Is There Value in Show and Tell? Creating a Salient General Deterrent Effect Through Overt & Covert Enforcement Technology

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IS THERE VALUE IN SHOW AND TELL? CREATING A SALIENT GENERAL DETERRENT EFFECT THROUGH OVERT & COVERT ENFORCEMENT TECHNOLOGY

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Executive Summary

Background

The present road safety research will deal with two of the most significant risky driving behaviours: mobile phone use while driving and speeding. Using a hand-held phone while driving is a high-risk behaviour that has been found to significantly increase crash risk and impair driver behaviour including increased breaking response time, increased steering wheel corrections (Collet et al., 2010), increased reaction time and departure away from the correct lane position (Lipovac et al., 2017; Oviedo-Trespalacios et al., 2016). Speeding has also been demonstrated to significantly increase crash risk and crash severity (Kloeden et al., 1997; Kloeden et al., 2001). Due to the significant impact of these behaviours in terms of fatalities, injuries and societal cost, governments have implemented policies and enforcement initiatives to deter drivers from engaging in such behaviours. Automated cameras have been used as one of the primary enforcement methods for preventing speeding behaviour. Given the challenges with enforcing the phone use while driving law and the continuous increases in this behaviour, numerous Australian jurisdictions such as New South Wales, Queensland and Victoria have also implemented mobile phone detection cameras. Meanwhile, the Australian Capital Territory (ACT) is set to fully implement these cameras with infringements in October 2023. However, the way in which these cameras can be implemented can vary. Some enforcement cameras take an overt approach, whereby the cameras are made very visible to drivers, such as with bright paint and/or signage. In contrast, a covert approach has also been used for some enforcement cameras, where the cameras have been more 'hidden', with no bright paint or overt signage. Despite the different approaches to enforcement cameras, the gold standard of application to create lasting deterrent effects remains unclear. As such, the objective of this project, funded by the ACT Road Safety Fund, was to identify the road rule camera enforcement approach (i.e., overt, covert or a mixture of both) that has the most salience in creating a strong deterrent effect against mobile phone use while driving and speeding violations.

Method

Two studies were conducted to address this objective. First, focus groups were conducted to provide an in-depth, qualitative understanding of the: (a) perceived advantages and disadvantages of overt, covert and mixed enforcement cameras and (b) the possible impact such practices can have on attitudes about road safety, high-risk behaviours and road rule compliance. In addition, the focus groups were also used to generate four enforcement-type scenarios that were to be used in the subsequent quantitative study. The focus groups consisted of 58 participants (29 males) across Australia with ages that ranged between 17 and 68 years (mean age = 38, *SD* = 13.16). Each focus group took approximately 40 to 90 minutes and following the session, focus group recordings were transcribed and coded for analysis. Study 2 involved a cross-sectional survey that aimed to identify (a) how different types of exposure to road rule enforcement impact perceptual deterrence, offending behaviours and recognition of the broader road safety problem and (b) how personal factors either promote or dilute the effect of different types of enforcement camera signage. To address the research aims, the survey collected demographic information (e.g., age, gender), as well as self-reported engagement in speeding and hand-held phone use while driving. In addition, participants were asked questions regarding the driving scenarios that were presented, such as perceived deterrence and willingness to engage in offending

behaviours. Study 2 included 1168 participants across Australia (660 males), with ages that ranged from 17 to 88 years (mean age = 48.4 years, SD = 20.45).

Results

In Study 1, it was found that overall, overt cameras were perceived as more acceptable as drivers believed the visible nature of these cameras maximised road safety instead of revenue raising. Despite these views towards the acceptability of overt cameras, it was found that covert cameras were perceived to maximise the deterrent effect, as drivers would believe they have a higher chance of being caught "anywhere, anytime" compared to overt cameras. The utilisation of both covert and overt cameras was perceived to optimise both the deterrent effect and the acceptability of the cameras. Nonetheless, a common message from the drivers was that cameras alone are not sufficient. For example, it was suggested that the visibility of cameras was not enough to influence perceptions that the behaviour is risky, and the implementation of cameras needs to be paired with educational and media campaigns. Further, it was suggested that receiving an infringement would only influence a driver's behaviour in the short term, which further highlights the need for additional campaigns beyond legal countermeasures. Encouragingly, knowing about mobile phone detection cameras was suggested to influence some drivers to take actions to avoid using their phone before starting their drive, such as putting the phone in the boot or glovebox, or purchasing a cradle for their phone. However, it was also suggested that some drivers may attempt to conceal their phone use more often because of increased enforcement via mobile phone detection cameras.

The results from Study 2 also suggest that combining overt and covert traffic enforcement cameras was the best enforcement strategy to reduce speeding and hand-held phone use while driving. This is because simultaneously using overt and covert traffic enforcement cameras provided the optimal combination for increasing the deterrence effect, increasing acceptance of the technology, and reducing willingness to engage in the offending behaviours. Study 2 also found that personal factors can influence the effect of different types of camera signage. Overall, it was found that younger drivers were more willing to use a hand-held phone while driving and older drivers were more willing to speed in some of the camera enforcement scenarios. In relation to gender, males were more willing to speed in all scenarios while there was no significant difference in willingness to use a phone while driving between genders in all scenarios.

Implications

A combination of overt and covert enforcement cameras for mobile phone and speed detection is required to maximise the deterrence effect, increase acceptance of the technology, and reduce the willingness to engage in the offending behaviours. Specifically, it is suggested that overt cameras would be most useful on roads that have a high crash risk to maximise rule compliance in those areas. Meanwhile, it is also suggested that warning signs would be beneficial in conjunction with covert cameras. To increase drivers' perceptions of being caught, the warning signs could be placed on many roads, including those that do not include the covert cameras. It is also suggested that advertisement campaigns should be used in combination with enforcement cameras to highlight the risks of the offending behaviours. Considering the new implementation of mobile phone detection cameras in the ACT, advertisement campaigns that connect (a) the risks associated with using a phone while driving and (b) the reason behind the implementation of these cameras, is suggested to be beneficial for the area. It is also suggested that evaluations and ongoing vigilance of the effectiveness of the

cameras consider behavioural adaptation of drivers such as the use of police avoidance strategies and technologies that identify the location of the on-road and automatic police operations.

