not benefit from *shared visual space*. The results from a study are explained which showed that remote speakers are more likely to keep talking during periods of highly demanding driving, whereas passengers tend to go quiet at this point because they are aware of the increased demands on the road. BCTs include an appeal to authority, knowledge provision, challenging common assumptions, and details of consequences.
5. *I need to use hands-free communication for work* – The narrator acknowledges that some drivers feel they have to take hands-free calls for work, especially calls from their immediate manager. They may feel they have little control over this form of distraction. A senior road safety manager from industry reinforces the belief that if a company has a policy against hands-free communication, then this should be followed, regardless of the expectations of others. The interviewee supports the idea that drivers can and should maintain control regarding their use of (or refusal to use) mobile phones while driving, and provides alternative strategies (e.g., using regular driving breaks to check messages and missed calls). The closing message of the video also references the role of managers and companies in supporting drivers to avoid hands-free calls.

3.3 Filming and editing

Filming was undertaken on real roads in Nottinghamshire, while expert interviews were undertaken in person or online (three and one, respectively). A Ford Transit van was hired for external shots and this vehicle was also used for collecting on-road eye tracking footage using Tobii eye tracking glasses. Simple animations were created to demonstrate the distribution of attention around the brain during a mobile phone call, and to show the number of drivers that were involved in the study. For simplicity we reported that 500 drivers had been asked for their thoughts. In reality, 682 drivers accessed the survey though we only had 429 respondents after data cleaning. Figure 8 displays four screen shots taken from the video.



Figure 8. Selected screen shots from the video intervention. Clockwise from the top-left they include (a) the narrator speaking through to camera; (b) an expert interview; (c) the narrator wearing eye-tracking glasses; (d) eye-movement recording while driving a van.

5 Study 2: The Intervention

5.1 Introduction

Following the development of the video we wanted to assess whether it had any impact on drivers' attitudes and use of hands-free phones. The role of evaluation is vital in the development of road safety resources such as the current video (e.g., Fosdick, 2019). It allows us to understand whether the current intervention achieves its aims and enhances the knowledge base for other researchers to build upon. In this regard, a negative outcome from an evaluation is just as valuable as a positive outcome as it allows subsequent interventions to avoid unfruitful approaches, increasing the chances of intervention success in the future.

To evaluate the impact of the video on drivers' attitudes and behaviours, we adopted a longitudinal design with participants randomly assigned to either an intervention or control group. Given the explicit attempt to change attitudes and behaviour in the video, there was a need to mitigate the demand characteristics of the study. Accordingly, participants were shown 5 videos over the course of 5 weeks (1 per week). Each video contained a road safety message (never use headlights other than as a warning, use the 'Dutch Reach' to open car doors, etc.). On week 3, half of the participants received the intervention video while the other half received a control video.

Measures of agreement with 6 attitudinal statements were taken at the start and the end of the study. One of the statements was concerned with hands-free phone use and another was based on hand-held phone use. The 4 remaining attitude statements covered a range of other driving

behaviours, such as speeding and overtaking, and were only included to further mitigate demands characteristics of the study.

Self-reported measures of behaviour were collected each week, prior to participants seeing that week's video. The behaviours were the same as those reflected in the 6 attitude statements (plus behaviours regarding the use of caffeinated drinks and driving angry, stressed, or frustrated). Once again, only the mobile phone items were of primary interest.

We hypothesised that over the course of 6 weeks, drivers' mobile phone attitudes and mobile phone behaviour would be positively influenced by watching the intervention video in Week 3. While our primary concern was the effect that the video might have on hands-free/work use, we were also interested in whether any effect was also reflected in hands-free/personal use or even hand-held phone use.

5.2 Method

5.2.1 Participants

A total of 68 professional drivers took part in the study (53 male, 13 female), with an average age of 45.3 (ranging from 21 years to 71 years). The intention was to recruit drivers from the same company who provided us with the majority of respondents for the survey. Drivers were offered the opportunity to win one of 10 £100 shopping vouchers. Unfortunately, voluntary uptake of the study was much lower than expected despite the incentive. Accordingly, we sought people who drive for work from a range of organisations including an insurance company, a law firm, a national bus operator and several additional construction companies. In total, 50 participants were recruited across 16 companies. In yet a further attempt to recruit drivers beyond these companies, we also launched the study on Prolific (an online research platform with thousands of registered respondents) targeting people who drive for work. We recruited a further 18 participants through this route.

All of our drivers predominantly drove cars for work, with van and HGVs being the next most represented (see Figure 9). The average general driving experience of all drivers was 25.7 years since passing their driving test (full car license), with intervention drivers passing 26.3 years ago, and control drivers passing 24.9 years ago. Other demographics are detailed in Table 1. No differences were noted between the two groups.

When asked whether their company had a mobile phone policy, 11 answered 'No', 13 answered 'Yes, we should always make/take 'hands-free' calls rather than 'handheld' calls', 35 answered 'Yes, we should never make/take 'hands-free' calls, and 9 responded with 'Other' (unsure/don't know, etc.)

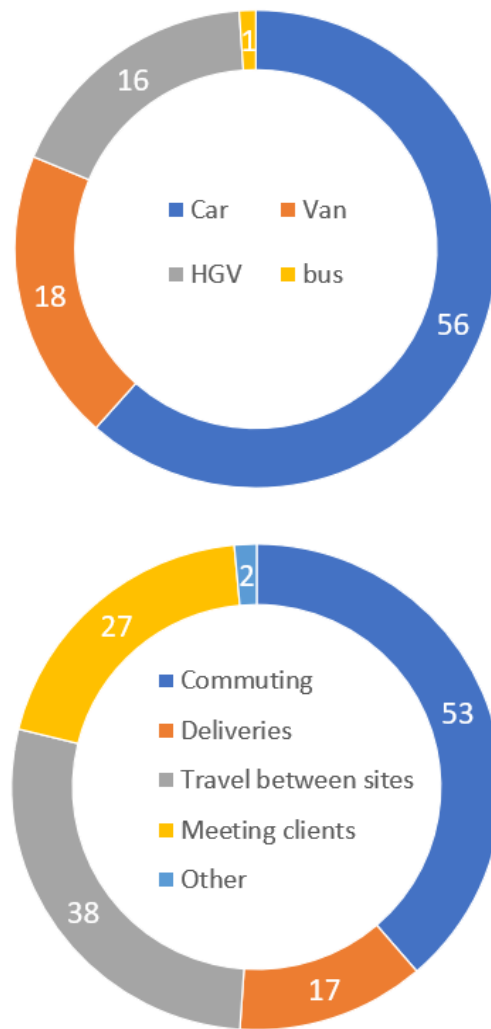


Figure 9. The vehicles that respondents reported using for work, and their reasons for driving for work. Seventeen respondents reported driving more than one type of vehicle for work purposes.

Table 1. Demographics of the intervention and control groups

	Intervention group	Control Group	Comparison
Number of participants	36	32	
Number of males	27	26	$\chi^2 = 0.38, p = .53$
Age	45.8	44.7	$t = .41, p = .68$
Experience since passing test (years)	26.3	24.9	$t = .48, p = .64$
Annual Mileage (work)	13966	17274	$t = -.32, p = .75$
Annual Mileage (personal)	6406	6868	$t = -.61, p = .54$
Points on license	0.2	0.6	$t = -1.00, p = .33$
Total collisions over 3 years	5	8	$\chi^2 = 1.35, p = .24$

5.2.2 Design

The study was a longitudinal randomised control trial designed to run across 6 weeks (see Figure 10 for an overview). Participants were randomly allocated to the intervention condition, while the other half were allocated to the control condition.

Drivers' attitudes towards hands-free and handheld phone use while driving (1 item for each) were collected in Week 1 and again in Week 6. Additional questions regarding attitudes to speeding, overtaking, keeping the vehicle clean, and making vehicle checks were also recorded. These attitudinal questions were randomised within the block.

All six surveys also included questions regarding self-reported behaviours in an average week (Week 1 survey) or in the last week (Weeks 2-6). Following Study 1, the questions asked about handheld phone use while driving, hands-free phone use while driving, speeding, overtaking, cleaning parts of the vehicle, undertaking vehicle checks, driving while angry, stressed, or frustrated, and the use of caffeinated drinks to get through a journey.

These measures of self-reported behaviours (from Weeks 1 to 6) and attitudes (Weeks 1 and 6 only) provided the primary dependent measures for the intervention study.

In Weeks 1 to 5, participants were also shown a road safety video (the videos were always shown after drivers had answered questions about the previous week's activities. After the video participants were asked 5 questions about the video (how interesting/informative/relevant was it? How like is it to improve drivers' attitudes/behaviour?).