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1. Introduction

In 2023, the Australian Capital Territory (ACT) is implementing both fixed and transportable mobile phone detection cameras. Similar devices were first implemented in New South Wales and have also been rolled out in other Australian states such as Victoria and Queensland. These cameras have primarily been covert, with their location not formally advertised. Such an approach is consistent with specific deterrence (deterring recidivist offenders from engaging in repeat offences after they have been sanctioned). In contrast, the overt displaying of cameras can be considered consistent with general deterrence (deterring the general public from committing an offence by exposure to enforcement). Based on the application of deterrence theory to road safety research, a driver's perceived certainty of being apprehended for an offence need to be high, and their experiences with avoiding being caught and subsequently punished need to be low for effective enforcement (Freeman et al., 2017; Homel, 1988; Truelove et al., 2017). However, questions remain regarding how best to maximise the effectiveness of enforcement in relation to levels of exposure to the cameras (i.e., overt or covert exposure).

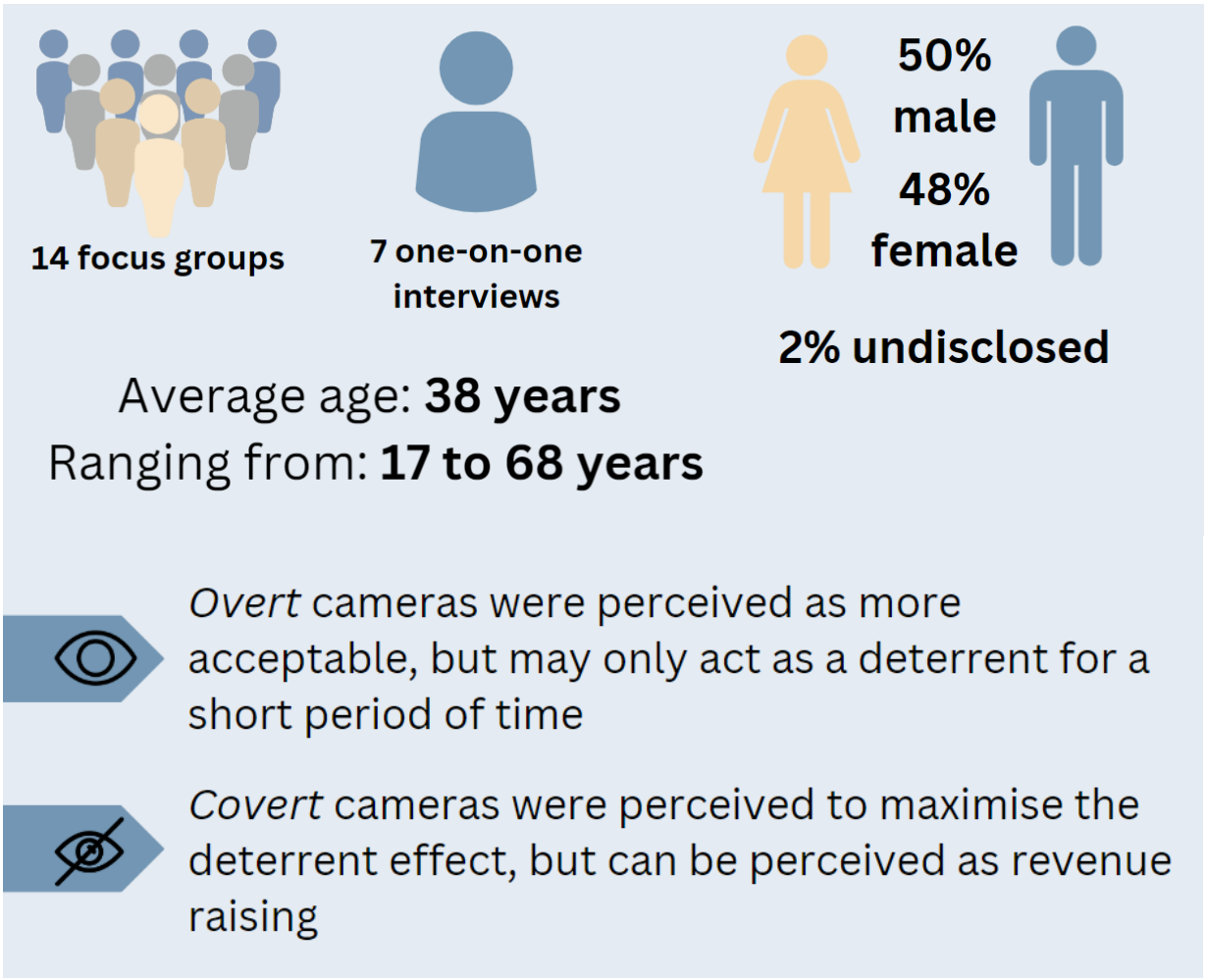
Given that limited research has been applied to mobile phone detection cameras, research into overt and covert speed cameras can provide some insight into the effectiveness of each approach. For example, a study that was conducted in the United Kingdom found that speeding significantly decreased after covert speed cameras were painted bright yellow to become more overt, however this effect was localised to the speed camera location (Keenan & Maunsell, 2003). This suggests that overt speed cameras can act as a general deterrent yet may only be effective in specific areas. Meanwhile, a simulator study found that there was a larger speed variance when there were overt speed cameras compared to covert speed cameras (Marciano et al., 2015). Further, a New Zealand study found that when overt speed cameras were changed to covert speed cameras, speeding behaviour, crashes and casualties decreased not only on roads that included the speed cameras, but also on other roads that had a 100km/hr limit generally (Keall et al., 2001). This effect was reportedly sustained for the following two years (Keall et al., 2002). Notably, while the cameras themselves were covert, they were accompanied by signage that stated "hidden camera may operate" as well as extensive publicity. This suggests that covert speed cameras can be an effective specific deterrent, yet to an extent, may also act as a general deterrent if accompanied by some degree of advertising.

An important further consideration is that the way in which overt and covert enforcement cameras influence behaviour may also be impacted by drivers' attitudes towards the cameras. Considering the new implementation of the mobile phone detection cameras, as well as mixed social acceptance towards illegal phone use while driving (George et al., 2018), it can be considered timely to also consider how overt versus covert cameras influence attitudes of drivers, as this might result in policy resistance. Specifically, it is important to consider if regular exposure to enforcement technology increases recognition of the problem of road safety. As such, research needs to be conducted to determine the effects of covert and overt speed enforcement operations and whether such an approach may create deterrent effects for the impending implementation of mobile phone cameras in the ACT, as well as other Australian states. Finally, it is possible that the enforcement cameras may have different effects on different groups of people due to socio-demographic characteristics which need to be considered to understand differential effects of the technology. Given the lack of empirically based research in the area, this project aimed to identify the road rule camera enforcement approach (i.e., overt, covert or a mixture of both) that has the most salience in creating a strong

deterrent effect against mobile phone use while driving and speeding violations. To address this objective, two studies were conducted with assistance from the ACT Government under the ACT Road Safety Fund Community Grant Program, including 1) focus groups and 2) a subsequent scenario-based survey.

2. Study 1: Focus Groups (Stage 1)

OVERVIEW OF KEY FINDINGS



2.1 OBJECTIVES

A qualitative focus group study was conducted for Stage 1 of this project. The focus groups were developed to address three objectives:

1. Identify the possible advantages and disadvantages of highly overt versus covert enforcement operations;

2. Explore drivers' perceptions and experiences of overt, covert and a mixture of both for road rule enforcement cameras;

3. Develop scenarios of these three conditions for use in a corresponding survey that aims to quantify possible deterrent effects.

Focus groups were used in the first phase of the study to allow a deeper qualitative exploration of the topic before a subsequent quantitative study was conducted.

2.2 METHOD

2.2.1 Procedure and materials

Ethics approval was granted by the University of the Sunshine Coast Human Research Ethics Committee (A211660). The study was advertised on various online platforms (e.g., Facebook, Gumtree), through University advertising, and in-person recruitment. Prior to completing the group interview, participants were provided with the information sheet outlining the aims of the study. In addition, they completed a short anonymous survey which consisted of demographics, driving history, and driving behaviour questions. The proposed sample size was obtained; 21 interviews were conducted, 7 of which involved one-on-one interviews since some participants did not attend their appointment. Consent to participate was obtained on the online form and verbally at the beginning of the sessions by all participants. Focus group questions explored a range of issues including: (a) perceived advantages and disadvantages of overt, covert versus mixed mobile device detection cameras and (b) the possible impact such practices can have on attitudes about road safety, high risk behaviours and road rule compliance. Further, the researchers developed a set of enforcement type scenarios that captured 1) concealed cameras, 2) visible cameras and 3) a mixture of both concealed and visible cameras. Participants were asked for suggestions to improve the enforcement scenarios for use in Study 2. Sessions were moderated and ran by a research assistant, with sessions lasting for approximately 40 to 90 minutes.

2.2.2 Data analysis

The data was analysed using a qualitative content analysis (Bengtsson, 2016), with themes created based on the overarching aims of the study. After familiarisation with the data, codes were developed based on the research aims. Related codes were then clustered into themes. For aim 1, themes related to the perceived advantages and disadvantages of overt, covert and a mixture of overt and covert enforcement cameras (for both speed and mobile phone detection cameras), were created. For the second aim, two themes were created based on 1) participants' attitudes towards the enforcement cameras and 2) how participants perceived the cameras would impact road rule compliance. While participants were asked separate questions for speeding and phone use enforcement cameras, results were similar for both types of cameras. As such, the

themes refer to both types of cameras. However, any differences in results between the two types of enforcement cameras are explicitly stated.

First, participant information is reported to provide context regarding the types of drivers who took part in this study. Next, a summary of participants' responses in relation to the perceived advantages and disadvantages of 1) overt cameras, 2) covert cameras and 3) a mixture of both overt and covert cameras is reported in table form. The themes that were developed for each research question are reported with supporting quotes from participants. Finally, a summary of participants responses to the enforcement type scenarios are reported.

2.3 RESULTS

2.3.1 Participants

Overall, 58 licensed drivers over the age of 17 years participated in the project. Half of the participants were male (*N* = 29), 28 participants were female, and one participant did not disclose a gender. The average participant age was 38 years (*SD* = 13.16), ranging from 17 to 68 years. The majority of participants held an open driver's licence (*n* = 49; 85%), 5 participants held a provisional 2 licence, 2 participants held a provisional 1 licence, and 2 participants held a learner's licence. On average, participants drove 12 hours per week. Participant locations included Queensland (*n* = 29; 36%), Australian Capital Territory (*n* = 20; 25%), New South Wales (*n* = 19; 24%), Victoria (*n* = 8; 10%), South Australia (*n* = 2; 3%), Northern Territory (*n* = 1; 1%), and Western Australia (*n* = 1; 1%).

2.3.2 Engagement in speeding and mobile phone use while driving

Participants reported engagement in hand-held phone use while driving data are demonstrated in Figure 1. Reported engagement in speeding on urban roads and open roads are presented in Figure 2 and Figure 3, respectively. Engagement in speeding was more common than engagement in phone use while driving.

2.3.3 Advantages and disadvantages of overt, covert and mixed enforcement cameras

The perceived advantages and disadvantages to drivers and more broadly, to road safety, of overt, covert and mixed enforcement cameras for speeding and phone use while driving that emerged from the focus groups are summarised in Table 1 and discussed below.