5.2.3 Materials

The six questionnaires were prepared on Qualtrics. The Week 1 questionnaire contained similar demographics to Study 1, and asked drivers to rate how often they engaged in eight driving behaviours *in an average week* (handheld use, hands-free use, speeding, overtaking, vehicle cleaning, vehicle check, driving while angry, stressed or frustrated, and using caffeinated drinks to get through a journey). Drivers answered each question for both work driving and personal driving on a 7-point Likert scale from 'never' to 'almost all of the time'.

Following this, drivers were asked to agree or disagree with 6 attitudinal statements (regarding handheld phones, hands-free phones, speeding, overtaking, vehicle cleaning and vehicle checks). They then watched the first video, after which they answered 5 video-evaluation questions about the interest, relevance, and usefulness of the video for increasing knowledge, changing attitudes and improving behaviour. A free-text response box was also provided for optional additional feedback.

Each subsequent survey began by asking about drivers' level of exposure to driving in the last week and whether they had been involved in any crashes. Following this, the 8 questions about the frequency of specific behaviours were asked, but in reference to the *previous week*, rather than the *average week* as referenced in the Week 1 survey. Then participants were presented with a video, and evaluation questions.

The week 6 survey did not include a video, however, in addition to the frequency of behaviours questions, the initial attitude questions shown in Week 1 were also included. At the very end of the Week 6 survey participants were asked whether their company has a specific policy on hands-free phones. This was left to the end of Week 6 so as not to alert drivers to the focus of the study.

The intervention video was a 9-min film with a narrator talking to camera and addressing the 'top five myths' about hands-free phones. Her argument was supported by interviews with experts, animations, driving footage, and a demonstration of eye tracking during driving. The five myths tackled by the video were:

1. Hands-free is legal so it must be safe.
2. Driving is 'dead' time, and hands-free calls allow you to make better use of your time.
3. Hands-free is safe because your hands are on the wheel and eyes are on the road.
4. Hands-free is no different from talking to a passenger.
5. I need to use hands-free to answer for work.

The other 'distracter' videos included the dangers of flashing one's headlights to signal to another vehicle, how to safely overtake a horse and rider, the 'Dutch Reach' technique of opening vehicle doors into the road, and a video showing a walk around of performing a vehicle check. The average length of the distracter videos was 186 seconds (ranging from 109 to 249 seconds; see Appendix C).

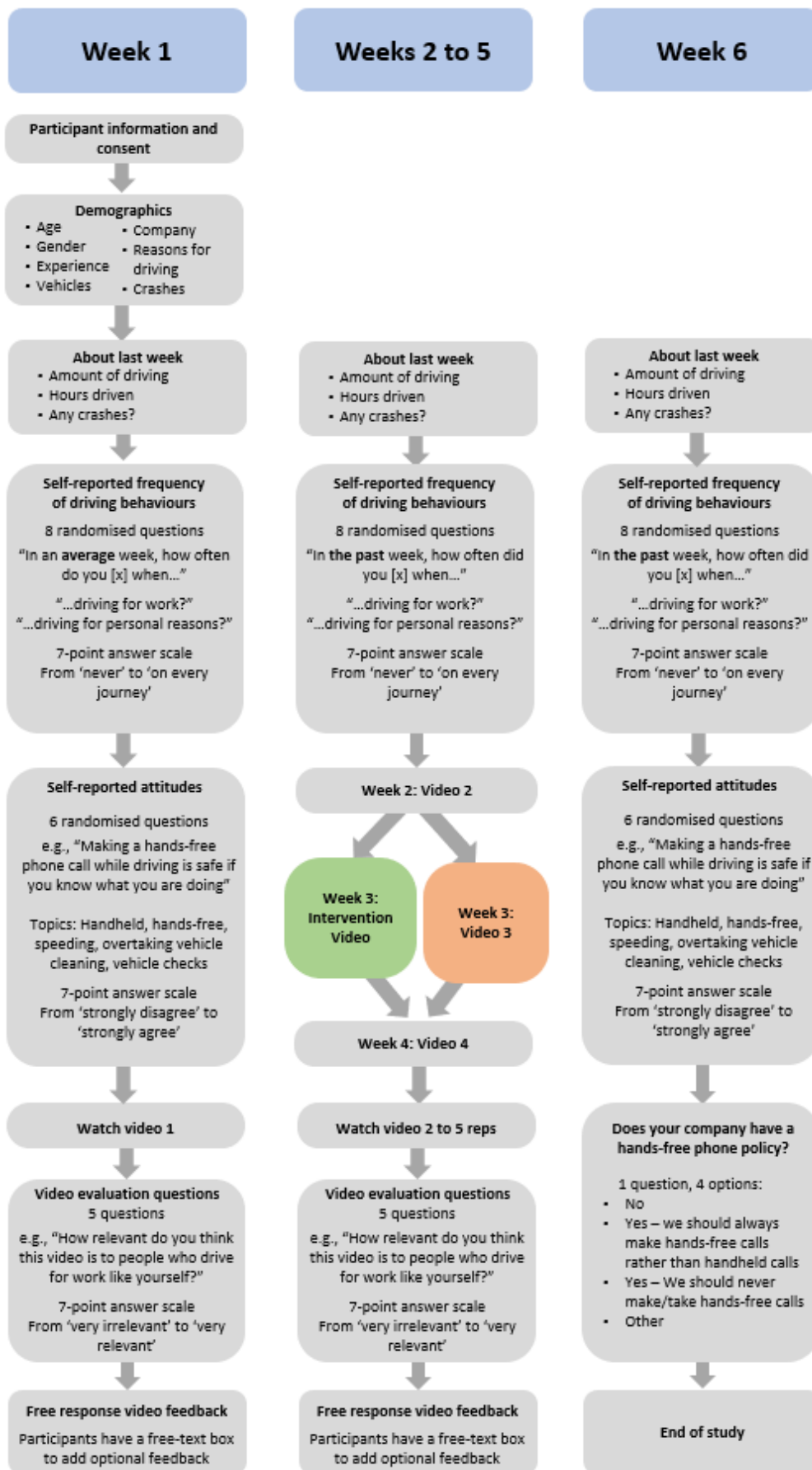


Figure 10. An overview of Study 2.

5.3 Results

The primary aim of Study 2 is to assess whether the intervention video changes drivers' attitudes towards, and frequency of use, of hands-free mobile phones. Before looking at comparisons, we explore the baseline responses of our groups to see whether there are any differences prior to the intervention that might confound the results.

5.3.1 Baseline behaviours and attitudes

Respondents were asked to record how often they engaged in eight different behaviours in an average week. These formed our baseline measures. Mann Whitney comparisons suggested that there was no difference between the groups in the reported use of hand-held or hands-free phones while driving (see Appendix D). In fact, the only difference at baseline between the intervention group and the control group was in regard to self-reported instances of overtaking, with the control group reporting more instances of overtaking. This should have little or no influence on the main hypotheses which require comparable baselines primarily on the mobile phone measures.

Regarding their baseline attitudes, there was no difference between the intervention group and the control group on attitude to handheld and hands-free mobile phone use (see Appendix E). There was evidence that the control group have stronger support for overtaking (which supports their more frequent report of overtaking behaviour), and that they place greater safety relevance on keeping the exterior of a vehicle clean. Once again, these differences are unlikely to impact on the main hypotheses.

5.3.2 Changes in driver behaviour across the study

The primary measure of interest is hands-free mobile phone use while driving, though handheld use is also of interest as attitudes may overlap for these two modes of communication. The medians and means of the frequency of behaviours are included in Appendix F and Appendix G for driving at work and driving for personal reasons, respectively. The exception is the number of reported crashes, which is reported as the sum of all reported crashes for that group in that week. Unsurprisingly, the number of crashes was very low and can safely be ignored.

To identify any changes in self-reported mobile phone use during the study we performed a series of repeated Analyses of Variance (ANOVAs) after transforming the data using the Aligned Rank Transform procedure (Wobbrock, Findlater, Gergle, and Higgings, 2011). These non-parametric ANOVAs compared the intervention group and the control group across a series of targeted pre-planned comparisons: Week 1 (baseline) phone use was compared to Week 2 (to check whether there was any shift in scores from an *average* baseline to a *last week* score); Week 3 data was compared to Week 4 data (phone use reports from immediately before and 1-week after the intervention video was shown to half of the participants), and Week 3 to Week 6 (to ascertain if any difference between the intervention and control groups still remains at the end of the study). The results are presented in Appendix H.

The analyses of primary interest are the interactions between the groups and the weeks. Significant interactions are sought to demonstrate the intervention video decreases phone use in the intervention group (pre vs. post) compared to the control group. None of the interactions between the pre/post measures and the two groups were significant, however.

Several main effects were noted which suggested phone use for all participants was reduced in W2 compared to baseline (this held for hands-free/work and hands-free/personal, and for handheld/personal). There was also a suggestion that handheld use was lower in W6 compared to W3. These main effects do not support the impact of the intervention (as all drivers show the effect regardless of which group they were in), but their meaning will be considered in the discussion.