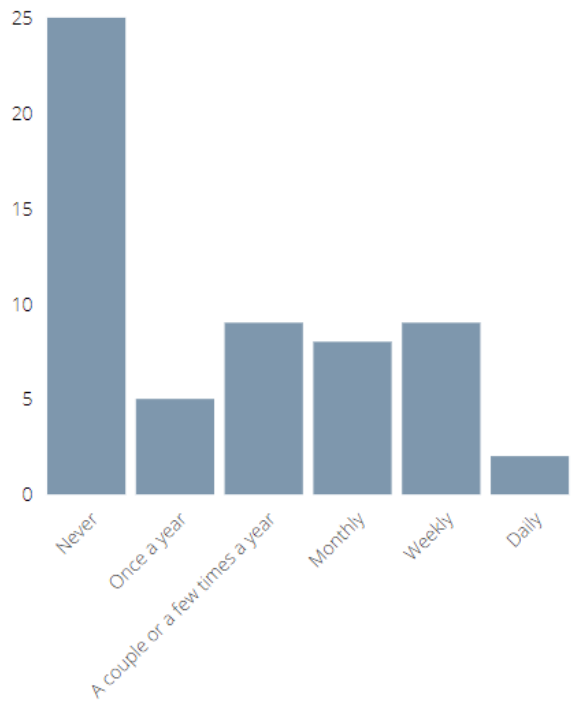


Figure 1. Engagement in mobile phone use while driving

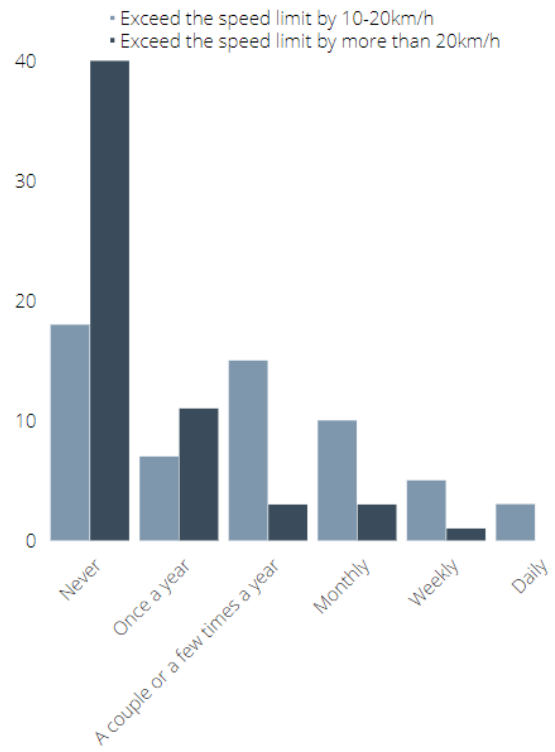


Figure 2. Engagement in speeding on urban roads

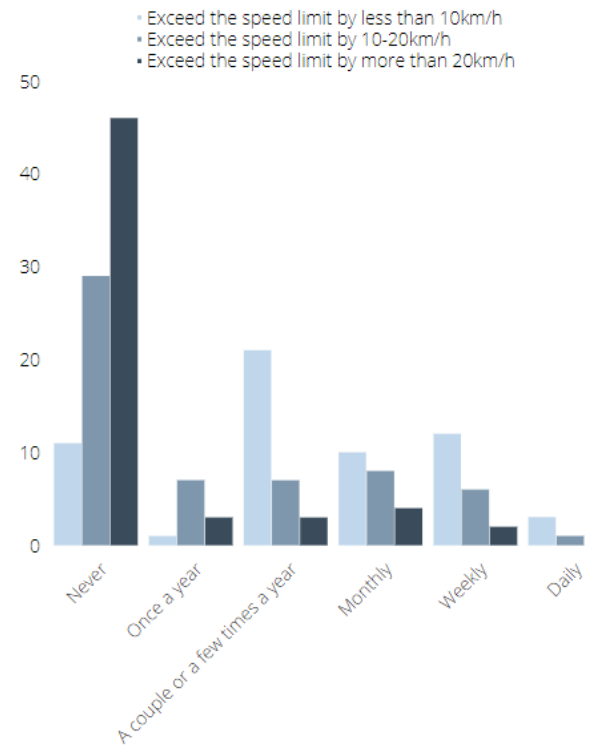


Figure 3. Engagement in speeding on open roads

Table 1. Perceived advantages and disadvantages for overt, covert and mixture of both types of enforcement cameras

	Advantages	Disadvantages
Overt cameras	- Reminder that the behaviour is illegal - Signage of cameras can remind drivers that the behaviour is dangerous - The visibility of the cameras stops the offending behaviour in high-risk areas	- The cameras only act as a deterrent against the offending behaviour for the small stretch of road that the camera is on
Covert cameras	- The cameras were perceived as more likely to influence behaviour over a longer period of time - Warning signs for covert cameras act as a reminder to comply with the road rules	- The time between committing the offence and receiving the punishment may limit the deterrent effect - These cameras can be perceived as revenue raising - The cameras (without warning signs) did not serve as a reminder that the offence is being enforced and is dangerous - Drivers can post locations of covert cameras on GPS applications and Facebook pages/groups which may make covert cameras have a similar effect to overt cameras but without the increased acceptance
Mix of overt and covert cameras	- The mixture of cameras can 1) act as a reminder to comply with the road rules and 2) maximise perceptions of being caught for the offence	

2.3.4 Perceived advantages and disadvantages of overt traffic enforcement cameras

Overt cameras were generally suggested to be useful as a general deterrent for both speeding and phone use while driving. It was noted that these types of cameras raise awareness that the general public can be caught and punished for the offence. However, it was also suggested that visible cameras act as a deterrent for a short period of time, specifically when drivers are passing the camera. Nonetheless, it was also highlighted that visible cameras are especially beneficial when they are placed in high-risk zones, as it was suggested that preventing the offending behaviour in those areas would be useful to reduce crashes. The below quote provides an example perception towards the overt cameras:

It's a good reminder and messaging is the way to actually change people's behaviour

Meanwhile, the primary disadvantage identified for overt cameras was that they were only perceived as a deterrent for a limited amount of time, with drivers perceiving a lower chance of being caught for the offence outside of those areas. Based on classical deterrence theory, this can be suggested to limit the deterrent effect. A high perceived certainty of being apprehended for an offence has been established as the most important component of effective deterrence (e.g., Homel, 1988; Piquero et al., 2011), and these results suggest that perceptions of the certainty of being apprehended would decrease after passing these overt cameras. A reconceptualization of deterrence theory (Stafford & Warr, 1993) has also found that engaging in the offending behaviour and avoiding being caught and punished is one of the most salient predictors of continued engagement in that behaviour (e.g., Freeman & Watson, 2009; Szogi et al., 2017). It may be suggested that if drivers are engaging in the offending behaviour after passing the cameras, they could be experiencing punishment avoidance, which may be further reinforcing their engagement in the behaviour.

While these results were similar for both speeding and mobile phone enforcement cameras, one notable difference in perceptions between these two types of detection cameras was observed. Specifically, it was found that if a driver was distracted when using their mobile phone, they would be less likely to see the cameras, making the difference between overt and covert cameras minimal in those instances. See the below quotes as examples to support the findings from this theme.

I don't think, again, for the same reason with cameras with speeding, once they will know where these cameras are, they're just going to start using their phone outside of these areas, so it's not really effective for changing behaviour.

I think it's going to be less likely that people are going to get caught with visible cameras, but if they're used in the right spots, I believe it will also reduce rogue practices.

2.3.5 Perceived advantages and disadvantages of covert traffic enforcement cameras

In contrast to the overt cameras, it was generally suggested that covert cameras would be a larger deterrent, resulting in drivers having a higher perceived certainty of being caught for the offence. This was because drivers' perceptions of being caught may be more consistently higher over their entire drive (or at least, over a larger period of their drive compared to the limited time they would be deterred by overt cameras). While covert cameras would be more consistent with specific deterrence (i.e., deterring those that have been caught and punished for the offence), a number of additional factors emerged from the focus groups to suggest that covert cameras could also partially act as a general deterrent (e.g. deterring the general population). For example, it was stated that most drivers would be aware of the camera when they pass it, even if they have limited warning before the camera. This did result in a disadvantage for speeding (but not for phone use while driving), where it was identified that viewing the cameras without any warning can result in some drivers braking very suddenly to comply with the speed limit, which can be a risk for rear end crashes. In addition, signs warning drivers that there may be hidden cameras in the area could also make covert cameras more of a general deterrent by raising drivers' awareness of their chance of being caught committing the offence. However, it was identified that there was some distrust in these signs, with drivers reporting they may not believe that there would actually be enforcement cameras in those areas. The below quote provides an example perception towards covert cameras:

It makes you more aware that you've got to be careful all the time, not just at the hotspots.

You're saying [cameras] may be there, people will go, "I'll take that chance."

A reported disadvantage to covert enforcement cameras was that if a driver did not see the camera when they were breaking the road rule, the time between committing the offence and receiving the punishment (usually approximately two weeks) was perceived as too long to elicit a change in later offending behaviour. This finding is consistent with the perceived swiftness of punishment component of classical deterrence theory, which states that a shorter time between engaging in the offending behaviour and receiving the punishment is needed to maximise the deterrent effect (Piquero et al., 2011). Further, in line with the finding that participants believed overt cameras served as a reminder, a disadvantage for covert cameras was that drivers would not be reminded of the law. Nevertheless, other participants stated that if they thought they saw a covert camera when they were engaging in the offending behaviour, they would be anxious for the next few weeks, waiting to see if they had received a ticket. As a result, they would also be less likely to engage in the

offending behaviour over that time between being caught and potentially receiving the ticket. Another disadvantage of covert cameras that was frequently mentioned among participants was the idea that these cameras are used for revenue raising. Some participants believed that because covert cameras provide limited opportunity to stop engagement in offending behaviour in time, the purpose of the cameras was to capture drivers who were unaware and thus raise revenue via the issuing of fines for the road rule offence. The below quotes provide some examples for the perceived disadvantages of covert cameras:

Not a reminder that the behaviour is illegal

Like smacking a naughty child because they've done something yesterday and you smack a two-year-old two days later because they've done something wrong. That doesn't work.

Another notable factor that emerged was that some drivers stated they could be made aware of the location of covert cameras while they were driving via GPS applications (such as Google Maps, Apple Maps and Waze), or before they're driving via posts on Facebook pages. This could mean that covert cameras may have a similar effect to overt cameras if their location is posted online, yet with less acceptance towards the cameras. However, it was acknowledged that the technology may not always be accurate.

2.3.6 Advantages and disadvantages of the use of a mixture of covert and overt enforcement cameras

Overall, a mixture of both covert and overt cameras was suggested to have the most salient deterrent effect. Specifically, it was suggested that, as explained above, the overt cameras can act as a reminder that the behaviour is illegal and risky. In addition, overt cameras can prevent engagement in the offending behaviour over specific roads. Meanwhile, the addition of covert cameras can maximise drivers' perceptions of the certainty of being caught, as there is the option that drivers could get caught by additional covert cameras. However, for the covert cameras to have the most salient deterrent effect, it was suggested that they should be moved around frequently and placed in unpredictable locations. While some participants still mentioned that revenue raising would remain an issue for them if covert cameras were in place (in addition to the overt cameras), other participants believed the combination of the two types of cameras would contribute towards a more favourable attitude towards the cameras than if only covert cameras were in place. Aside from the disadvantages mentioned above for the overt and covert cameras separately, no additional disadvantages were suggested for the combination of overt and covert cameras. The below quote provides an example perception towards the use of both types of cameras:

Can we say both [covert and overt cameras]? Because you could have some in particular areas that are high risk that then if you've got others that are moving around, then it's probably more of a deterrent.

2.3.7 Impact of traffic enforcement cameras on drivers' attitudes towards the behaviours

A number of factors were found to impact drivers' attitudes towards both speeding and mobile phone detection cameras. As explained above, many participants reported negative attitudes towards covert cameras due to their perception that the purpose of the cameras was to contribute to revenue raising. However, it was also acknowledged that signage and overtly visible cameras were not sufficient factors to influence perceptions that the behaviour is risky. Instead, it was frequently mentioned that educational campaigns are needed to influence attitudes towards the perceived risk of the behaviours, as well as the purpose of the enforcement cameras. Specifically, participants suggested that such campaigns should provide statistics related to crash risk for speeding and using a phone while driving, as well as outlining what the money from

speeding and phone use while driving fines go towards. It was also identified that a stronger association needs to be made linking illegal behaviour with risky behaviour. Importantly, many participants also suggested that these campaigns should not be restricted to television as the medium, as many people no longer watch television. In contrast, it should also be acknowledged that a number of participants already reported a high acceptance of the cameras. The below quotes provide some examples of the opinions that were discussed:

I don't think signs saying, "there's a camera here" would really communicate the risk of crashes.

It is finding just subtle ways to keep it in the mind of people. The only problem is not everybody watches TV, particularly these days.