5.3.3 Changes in driver attitudes across the study

Attitudes towards a range of behaviours (including mobile phone use) were collected at baseline (Week 1) and at the end of the study (Week 6). To explore changes in self-reported attitude and behaviour between baseline and Week 6 we performed a series of mixed ANOVAs after transforming the data using the Aligned Rank Transform procedure (Wobbrock, et al., 2011).

As with the analysis of frequency of behaviours, we are only interested in significant interactions that would suggest the intervention group improved their attitudes from W1 to W6 more than the control group. No such interactions were found (see Appendix I). Some of the main effects were significant: Control participants appear to favour overtaking more than the intervention group but also have a more positive attitude to cleaning their vehicles (both of which were noted in the baseline comparison). Our drivers also became less concerned about checking for vehicle defects over the course of the study. This anomaly will be addressed in the discussion.

5.3.4 Looking for relationships among the data

The most relevant outcome measure of this study is the self-reported frequency of hands-free use while driving for work. Accordingly, Spearman rank correlations were calculated between this DV (measures taken from W1 to W6) with other self-reported frequencies of phone use and with pre- and post-intervention attitudes to phone use (see Appendix J).

Similar to Study 1, there were strong correlations between hands-free/personal use and hands-free/work use, suggesting that use of phones at work is closely linked to similar habits in personal driving. There was a correlation at baseline (W1) between hand-held/work and hands-free/work, though this relationship disappears for W2 to W5, emerging as significant once more at W6. Hand-held/personal is also related to hands-free/work at W1 and W2, but again this relationship disappears from W3 onward.

Driving experience did not correlate with hands-free/work use on any of the 6 weeks. This mirrors a similar lack of correlation in Study 1. Hours driven was included in the current correlation matrix and this proved to be significant across all 6 weeks, suggesting that greater time on the road leads to greater hands-free phone use. Both pre- and post-intervention attitudes to hands-free use correlate with hands-free/work, though hand-held attitudes have no relationship with hands-free/work use.

5.3.5 Thoughts on the videos

After watching each video (all control videos and the intervention video), participants were asked to provide ratings on how interesting and relevant they were, and how likely they were to improve drivers' knowledge, attitudes, and behaviour. For the four control videos that all participants saw, ratings were averaged and then compared to ratings for the intervention video using a Wilcoxon Signed Rank test. Results are shown in Table 2.

The intervention video was rated more interesting and relevant than the control videos. It was also judged more likely to increase knowledge and understanding of, and improve attitudes towards, road safety issues than the control videos. Finally, participants rated the intervention video more likely to improve driving behaviour than the control videos.

Table 2. Thoughts on the intervention and control videos on a 1-7 scale. (Q1: 1 = very boring, 7 = very interesting; Q2: 1 = very irrelevant, 7 = very relevant, Q3-5: 1 = very unlikely, 7 = very likely).

	Intervention video	Control videos	z	P
1. How interesting were the videos?	6 (5.3)	5 (4.9)	-2.18	<.05
2. How relevant were the videos to people who drive for work?	6 (6.3)	6 (5.6)	-4.04	<.001
3. Is this video likely to increase the knowledge and understanding of road safety issues?	6 (5.7)	5 (5.1)	-3.03	< .01
4. Is this video likely to improve attitudes towards road safety issues?	5 (5.2)	5 (4.8)	-2.44	< .05
5. Is this video likely to improve driving behaviour?	5 (5.0)	5 (4.6)	-2.54	< .01

In addition to the ratings, drivers had the opportunity to leave free-response comments. The majority of comments were very positive, commenting on the style of the video and the evidence presented:

"A really excellent well-presented video, it was informative, enlightening and engaged (sic)... A first-class video."

"I like the way the video looks at the main reasons and breaks down the answers to these so it's easy to understand the reasons behind not using your mobile or calls while driving."

Respondents recognised the need for discussion on mobile phone use while driving for work, "Video was informative and not a topic that is often talked about regarding road safety and work," and some reported that the information was new and compelling:

"Very thought provoking and makes me think twice about using a phone in the car."

"The information provided was an eye opener..."

The scientific, evidence-based approach was particularly appealing to some, suggesting that our 'appeal to authority' had been pitched appropriately for some drivers:

"The context of the video is good and reveals some science behind the banning of calls whilst driving for work..."

"The presenter made valid points against engaging in hands free calls whilst driving, backed up by research and studies supporting that by making/receiving calls when driving can increase the risk of an accident."

"Particularly liked the science aspect ... [it] went into a lot of detail and clearly a lot of research had been done in this topic."

"Facts based and comparisons that bring it to reality."

"The different aspects were very well analysed and the five examples of the dangers of hands-free calling whilst driving were illustrated very effectively."

Some drivers appreciated the intentions behind the video, but believed that the message also needed to be extended to management:

"Whilst [my company] states we should turn our phones off, there is a culture from a senior level to always be contactable. Unless there is a top-level behaviour shift, this will not change for management/contributor levels of staff."

"I think to make the change in behaviour, companies will really need to support this by confirming that they do not want people to be taking calls and making this very clear to all managers and leaders, so they also provide the correct behaviour and messaging."

"If the instigator of the phone call is in an office and they can be shown to be constantly calling mobile workers then they should be disciplined. This includes managers. Then the calls will desist, and mobile workers will feel under less pressure allowing them to be safer. However, in most companies the purpose of these rules is aimed at the mobile worker not the office-based employee."

A minority of drivers had a more critical view, with a handful reporting that the video was too long, or that it would have no effect on their behaviour.

"It was longer than it needed to be as the instructions were straightforward and could have been summarised in a shorter video."

"The video was too long and boring. People will turn off near the start."

"If in a city or a road I'm not sure off I will cancel my call or not answer calls"

5.4 Discussion

5.4.1 Evaluation of the intervention video

The intervention video did not appear to reduce hands-free mobile phone use while driving for work, nor did it change attitudes towards mobile phone use in any of the forms measured (hands-free, handheld, for work, for personal driving).

Some interesting main effects were noted, however. There was a tendency for self-reported use of hand-held/personal, hands-free/work, and hands-free/personal to decrease from Week 1 to Week 2. Week 1 scores were considered the baseline, where we asked how much drivers used phones in an *average week*. By Week 2, drivers had seen the first video and we were specifically interested in how much they had engaged in phone use over the *last week*. It is possible that the change in question resulted in lower reported frequencies in Week 2. When estimating the duration of past events, the estimation is influenced by the amount of information we processed at the time. The more information we process during a task, the longer we will estimate that task took (even if it took the same time as a task that required less informational processing; Ornstein, 1975). This bias may be compounded if respondents are asked to estimate an average duration of such events. Thus, it is possible that our baseline scores of phone use were overestimates that were rectified when drivers were asked to focus on last week's duration rather than an average week's duration.

We also noted a decrease in handheld use for both groups between Week 3 and Week 6. This cannot be attributed to the intervention video (as this would not have impacted on the control group). Instead, this may reflect a general trend to decrease handheld use which may have been prompted by repeatedly asking respondents to report this behaviour week after week. Alternatively, the repeated questions may have encouraged more accurate memory for the durations respondents spent on the phone.

One particularly odd effect was noted: There was a tendency for drivers to report worse attitudes towards vehicle checks by the end of the study. This was not specific to the intervention video, as the effect was found across the groups. It seems unlikely that involvement in a road safety study (regardless of the content) would degrade attitudes to vehicle checks, and it is possible that this reflects some other systematic effect that occurred outside the study (e.g., if the weather improves, or the hours of daylight increase across the span of the study, drivers may be less concerned about checking headlights, etc.).

Despite the lack of impact on drivers' attitudes and phone use, the intervention was well received by those who saw it. The intervention video was rated as more interesting and relevant than the control videos, and drivers thought that it was more likely to improve knowledge and understanding, attitudes to safety, and change behaviour for the better. Many drivers left positive comments to this effect. A small number of negative comments related either to the length of the video (too long) and how management needed to be targeted for similar information, as without their support, drivers were unlikely to resist answering calls.

5.4.2 Limitations of the study

There are two potential problems with the study that may have prevented the identification of a positive impact of the intervention video on self-reported phone use. The first problem is the sample size. We aimed for 200 drivers, all of whom were to be recruited from a single company. When it became apparent that we would not fulfil our sample size, we sought support from a range of other companies (16 in total), and also recruited from an online database. Unfortunately, the chance to win one of ten £100 shopping vouchers did not overcome reticence to commit to a 6-week study. With a larger sample we may have seen the positive comments and ratings towards the video (section 5.3.5) translated into positive impacts on attitudes and phone use.