I think I'm pretty supportive as it is. They're there for a reason

A number of unique findings in relation to attitudes towards the mobile phone detection cameras were also identified. As the mobile phone detection cameras are new, it was suggested that they need to be widely advertised before and during their initial implementation to increase drivers' acceptance towards these cameras. Numerous participants from the ACT also noted that they were not aware of the 8-week mobile phone detection camera trial that began in February 2022. Some ACT participants thought the cameras were already in place, and others stated they believed they would come in soon anyway because these participants were aware of their implementation in New South Wales. The below quotes provide some of these responses from the ACT participants:

I actually thought that they already started rolling out

New South Wales, I've heard rumors and murmurs about them being implemented in the ACT but I didn't know when-- I've been in a few intersections that I thought, "Have they changed something up, is there some new mobile phone cameras up there?"

I was aware recently of those in New South Wales and I assumed that at some point they would be used in the ACT.

No, I didn't know, I know they're in New South Wales.

2.3.8 The perceived impact of traffic enforcement cameras on road rule compliance

In addition to the factors already mentioned above, it was also identified that a driver's behaviour is only likely to be changed in the short term after receiving an infringement notice for the offence, irrespective of the type of camera. Overall, participants believed compliance with the road rules would last from 5 trips to 6 months after receiving an infringement. This is consistent with previous research that has identified the impact of legal sanctions on behaviour can be temporary (Saltzman et al., 1982; Truelove et al., 2020). The below quote provides an example of this perception:

I think at least six months, some people would change their behaviour

Meanwhile, a number of additional factors related to the cameras were thought to influence mobile phone use while driving behaviour specifically. Some drivers stated that, regardless of the type of camera (i.e., overt or covert), the implementation of the mobile phone detection cameras would make them less likely to use any phone functions while driving, apart from navigation applications. It was also stated that the implementation

of these cameras would encourage some drivers to take actions to avoid the temptation of illegally using their phone while driving. For example, some participants stated they would purchase a cradle to put their phone in, while others suggested they would be more likely to put their phone in their car boot or glovebox before they start driving. Some participants also identified that they needed some clarification on the law related to phone use while driving, as they were unaware of the legality of using their phone while it is in a cradle. Notably, participants agreed that they would need to be made aware of the mobile phone detection cameras to make these changes. However, drivers who believed the Bluetooth functionality of their vehicle and phone was adequate were less likely to report making any of these changes. These perceptions are demonstrated in the below quotes:

If I had to use Maps, I'd now use my cradle

maybe back on in the back or in the glove box or something just where by chance if it does ring something, you're going to turn it off and just be caught in that very own moment.

simply got a modern car, that come with Bluetoothy stuff that just connects

In contrast, the implementation of the mobile phone detection cameras was also suggested to contribute to more risky engagement in the behaviour in some cases. Specifically, it was mentioned that some may take measures to try to avoid detection (instead of stopping the behaviour) by attempting to conceal their use of the phone. This finding is supported by previous research that has found concealed phone use while driving is a common behaviour (Gauld et al., 2014; Truelove et al., 2021b). The below quote provides an example of this perception:

A part of me just thinks that there's going to be a population out there who is going to still use their phone, but just more concealed, maybe making it even more risky

2.3.9 Generation of enforcement scenarios

During the focus groups, participants were presented with a set of enforcement type scenarios that were created by the researchers of this project. Note that these scenarios will be used for the quantitative survey in stage 2 of this project, where questions related to drivers' perceptions of deterrence and acceptance of the technology will be asked for each scenario. Participants were asked to provide feedback on these scenarios to ensure they would be appropriate for the survey. The aggregated feedback is provided below:

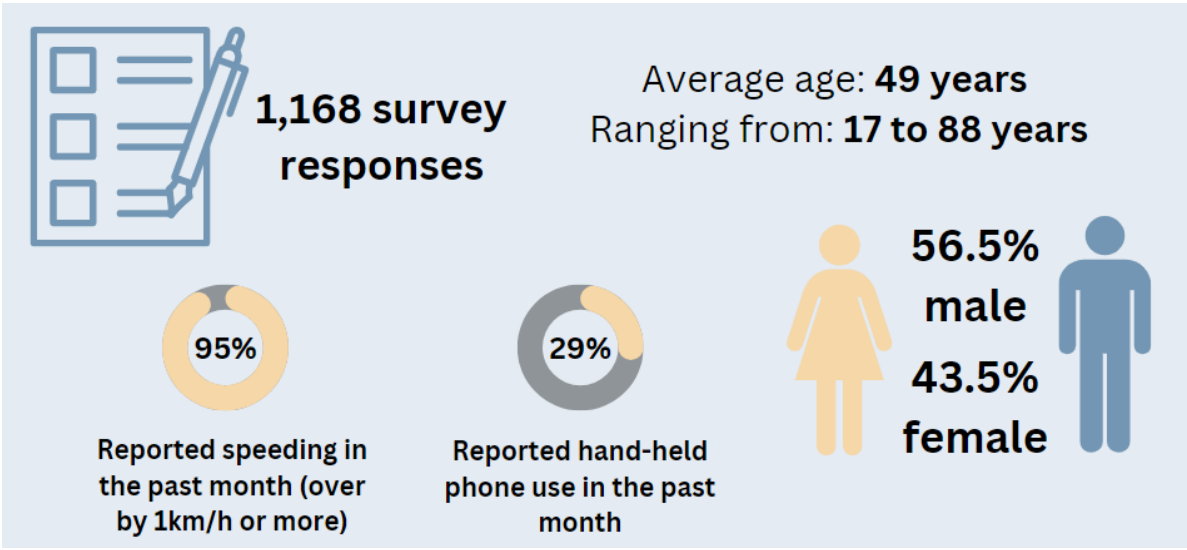
- Inclusion of a visual aid (i.e., image) would help to further illustrate each scenario
- The wording of a 'stationary mobile phone camera' can be unclear
- The use of a '100km journey' was confusing and should be replaced by the time, e.g., '1 hour journey'
- There was some confusion around the inclusion of the speed limit for the mobile phone scenario
- For the scenarios regarding mobile phone detection cameras, the first sentence should talk about mobile phone use, instead of the speed limit, to avoid confusion
- The distance between the sign and camera should be included
- The word 'mobile' has two different meanings in this context (e.g. mobile phone and moveable camera). Therefore, it was stated that the use of the word 'mobile' in the phone scenarios should be changed to a synonym of that word

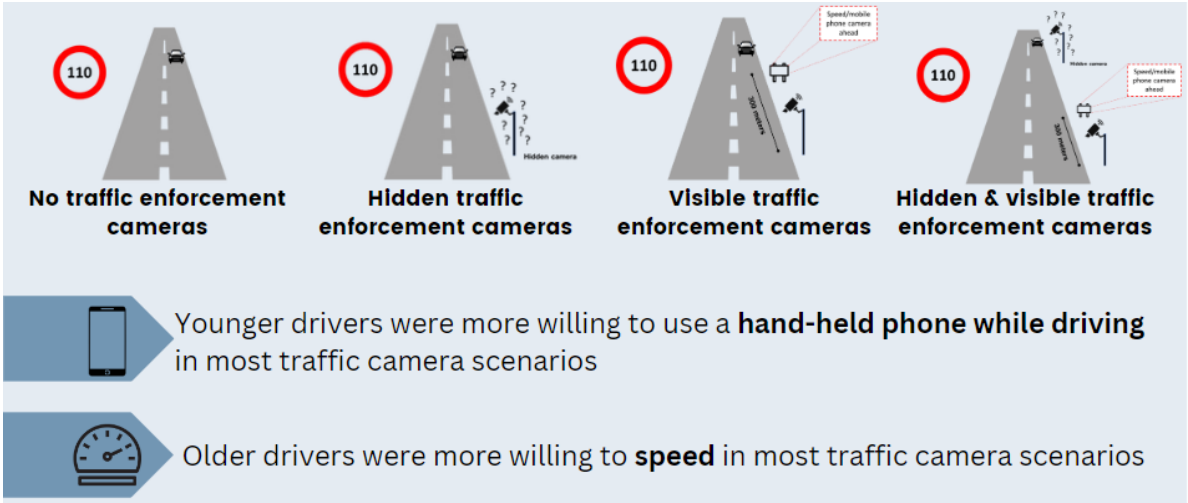
- The type of behaviour the 'mobile marked police van' is capturing needs to be made clear
- Fixed overt cameras were identified as more appropriate than moveable overt cameras, as it was stated they should remain in high crash zones
- The scenarios were perceived as appropriate for both mobile phone and speed detection cameras

The results from the focus groups will be used to guide the creation of the quantitative survey for Stage 2 of this project.

3. Study 2: Cross-sectional survey (Stage 2)

OVERVIEW OF KEY FINDINGS





A combination of overt and covert traffic enforcement cameras provides the optimal combination to maximise the deterrence effect, increase acceptance of the technology, and reduce willingness to engage in hand-held phone use while driving and speeding

3.1 OBJECTIVES

Study 2 involved a cross-sectional survey that was partially informed by Study 1 results. The objectives of the survey are outlined below.

1. Identify how different types of exposure to road rule enforcement impact: (a) perceptual deterrence, (b) offending behaviours and (c) recognition of the broader road safety problem;

2. Identify how personal factors either promote or dilute the effect of different types of mobile device detection camera signage.

3.2 METHOD

3.2.1 Procedure

We conducted a cross-sectional research study. Ethics approval was granted by the University of the Sunshine Coast Human Research Ethics Committee (A211660). Participants involved drivers in Australia who held an Australian driver's licence and were over the age of 17. Eligible participants provided consent via an online form and then completed the Qualtrics survey, which took approximately 25 minutes. Following survey completion, participants were able to enter the prize draw to win one of 20 AUD$50 gift cards. Participants entered their email address via a separate link and were contacted following data collection if they were a winner. The majority of participants were recruited through paid Facebook advertising Australia wide. In addition, a newsletter, flyers and posters were disseminated in the University of the Sunshine Coast and by email at Queensland University of Technology. Further, first year psychology students were recruited and could earn one course credit for their participation via an online platform (TakePart).

3.2.2 Materials

A questionnaire was developed as part of the study. The questionnaire had the following sections:

Demographic information

Demographic details were collected from participants to provide contextual information on the sample. The survey collected information on participants' age, gender, location and driving history.

Past driving behaviours

Illegal mobile phone use while driving was measured using the item *"In the past month, how often have you held a phone in your hand while driving?"* Past speeding behaviour was measured with the item "*In the past month, how often have you gone over the speed limit by 1km/h or more".* Both items were measured on a 5-point scale from 1 (never) to 5 (nearly all the time).

Past exposure to traffic enforcement cameras

In order to obtain an understanding of participants' exposure to traffic enforcement cameras within a reasonable time period for accurate memory recall, participants were asked *"In the past two weeks, how many times have you seen a speed camera while driving?"* If participants answered 1 time or more, they were then asked "*How many were supposed to be visible*?" and "*How many were supposed to be hidden?"* Similarly, participants were also asked *"In the past two weeks, how many times have you seen a mobile phone camera*

while driving?" Participants were asked the additional two questions outlined above if they answered 1 time or more.

Driving scenarios

Participants were presented with four different scenarios that represented potential road rule enforcement activities. Scenario development was informed by stage 1 of this project. Scenarios were presented to participants in a random order. The four scenarios included 1) no traffic enforcement, 2) covert traffic enforcement cameras, 3) overt traffic enforcement cameras with a warning sign around 300 metres from the camera, and 4) overt traffic enforcement cameras with a warning sign and covert enforcement cameras. Prior to the scenarios, participants were told "*Imagine that you are going for a 20-minute drive on a 110km/hr motorway. We are going to present some scenarios of potential road rule enforcement activities. Please read each scenario and provide responses*." Each scenario is presented in Figures 4-7.

For each enforcement scenario, participants were asked a series of questions to measure perceptions of deterrence, willingness to engage in the offending behaviours and recognition of the broader road safety problem. The deterrence questions were measured on a 7-point Likert scale from 1 (strongly disagree) to 7 (strongly agree). Four questions were asked related to deterrence (two for speeding and two for phone use while driving), based on previously established items (e.g., Freeman et al., 2017; Freeman & Watson, 2006, Freeman & Watson, 2009, Homel, 1988; Truelove et al., 2017) and reworded to fit each scenario. One item was used to measure drivers' perceived certainty of apprehension, *"My chances of being caught speeding would be high".* The other item measured perceptions of punishment avoidance, *"I would be able to speed and not be caught*".