A second problem was that the reported attitudes of our drivers were already very safety conscious at the start of the study, and their reported use of mobile phones was very low. For example, in Week 2, the median response for handheld and hands-free phone use while driving for work was 1 (i.e., never). Thus, any effects would have to rely on the distribution of responses above the median. This is likely to have created a floor effect. It is hard to demonstrate an improvement in scores if half of your sample is already at the lower point on the measurement scale before the intervention. The initial intention of Study 1 was to recruit drivers from the primary organisation who had already admitted to reasonable levels of hands-free phone use in Study 1. This recruitment aim had to be dropped when it became apparent that we were not going to fill our sample from the primary company.

Due to the likely impact of these two problems on the findings, readers may decide to place more weight on the ratings that drivers gave about the intervention video, and their (mostly positive) comments. Fortunately, we had an opportunity to collect data from a different sample of drivers by piggybacking on a planned study on a different project. This became Study 3 and allowed us to look at the potential for attitude change in a much larger sample.

6 Study 3: A second evaluation

6.1 Introduction

As the intervention study did not reach the intended target of 200 participants, additional data were collected as part of a separate project. The other project was designed to assess the impact of 4 mindfulness videos on average (i.e., non-professional) drivers' attitudes towards vulnerable road users (VRUs). Given that VRUs can arouse feelings of frustration and anger in car drivers, it was hypothesised that mindfulness techniques might help reduce drivers' negative emotions and improve their decisions on when and how to overtake. Four videos were created, each focusing on a particular technique. To evaluate the mindfulness videos, we designed a study similar to Study 2 in the current project, with videos and surveys distributed over six weeks in a longitudinal randomised control trial. To provide control participants in this study with a similar series of road safety videos, we split the hands-free myth-busting video in four shorter videos, each focussing on one of the myths (leaving out the fifth myth, 'I need to use hands-free for work', which was not relevant for the current sample of non-professional drivers). For the purpose of the current project, the participants

who watched the hands-free myth videos were considered the ‘intervention’ group, while the participants who watched the mindfulness videos are referred to as the control group.

This main difference with Study 2 is that our drivers were not recruited on the basis that they drove for work. This made recruitment easier, though we acknowledge that the myth-busting videos were still clearly aimed at people who drive for work. Our participants were recruited through a paid-participant panel which ensured that a sizeable sample could be gathered in a much shorter period of time.

Another key difference was the length of the videos. Cutting our intervention video into 5 pieces (before dropping the final myth) produced mini-myth-busting videos, potentially of a more digestible length. To ensure that each video could stand alone, some minor editing was required to provide an introduction and an ending to each myth, though the content of the four remaining myths was otherwise identical to that used in Study 2. A small number of drivers in the last study reported that the video felt too long, so it was considered possible that the shorter clips might have a better impact.

Finally, given the additional questions added to the study to assess the impact of the mindfulness videos (which all drivers answered regardless of whether they saw the mindfulness videos or the myth-busting videos), it was not appropriate to also collect self-reported phone usage on a weekly basis. We did however record attitudes to mobile phones using the 12-items from Study 1 both at the start and the end of the study. This allowed a more in-depth assessment of attitudes than was available in Study 2. We hypothesised that with this new, larger sample, our myth-busting mini-videos would change attitudes towards hands-free mobile phone use more so than any change that might occur in the control (mindfulness) group.

6.2 Method

6.2.1 Participants

A total of 323 drivers took part in Study 3 (188 males, 162 females, 3 other), with an average age of 37.3 (ranging from 20 years to 50 years). Participants were recruited from the online platform ‘Prolific’ and were compensated for their time at a minimum rate of £9 per hour. If participants made it to the end of the study (Week 6) they received an extra £1 bonus. The average driving experience of the sample was 16.4 years, with a minimum of 1 year. Further demographic details can be found in Table 3.

Table 3. Respondent demographics for Study 3.

	Intervention group	Control Group	Comparison
Number of participants	169	154	
Number of males	83	75	$\chi^2 = 0.01, p = .94$
Age	37.6	37.3	$t = -.027, p = .98$
Experience (years since test)	16.5	16.3	$t = -.203, p = .84$
Annual mileage	7274	7848	$t = 1.02, p = .31$

6.2.2 Design, Materials, and Procedure

Participants received a link to six online surveys created on the Qualtrics platform. Subsequent surveys would become available one week after completion of the previous survey. The Week 1 survey contained questions about demographics, driving history in the past month, experiences with, and attitudes towards, vulnerable road users (for the mindfulness study) as well as the same ratings of agreement with the 12 attitudinal statements about hands-free calls that were used in Study 1.

In weeks 2 to 5, participants were presented with either a road safety video about mindful driving or a myth-busting video on the dangers of hands-free phone use (see Appendix K) depending on which group they had been randomly allocated to. After the presentation of the video, participants were given three multiple choice comprehension questions about the video to check that they had watched them.

The Week 6 survey did not contain a video. It repeated the same attitudinal questions as in Week 1. The survey also asked participants to rate the videos on how informative, persuasive, and interesting they were, and how professionally produced they looked. We also asked whether they thought the videos would change other drivers' behaviour.

A final section asked whether the participants themselves had gained any benefits from watching the videos: Did they feel that their knowledge of the dangers had improved? Did they feel more in control of whether to accept an incoming call? Did they feel their own attitudes to mobile phone use had improved? Are they more likely to limit or avoid hands-free calls while driving in the future?

6.3 Results

Before analysing the attitudinal data, we looked at responses to the multiple-choice questions that were designed to assess whether drivers were paying attention to the videos. The maximum score across four videos was 12 points (3 questions per video). We selected a score of 8 as a threshold for exclusion. Only 5 participants (all in the control group) fell below this threshold. Removal of these participants did not change the pattern of results reported below, therefore the analyses are reported with the whole sample.

6.3.1 Changes in driver attitudes to hands-free mobile phones

Responses to the 12 hands-free attitudinal items that were collected in W1 and W6 were compared across the two groups in a series of individual 2x2 Repeated Measures ANOVAs (following data transformation using the ART procedure, Wobbrock et al, 2011). Ten out of 12 attitudinal statements showed a significant interaction, with the decrease in dangerous beliefs being greater for intervention group than for the control group (see Appendix L for details).

The greatest improvements in the intervention group's attitudes included items such as 'Talking on a hands-free mobile is a safe... as your hands are on the steering wheel', 'If a car has an integrated hands-free system, it must be safe' and 'My reaction times are unaffected...'. While the control group also

showed some small improvements in most of the attitudes between Week 1 and Week 6, the significant interactions demonstrate that the attitudinal improvements were greater for participants in the intervention group.

6.3.2 Video Evaluation

In week 6, respondents were asked to reflect on the four videos as a whole. They were given five statements and were asked to select a level of agreement on a 1-7 scale (from 'strongly disagree' to 'strongly agree'). Responses were overwhelming positive: 98% agreed that the videos were informative, 93% agreed they will improve some drivers' behaviour, 92% agreed they were persuasive and looked professional, while 90% agreed that the content was interesting (Figure 11).

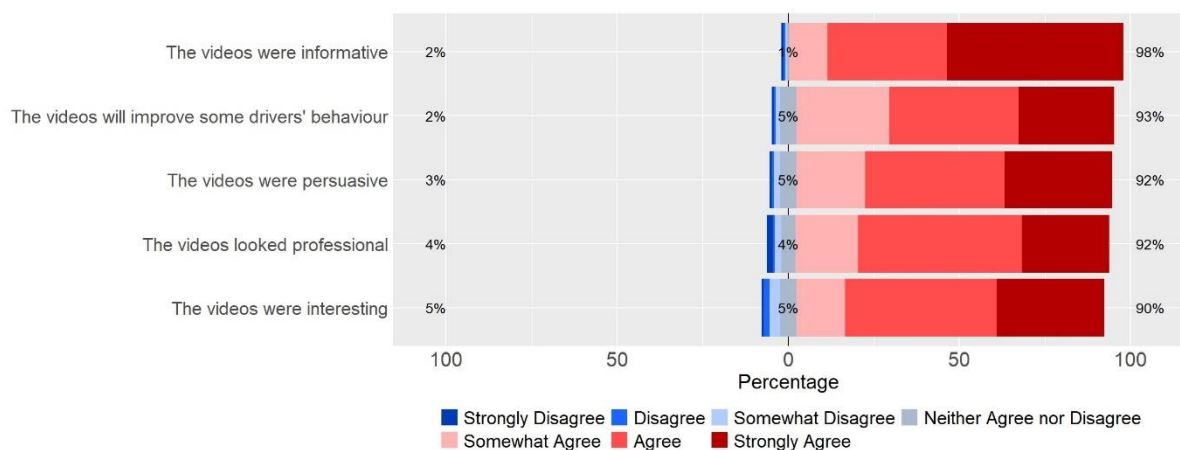


Figure 11. Drivers' agreement with belief statements regarding the mini-myth busting videos as a whole. Numbers reflect the percentage of the sample who disagreed, were ambivalent, or agreed with the statements (from left to right).

6.3.3 Self-reported benefits from watching the videos

At the end of Week 6, drivers in the intervention group were asked to reflect on whether they thought they had benefited from seeing the videos. There were given 5 statements and were asked to rate their agreement on a 1-7 scale (Figure 12).

The responses show that 95% believed their knowledge of hands-free dangers had increased. More importantly however, 83% reported feeling more in control about whether to accept or engage in a hands-free call, and 80% agreed that they would be more likely to limit or complete avoid hands-free calls while driving in the future. Despite these positive responses, only 51% believed that their attitudes towards hands-free phones had improved. Given the positive changes in the first three responses, participants' lower agreement with this final item may reflect their belief that they already had appropriate attitudes to hands-free communication while driving.

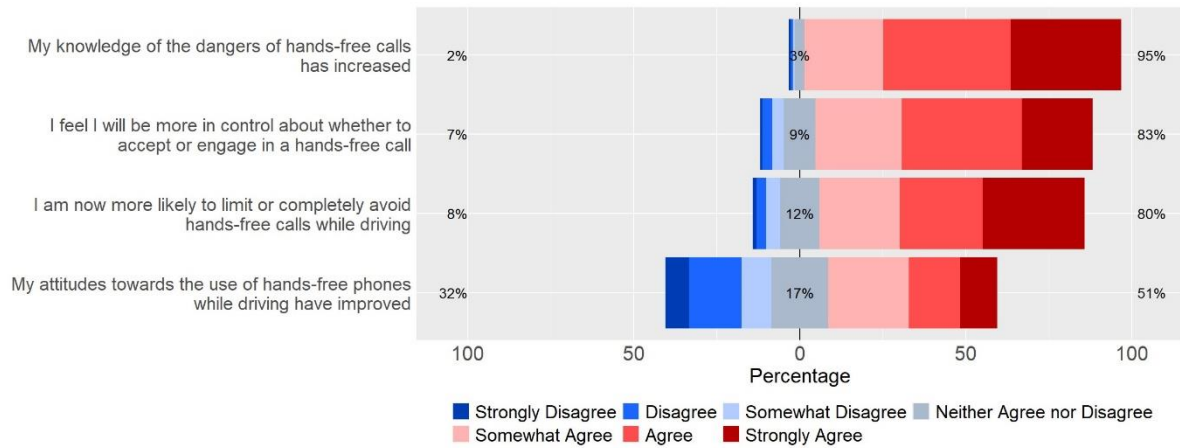


Figure 12. Drivers' agreement with statements about potential benefits from watching the videos. Numbers reflect the percentage of the sample who disagreed, were ambivalent, or agreed with the statements (from left to right).

In the absence of an actual measure of hands-free use while driving, participants' responses to the item 'I am now more likely to limit or completely avoid hands-free calls while driving' are important as this reflects future intended behaviours. Intentions to undertake certain behaviours in the future are one of the key determinants of actual future behaviour (e.g., Hohmann and Garza, 2022). A series of Spearman Rank correlations were conducted comparing pre- and post-intervention responses on the 12-attitudinal items to participants' level of agreement with the intended future behaviour item. Only one correlation with pre-intervention attitudes was significant (lower belief that 'hands on the wheel' implies safety relates to greater likelihood to avoid hands-free calls in the future). However, all but one of the post-intervention attitudes demonstrated a significant negative correlation with further intended behaviour. The link between safer attitudes and intentions towards safer behaviour in the future appears much stronger following the intervention (Table 4).

6.4 Discussion

Study 3 was a second attempt to evaluate the impact of the myth-busting video. While the design of Study 2 was able to include more direct measures of behaviour, the low sample and possible floor effects may have been to blame for the lack of positive findings. Study 3 was an opportunistic attempt to revisit the evaluation with a much larger sample.

The results were in stark contrast to Study 2. Almost all attitudes reported by drivers in the intervention group showed an improvement in acknowledging the dangers of hands-free phones that was not present in the control group. The responses to the videos were also overwhelmingly positive, with at least 9 out of 10 agreeing that the videos were interesting, informative, persuasive, and had the potential to change the behaviour of some drivers. They also reported personal benefits from watching the videos, such as increased knowledge, greater control over their future phone use while driving, and 8 out of 10 said the videos would make them limit or avoid hands-free calls in the future.

Table 4. Spearman rank correlations of the twelve beliefs regarding handsfree phone use before and after seeing the videos (Week 1 and Week 6) and agreement with the statement 'I am now more likely to limit or completely avoid hands-free calls when driving'.

	Pre	Post
I need to use a hands-free mobile for my work	-0.062	-0.090
Talking on a hands-free device whilst driving is no more dangerous than talking to a passenger	-0.063	-.439**
I am just as aware of the road around me when I am on a hands-free phone call	-0.078	-.507**
I am no more likely to miss road signs when on a hands-free phone call than when I am not	-0.118	-.354**
My reaction times are unaffected by talking on a hands-free phone	-0.141	-.504**
Driving is automatic, so talking on a mobile phone should not affect driving ability	-0.137	-.521**
Experienced drivers know when it is safe to use their phones	-0.097	-.483**
Talking on a hands-free mobile is safe as... hands are on the steering wheel	-.158*	-.458**
Talking on a hands-free device is acceptable, but drink/drug driving is not	-0.053	-.508**
Using hands-free mobiles while driving is not illegal, so it must be safe	-0.060	-.502**
If a car has an integrated hands-free system, it must be safe	-0.119	-.497**
Hands-free mobile calls are safer in electric/ automatic vehicles...	-0.111	-.453**

Note: * <.05, **<.01, ***<.001

The success of Study 3 may be due to the larger sample size, though the smaller video format may have also played a role. This study was not designed to specifically compare short and long video formats, but the results of these two studies suggest that this is an interesting avenue for future research.

Another factor that may explain the difference between Study 2 and 3 is that participants for the former were mostly recruited through their companies. Despite the evidence from Study 1 suggesting that social desirability was low in this sample, and despite our assurances that participation was voluntary and responses were confidential, it remains a possibility that drivers gave artificially better attitudes and lower usage rates, creating a floor effect in the data. Study 3 participants felt no such compunction as they were recruited directly and as individuals. As they are not classed as 'professional drivers' they may also have felt no pressure to defend their self-belief in their own driving expertise.

7 Discussion

7.1 An overview of the project

The current project consisted of three studies to understand why people use hands-free phones while driving for work, especially in the face of company policies that ban such communication, and to reduce their future hands-free phone use. The first study identified a range of beliefs that drivers used to justify hands-free communication via converging evidence. These justifications, or myths, were taken to an expert focus group who helped us to select five key myths to be addressed in a persuasive and informative road safety video. The script was then written with consideration of different behavioural change techniques that could be incorporated. Filming and editing followed, resulting in a 9-minute video that addressed and debunked our five key myths.

The ability of this video to change attitudes and behaviour in regard to hands-free phone use while driving was investigated in Study 2. Feedback on the videos was very positive, with high ratings on interest, informativeness, relevance, and respondents' perceptions of the likelihood of the videos changing both attitudes and behaviours in drivers. Unfortunately, this feedback was not reflected in the actual attitudes of the respondents or their self-reported use of mobile phones while driving over the 6 weeks of the study.

It is likely that low sample size and floor effects in the data hindered the detection of any effects. Accordingly, we undertook a third study with a more in-depth look at driver attitudes. Additionally, in lieu of actual measures of hands-free use, we asked about drivers' future intended behaviours regarding the use of phones while driving.

Study 3 demonstrated clear improvements in attitudes towards mobile phone use in the intervention group, with 8 out of 10 drivers reporting that they intend to limit or completely avoid hands-free phone use in the future. The differences between Study 2 and 3 may be due to the use of company employees in the first evaluation (with the possibility of social desirability still playing a role in creating the floor effects), or the fact that Study 3 had much shorter videos distributed a week apart (each mini-myth-busting video lasted 2 minutes and 14 seconds on average). Longer training sessions are more likely to lead to mind-wandering and loss of concentration (e.g., Farley, et al., 2013), while gaps between training sessions (longer intertrial intervals) allow material to be integrated into memory, which may involve neural restructuring to accommodate new knowledge (e.g., Smolen, et al., 2016). Alternatively, the effects may have been present in Study 2 but the analyses were too underpowered to find them.

Regardless of the reasons why Study 2 did not produce the desired results, the findings from Study 3 suggest that our video does have the ability to change attitudes and future intended behaviour. On this basis we argue that the development of the video has been a success.

7.2 A protocol for future road safety videos

One benefit of this project is that we have developed a protocol for the development of road safety videos. On reflection of our experiences, we recommend the following processes:

1. Identify the problem you are trying to solve or the behaviour you are trying to change (e.g., people using hands-free mobile phones while driving for work).
2. Interrogate the literature and identify potential causes for this problem or aberrant behaviour.
3. Survey a large number of drivers in your target population to identify why the problem or behaviour occurs, and what can be done about it.
4. Review your data with experts and stakeholders to identify core themes that you need to address in the video.
5. Return to the literature to identify evidence that addresses each theme and be explicit about your chosen behavioural change techniques. Fylan's (2017) review of behaviour change techniques is an excellent source in this regard.
6. Seek expert reviews on the script to make sure it is accurate and understandable by your target audience. Trial the script and storyboard with the target audience.
7. Once filming is complete, evaluate the impact of your video on the attitudes and behaviours (or at least intended future behaviours) of your target audience.
8. Iterate according to feedback as necessary.

7.3 The final video

Following the studies and extensive feedback gathering outside of those studies, we made one significant change. One of our expert interviews was originally recorded via video conferencing software, but feedback from industry experts suggested that this interview felt more informal than the others which potentially lessened the appeal to authority. We re-filmed this interview in person and re-edited the intervention video to include it.

The final film is available to be viewed at <https://www.roadsafetytrust.org.uk/small-grants-awarded/kier-foundation-handsfree>. It remains 9-minutes in length rather than being replaced with the shorter videos used in Study 3. Though there is much published evidence to show shorter training can be more effective, the optimum length of a training session is relative. Our video is much shorter than an hour-long lecture but is longer than a typical Tik Tok video. While Study 3 found impacts of the short videos on driver attitudes, it is not clear that this was solely due, or even in part, to the shorter duration of the clips (as the study was not designed to specifically test this hypothesis). Accordingly, we have left the video available in its entirety.

7.4 A conclusion

The project has demonstrated a method for producing a road safety video and has provided evidence that it impacts on attitudes in the short-term. We do not know whether these impacts will persevere, or whether drivers' intentions to behave in a certain way will carry through to actual behaviour, but the positive results of Study 3 support the distribution and use of this video. One caveat to this however was pointed out by several drivers in our studies: If we are aiming to improve

the acceptability of a hands-free ban among company drivers, we must also include managers (and possibly clients) within our target audience. If drivers feel pressured to take hands-free calls for whatever reason this may counteract any benefits of attitudinal change. Accordingly, we recommend that managers within a company should also be exposed to the video at the same time as fleet drivers, hopefully helping to create a hegemony of road safety attitudes within an organisation.

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Appendix A: Frequency of self-reported behaviours in an average week (Study 1)

Table A1. The number of respondents who chose each response option for self-reported frequency of behaviours in an average week when driving for work.

<i>In an average week how often do you...</i>	Never	Very rarely	Rarely	Sometimes	Often	Very often	On every journey
(1)...have a hand-held mobile phone conversation...	398	20	4	5	0	2	0
(2)...have a hands-free mobile phone conversation...	168	65	38	74	36	38	10
(3)...purposefully drive above the speed limit for the road...	92	94	84	114	20	13	12
(4)...overtake other vehicles that you feel are moving too slowly...	25	56	45	172	90	20	21
(5)...clean any exterior part of your vehicle (e.g., windscreen, headlights, etc.)... [Reversed]	17	51	44	134	123	56	4
(6)...check that your headlights, brake lights and indicator lights work... [Reversed]	37	42	57	88	108	46	51
(7)...use caffeinated drinks to get through a journey...	217	56	43	55	36	15	7
(8)...find yourself driving while angry, stressed, or frustrated...	43	128	106	122	22	4	4

Table A2. The number of respondents who chose each response option for self-reported frequency of behaviours in an average week during personal driving.

<i>In an average week how often do you...</i>	Never	Very rarely	Rarely	Sometimes	Often	Very often	On every journey
(1)...have a hand-held mobile phone conversation...	381	31	5	9	3	0	0
(2)...have a hands-free mobile phone conversation...	87	90	60	108	45	32	7
(3)...purposefully drive above the speed limit for the road...	67	100	84	124	32	13	9
(4)...overtake other vehicles that you feel are moving too slowly...	15	49	61	167	98	20	19
(5)...clean any exterior part of your vehicle (e.g., windscreen, headlights, etc.)... [Reversed]	17	54	48	137	119	53	1
(6)...check that your headlights, brake lights and indicator lights work... [Reversed]	38	45	65	100	110	42	29
(7)...use caffeinated drinks to get through a journey...	217	74	54	53	22	7	2
(8)...find yourself driving while angry, stressed, or frustrated...	45	144	130	99	10	0	1

Table A3. Medians (and means) and their comparisons for responses to questions probing the frequency of self-reported behaviours in an average week. Responses are on a 1 to 7 scale from 'never' to 'on every journey'. Scales for items 5 and 6 are reversed so that higher ratings always reflect more risky or potentially dangerous behaviours.

<i>In an average week how often do you...</i>				
Question	<i>...while driving for work?</i>	<i>...while driving for personal reasons?</i>	Z	p
(1)...have a hand-held mobile phone conversation...	1 (1.12)	1 (1.19)	2.79	< .01
(2)...have a hands-free mobile phone conversation...	2 (2.76)	3 (3.14)	5.31	< .001
(3)...purposefully drive above the speed limit for the road...	4 (2.91)	4 (3.07)	3.98	< .001
(4)...overtake other vehicles that you feel are moving too slowly...	4 (3.91)	4 (3.98)	2.64	<.01
(5)...clean any exterior part of your vehicle (e.g., windscreen, headlights, etc.)... [Reversed]	4 (3.88)	4 (3.95)	2.58	.01
(6)...check that your headlights, brake lights and indicator lights work... [Reversed]	4 (3.76)	4 (3.97)	5.58	<.001
(7)...use caffeinated drinks to get through a journey...	1 (2.32)	1 (2.11)	-5.21	<.001
(8)...find yourself driving while angry, stressed, or frustrated...	3 (2.95)	3 (2.74)	-4.76	<.001

Appendix B: Correlations between mobile phone use, driving experience and attitudes (Study 1)

Table B1. Spearman rank correlations for the four measures of mobile phone use (above the dashed line) and with driving experience and attitudinal variables (below the dashed line).

	Driving for work		Personal driving	
	Hands-free	Hand-held	Hands-free	Hand-held
Hands-free use at work	1	.183**	.691**	0.080
Hand-held use at work	.183**	1	.117*	.705**
Hands-free for personal use	.691**	.117*	1	.100*
Hand-held for personal use	0.080	.705**	.100*	1
<hr/>				
Experience (years)	-0.084	-.175**	-.145**	-.135**
I need to use a hands-free mobile for my work	.182**	-0.032	.116*	-0.015
It's no more dangerous than talking to a passenger	.583**	.157**	.464**	.139**
I am just as aware of the road around me...	.295**	0.055	.363**	0.012
I am no more likely to miss road signs...	.378**	0.087	.432**	0.041
My reaction times are unaffected...	.257**	-0.007	.278**	0.011
Driving is automatic...	.386**	.115*	.416**	0.062
Experienced drivers know when it is safe to use their phones	.330**	.105*	.340**	0.091
It's a safe alternative... as your hands are on the steering wheel	.334**	0.053	.347**	0.042
It's acceptable, but drink-driving or drug-driving is not	.414**	.107*	.453**	0.029
It's not illegal, so it must be safe	.409**	0.058	.455**	0.003
If a car has an integrated hands-free system, it must be safe	.391**	.124*	.413**	0.083
Hands-free phones are safer in electric/automatic vehicles	.369**	.102*	.399**	0.055
I need to use a hands-free mobile for my work	.287**	.129**	.300**	0.060

Note: *<.05, **<.01, ***<.001

Appendix C: The intervention and distracter videos

Table C1. The intervention and distracter videos.

Video	Title/Story	Duration
Intervention	An educational video explaining the risks of using hands-free mobile phones whilst driving.	537 s
Video 1	Driver training video by ESITU Solutions on the hazards of flashing one's headlights to signal to another vehicle.	249 s
Video 2	A clip from the DVSA 'Van drivers walkaround checks outside the van'	222s
Video 3	'The Dangers of driving fatigue' by GEM Motoring Assist	234s
Video 4	Video aiming to humanise vulnerable road users by showing how to safely overtake a horse rider who works for the fire service.	109 s
Video 5	A Video on the "Dutch Reach" technique of opening vehicle doors into the road to avoid causing danger to other road users.	117 s

Appendix D: Frequency of self-reported behaviours in an average week (Study 2)

Table D1. Medians (and means) and their comparisons for responses to questions probing the frequency of self-reported behaviours in an average week (on a 1-7 scale, 1 = “never”, 7 = “almost all the time”). Scales for items 5 and 6 are reversed so that higher ratings always reflect more risky or potentially dangerous behaviours.

Question	...while driving for work?				...while driving for personal reasons?			
	Intervention group	Control Group	z	p	Intervention group	Control Group	Z	P
<i>(1)...have a hand-held mobile phone conversation...</i>	1 (1.6)	1 (1.6)	>-0.01	.99	1 (1.6)	1 (1.5)	-0.525	.60
<i>(2)...have a hands-free mobile phone conversation...</i>	4 (3.4)	4 (3.8)	.782	.43	3 (3.2)	3 (3.3)	0.219	.83
<i>(3)...purposefully drive above the speed limit for the road...</i>	2.5 (2.6)	3 (3.2)	1.74	.08	3 (3.1)	3 (3.3)	0.566	.57
<i>(4)...overtake other vehicles that you feel are moving too slowly...</i>	4 (3.6)	4.5 (4.4)	2.54	.01	4 (3.8)	4 (4.5)	1.89	.06
<i>(5)...clean any exterior part of your vehicle (e.g., windscreen, headlights, etc.)... [reversed]</i>	4 (4.1)	4 (3.7)	1.04	.30	4 (4.4)	4 (4.2)	0.643	.52
<i>(6)...check that your headlights, brake lights and indicator lights work... [reversed]</i>	3.5 (3.8)	4 (3.7)	0.14	.89	5 (4.7)	4 (4.5)	0.337	.74
<i>(7)...use caffeinated drinks to get through a journey...</i>	1.5 (2.1)	2 (2.7)	0.754	.45	1.5 (1.9)	1 (2.0)	0.53	.96
<i>(8)...find yourself driving while angry, stressed, or frustrated...</i>	3 (2.8)	3 (3.3)	1.47	.14	3 (2.9)	3 (2.9)	0.41	.69

Appendix E: Agreement with attitudinal statements (Study 2)

Table E1. Medians (and means) and their comparisons for responses to questions probing agreement with a series of attitudinal statements recorded on a 1-7 scale (1 = strongly disagree, 7 = strongly agree). Items 5 and 6 have had their scales reversed so that higher ratings always reflect more risky behaviour.

<i>How strongly do you agree that...</i>				
<i>Question</i>	<i>Intervention group</i>	<i>Control Group</i>	<i>Z</i>	<i>p</i>
<i>(1) ...making a hand-held phone call while driving is safe if you know what you are doing</i>	1 (1.6)	1 (1.9)	0.307	.76
<i>(2) ...making a hands-free phone call while driving is safe if you know what you are doing</i>	4 (3.9)	4 (4.1)	0.392	.70
<i>(3) ...travelling above the speed limit does not increase your chances of crashing if you are a good driver</i>	2 (2.8)	2 (2.7)	0.177	.860
<i>(4) ...overtaking is an important skill to develop as it allows traffic to flow more smoothly</i>	5 (4.6)	5 (5.3)	2.03	.04
<i>(5)... ensuring that the exterior of your vehicle is clean is vitally important for safe driving [Reversed]</i>	3 (3.7)	2.5 (2.9)	2.58	.01
<i>(6) ...checking your vehicle for defects before driving should never be skipped for any reason [Reversed]</i>	3 (2.9)	2.5 (2.8)	0.345	.73

Appendix F: Crashes and self-reported behaviour weeks 1-6 (driving for work)

*Table F1. Crashes and scores from drivers across all 6 weeks in reference to **driving for work**. Crash numbers reflect the sum of crashes across all drivers in each group, and the last two columns provide the overall total of crashes for the interaction group (Int) and Control group (Con). Other measures report the medians (and means) of drivers' frequency of behaviours. The last two columns provide means across the 6 weeks for each group. Items 5 and 6 have had their scales reversed [R] so that higher ratings always reflect more risky behaviour.*

	Intervention group						Control group						All weeks	
	W1	W2	W3	W4	W5	W6	W1	W2	W3	W4	W5	W6	Int	Con
<i>Crashes</i>	0	1	0	0	0	1	0	0	1	0	0	0	2	1
<i>Hand-held use</i>	1 (1.6)	1 (1.5)	1 (1.1)	1 (1.1)	1 (1.2)	1 (1.1)	1 (1.6)	1 (1.1)	1 (1.4)	1 (1.3)	1 (1.0)	1 (1.2)	1 (1.3)	1 (1.3)
<i>Hands-free use</i>	4 (3.4)	1 (2.3)	1.5 (2.4)	1.5 (2.4)	1 (2.4)	1 (2.4)	4 (3.8)	2 (2.6)	1 (2.3)	2 (2.6)	2 (2.6)	2 (2.7)	1.7 (2.5)	2.2 (2.8)
<i>Speeding</i>	2.5 (2.6)	1 (2.1)	1 (1.8)	1 (1.8)	1 (1.8)	1 (1.8)	3 (3.2)	2 (2.3)	2 (2.6)	2 (2.2)	2 (2.5)	2 (2.5)	1.3 (2.0)	2.2 (2.5)
<i>Overtaking</i>	4 (3.6)	2 (2.6)	2 (2.3)	2 (2.3)	1 (2.1)	2 (2.1)	4.5 (4.4)	3 (3.0)	3.5 (3.2)	2 (2.8)	3 (2.8)	3 (3.0)	2.2 (2.5)	3.2 (3.2)
<i>Cleaning [R]</i>	4 (4.1)	6 (5.3)	6 (5.6)	6.5 (5.6)	5.5 (5.1)	6.5 (5.4)	4 (3.7)	5 (4.9)	5 (4.9)	4 (4.6)	5 (4.8)	5.5 (4.8)	5.8 (5.2)	4.8 (4.6)
<i>Vehicle checks [R]</i>	3.5 (3.8)	4 (4.2)	5 (4.6)	6 (5.0)	6 (4.8)	7 (5.2)	4 (3.7)	6 (4.8)	6 (4.8)	4.5 (4.5)	4.5 (4.6)	5 (4.6)	5.3 (4.6)	5.0 (4.5)
<i>Caffeinated drinks</i>	1.5 (2.1)	1 (1.6)	1 (1.3)	1 (1.4)	1 (1.3)	1 (1.5)	2 (2.7)	1 (1.7)	1 (2.0)	1 (2.1)	1 (1.8)	1 (2.1)	1.1 (1.6)	1.2 (2.1)
<i>Angry etc.</i>	3 (2.8)	1 (2.0)	1 (1.8)	1 (1.9)	1 (1.4)	1 (1.6)	3 (3.3)	2 (2.4)	2 (2.3)	1.5 (2.2)	1.5 (2.0)	2 (2.3)	1.3 (1.9)	2.0 (2.4)

Appendix G: Crashes and self-reported behaviour weeks 1-6 (personal reasons)

*Table G1. Crashes and scores from drivers across all 6 weeks in reference to **driving for personal reasons**. Crash numbers reflect the sum of crashes across all drivers in each group, and the last two columns provide the overall total of crashes for the interaction group (Int) and Control group (Con). Other measures report the medians (and means) of drivers' frequency of behaviours. The last two columns provide means across the 6 weeks for each group. Items 5 and 6 have had their scales reversed [R] so that higher ratings always reflect more risky behaviour.*

	Intervention group						Control group						All weeks	
	W1	W2	W3	W4	W5	W6	W1	W2	W3	W4	W5	W6	Int	Con
<i>Crashes</i>	0	0	1	0	0	0	0	0	0	0	0	1	1	1
<i>Hand-held use</i>	1 (1.6)	1 (1.3)	1 (1.2)	1 (1.1)	1 (1.2)	1 (1.1)	1 (1.5)	1 (1.0)	1 (1.3)	1 (1.3)	1 (1.1)	1 (1.0)	1 (1.3)	1 (1.2)
<i>Hands-free use</i>	3 (3.2)	2 (2.5)	2 (2.4)	2 (2.4)	2 (2.7)	2 (2.6)	3 (3.3)	1 (2.2)	1 (2.3)	2 (2.3)	2 (2.4)	2 (2.5)	2.2 (2.6)	1.8 (2.5)
<i>Speeding</i>	3 (3.1)	2 (2.7)	2 (2.5)	2 (2.6)	2 (2.4)	2.5 (2.5)	3 (3.3)	2.5 (2.6)	2.5 (2.8)	2.5 (2.7)	2 (2.4)	3 (2.7)	2.3 (2.6)	2.6 (2.7)
<i>Overtaking</i>	4 (3.8)	3 (2.9)	2.5 (2.9)	2 (2.7)	2 (2.7)	2.5 (2.8)	4 (4.5)	4 (3.5)	4 (3.6)	3.5 (3.3)	3.5 (3.3)	4 (3.5)	2.7 (2.9)	3.8 (3.6)
<i>Cleaning [R]</i>	4 (4.4)	6 (5.4)	5 (5.2)	5.5 (5.4)	5.5 (5.4)	6 (5.5)	4 (4.2)	5 (5.0)	5 (5.2)	6.5 (5.3)	6 (5.5)	6 (5.4)	5.3 (5.2)	5.4 (5.1)
<i>Vehicle checks [R]</i>	5 (4.7)	6 (5.3)	6 (5.4)	6 (5.3)	5.5 (5.3)	6 (5.7)	4 (4.5)	5.5 (5.1)	5.5 (5.2)	5 (4.9)	5 (5.0)	5.5 (5.3)	5.8 (5.3)	5.1 (5.0)
<i>Caffeinated drinks</i>	1.5 (1.9)	1 (1.5)	1 (1.3)	1 (1.4)	1 (1.4)	1 (1.5)	1 (2.0)	1 (1.4)	1 (1.6)	1 (1.6)	1 (1.6)	1 (1.5)	1.1 (1.5)	1 (1.6)
<i>Angry etc.</i>	3 (2.9)	1.5 (1.9)	2 (2.0)	2 (2.1)	1 (1.9)	1 (1.8)	3 (2.9)	2 (2.3)	2 (2.1)	1 (1.9)	1 (1.9)	1 (1.8)	1.8 (2.1)	1.7 (2.1)

Appendix H: Mobile phone use of intervention and control group

Table H1. F-values for interactions between the two groups (intervention/control) and two time periods of data collection for self-report phone usage. ME1 is Main Effect 1 (Intervention vs. Control group), ME2 is Main Effect 2 (Week X vs Week Y), and Int is the Interaction between the two factors.

Question	Baseline vs. Week 2			Week 3 vs. Week 4			Week 3 vs. Week 6		
	ME1	ME2	Int	ME1	ME2	Int	ME1	ME2	Int
Hand-held use while driving for work	0.01	1.55	0.02	0.08	2.35	0.75	0.24	7.37 **	2.02
Hands-free use while driving for work	1.17	44.18 ***	0.32	0.02	2.66	1.26	0.20	2.50	2.63
Hand-held use while driving for personal reasons	0.11	4.24 *	0.58	0.39	2.24	1.32	0.01	28.92 ***	0.80
Hands-free use while driving for personal reasons	0.12	31.84 ***	0.34	0.70	0.37	0.08	0.20	2.29	0.25

Note: * <.05, **<.01, ***<.001

Appendix I: Attitudinal changes between Week 1 and Week 6

Table I1. Medians (and means) from 6 attitudinal measures taken from drivers in Week 1 and Week 6, and their analyses. ME1 is Main Effect 1 (Intervention vs. Control group), ME2 is Main Effect 2 (Week 1 vs Week 6), and Int is the Interaction between the two factors.

Question	Intervention Group		Control Group		ME1	ME2	Int
	Pre	Post	Pre	Post			
<i>(1) ...making a hand-held phone call while driving is safe if you know what you are doing</i>	1 (1.6)	1 (1.5)	1 (1.9)	1 (1.5)	0.24	5.41*	0.80
<i>(2) ...making a hands-free phone call while driving is safe if you know what you are doing</i>	4 (3.9)	4 (3.6)	4 (4.1)	5 (4.4)	1.98	0.01	2.00
<i>(3) ...travelling above the speed limit does not increase your chances of crashing if you are a good driver</i>	2 (2.8)	2 (2.4)	2 (2.7)	2 (2.6)	0.06	0.81	<.001
<i>(4) ...overtaking is an important skill to develop as it allows traffic to flow more smoothly</i>	5 (4.6)	5 (4.7)	5 (5.3)	5 (5.3)	4.58*	0.31	0.26
<i>(5) ... Ensuring that the exterior of your vehicle is clean is vitally important for safe driving [Reversed]</i>	3 (3.7)	4 (4.1)	2 (2.9)	3 (3.4)	4.20*	3.13	0.33
<i>(6) ...checking your vehicle for defects before driving should never be skipped for any reason [Reversed]</i>	3 (2.9)	3 (3.1)	2 (2.8)	3 (3.4)	0.16	7.10**	2.71

Note: * <.05, **<.01, ***<.001

Appendix J: Correlations of mobile phone use and attitudes (Study 2)

Table J1. Spearman rank correlations of handsfree use for work with other mobile phone use and attitudes.

	Self-reported hands-free/work use					
	W1	W2	W3	W4	W5	W6
Hands-free/personal use	.535**	.545**	.530**	.546**	.537**	.404**
Hand-held/work use	.427**	0.202	0.191	0.154	0.176	.260*
Hand-held/personal use	.266*	.318**	0.038	-0.035	0.075	-0.188
Driving experience	-0.050	-0.020	-0.10	-0.051	-0.090	-0.104
Hours driven in the week	.457**	.528**	.508**	.522**	.466**	.571**
Pre-intervention attitude to hands-free use	.265*	.266*	.367**	.360**	.282*	.261*
Post-intervention attitude to hands-free use						.265*
Pre-intervention attitude to hand-held use	0.060	0.157	0.136	0.137	0.019	0.076
Post-intervention attitude to hand-held use						-0.020

Note: * <.05, **<.01, ***<.001

Appendix K: List of intervention videos (Study 3)

Table K1. The videos used in Study 3

Video	Title/Story	Duration
Mobile phone video 1 (W2)	Hands-free is legal so it must be safe.	150s
Mobile phone video 2 (W3)	Driving is 'dead' time, and hands-free calls allow you to make better use of your time.	133s
Mobile phone video 3 (W4)	Hands-free is safe because your hands are on the wheel and eyes are on the road.	109s
Mobile phone video 4 (W5)	Hands-free is no different from talking to a passenger.	142s
Mindfulness video 1 (W2)	The STOP technique (Stop, Take a breath, Observe and Proceed)	285 s
Mindfulness video 2 (W3)	Monitoring for negative thoughts or emotions and stopping them from affecting behaviour	249 s
Mindfulness video 3 (W4)	Three little things technique (thinking of three things about another road user)	244 s
Mindfulness video 4 (W5)	Emotion labelling (saying negative emotions out loud)	207 s

Appendix L: Agreement with attitudinal statements (Study 3)

Table L1. Medians (and means) from drivers' agreement with the twelve belief statements regarding handsfree mobile phone use from study 1 on a 1-7 scale of agreement (1=Strongly disagree, 7= Strongly agree) and F-values for interactions between the two groups (intervention/control) and the two time periods before and after exposure to the videos. ME1 is Main Effect 1 (Intervention vs. Control group), ME2 is Main Effect 2 (Week 1 vs Week 6), and Int is the Interaction between the two factors.

Question	Intervention Group		Control Group		ME1	ME2	Int
	Pre	Post	Pre	Post			
I need to use a hands-free mobile for my work	1(2.2)	1(2.0)	2(2.8)	2(2.4)	11.62 ***	12.13 ***	2.33
It's no more dangerous than talking to a passenger	3(3.7)	2(2.4)	4(3.9)	3(3.4)	24.81 ***	53.72 ***	12.49 ***
I am just as aware of the road around me...	4(4.0)	2(2.6)	4(3.7)	3(3.4)	3.71	61.70 ***	19.94 ***
I am no more likely to miss road signs...	4(3.8)	2(2.8)	3(3.5)	3(3.5)	2.27	19.59 ***	17.09 ***
My reaction times are unaffected ...	4(3.8)	2(2.3)	3(3.4)	3(3.1)	1.79	57.93 ***	23.1 ***
Driving is automatic...	3(2.9)	2(2.1)	2(2.8)	2(2.5)	0.93	21.60 ***	4.26 *
Experienced drivers know when it is safe to use their phones	3(3.3)	2(2.6)	3(3.2)	2(2.9)	0.12	14.74 ***	2.02
Talking on a hands-free mobile is a safe... as your hands are on the steering wheel	5(4.4)	2(2.9)	5(4.4)	4(4.2)	19.07 ***	57.77 ***	34.16 ***
Talking on a hands-free device is acceptable, but drink-driving or drug-driving is not	6(5.1)	4(3.6)	6(5.1)	5(4.8)	16.49 ***	44.57 ***	19.56 ***
It's not illegal, so it must be safe	3(3.5)	2(2.4)	4(3.6)	3(3.2)	14.69 ***	50.49 ***	11.87 ***
If a car has an integrated hands-free system, it must be safe	4(3.8)	2(2.5)	4(3.6)	3(3.3)	7.80 **	66.98 ***	22.45 ***
It safer in electric/ automatic vehicles...	4(3.5)	2(2.4)	3(3.4)	3(3.2)	5.96 *	27.93 ***	18.31 ***

Note: * <.05, **<.01, ***<.001