Willingness to engage in the offending behaviours was measured on a 7-point scale from 1 (not willing at all) to 7 (very willing). Willingness to speed was measured with *"I am willing to drive over the speed limit by 1km/h or more*" and willingness to illegally use a phone while driving was measured with "*I am willing to use a hand-held phone while I am driving in this drive".*

To understand drivers' recognition of the broader safety problem, first participants were asked "*How likely do you think it is that traffic enforcement in this scenario would decrease the chances of having a crash for you personally".* This item was measured on a 7-point scale from 1 (very unlikely) to 7 (very likely). Further, participants were asked "*Describe your immediate feelings towards the camera enforcement in this scenario*" on a 7-point scale from 1 (very negative) to 7 (very positive).

There are no traffic enforcement cameras.

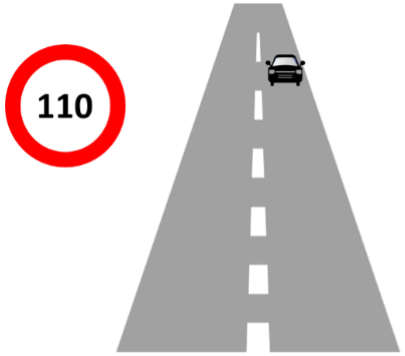


Figure 4. Scenario 1: No traffic enforcement

There are hidden traffic enforcement cameras.

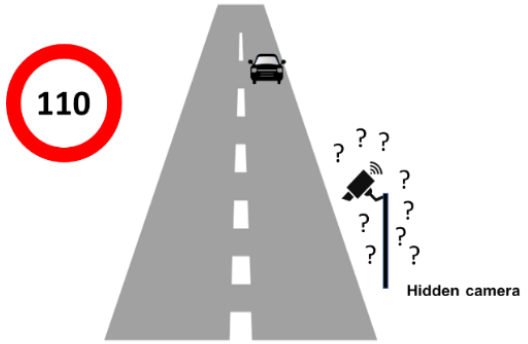


Figure 5. Scenario 2: Covert camera enforcement

There are traffic enforcement cameras with a warning sign. The sign is located around 300 meters from the camera.

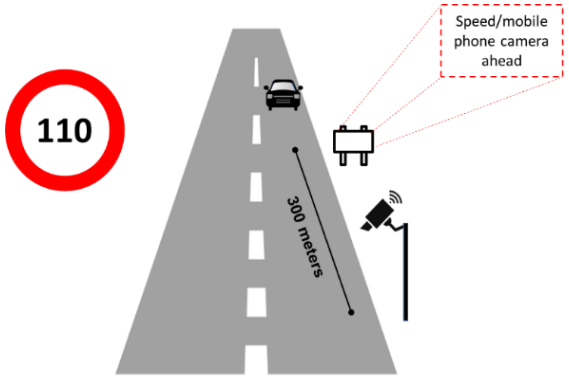


Figure 6. Scenario 3: Overt camera enforcement

There are traffic enforcement cameras with a warning sign and hidden enforcement cameras. When available, the warning sign is located around 300 meters from the camera. There is no warning sign for the hidden camera.

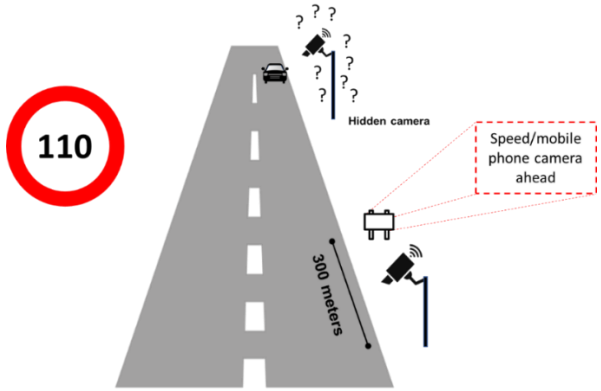


Figure 7. Scenario 4: A combination of both covert and overt camera enforcement

3.2.3 Data analysis

First, descriptive data are reported to provide an understanding of the sample. Specifically, an overview of participant characteristics is provided, followed by the extent to which participants have recently been exposed to traffic enforcement, including overt and covert speed and mobile phone detection cameras, as well as police presence. Further, demographic characteristics are analysed by engagement in speeding and phone use while driving. To address objective 1, a series of repeated measures ANOVAs were conducted to determine differences in 1) willingness to engage in the offending behaviours, 2) deterrent perceptions and 3) recognition of the broader road safety problem across the four different traffic enforcement camera scenarios. If the sphericity assumptions was breached, the Greenhouse-Geisser correction was used for scores above 0.75, while the Hund-Feldt correction was used if the score was below 0.75. Cohen's d was used to interpret the effect size, with scores of .2 indicating a small effect, .5 a medium effect and .8 a large effect.

To address objective 2, drivers' reported willingness to engage in the offending behaviour in each traffic enforcement scenario was analysed by the personal characteristics of age and gender. Age was categorised into two groups, including younger drivers aged between 17-25 years and older drivers aged over 25 years. This is because previous research has identified that drivers aged under 25 years are overrepresented in crash statistics and are more likely to engage in risky driving behaviours (e.g., Cassarino & Murphy, 2018; Fleiter et al., 2006; Scott-Parker & Oviedo-Trespalacios, 2017; Wilson et al., 2013). Hedges g was reported for the effect size, to account for the different sample sizes in each group. Scores of .2 indicated a small effect, .5 a medium effect and .8 a large effect. Bootstrapping was used to account for any violations in normality.

3.3 RESULTS

3.3.1 Participants

A total of 1168 individuals participated in the study. The average age of participants was 48.8 years (*SD* = 20.45), ranging from 17 to 88 years. There were 660 (56.5%) males and 508 (43.5%) females. The majority of participants held an open driver's licence (*n* = 924, 79.1%), followed by a provisional 2 licence (*n* = 110, 9.4%), provisional 1 licence (n = 108, 9.2%), learners licence (*n* = 21, 1.8%) and restricted or suspended licence (n = 5, 0.5%). A total of 387 participants (33.1%) had received a speeding ticket in the last 5 years while only 23 participants (2%) had received an infringement notice for illegal phone use while driving in the last 5 years. Further, 186 drivers (15.9%) had reported previously losing their driver's licence. On average, drivers spend 14.65 (*SD* = 31.5) hours per week driving. Table 2 displays the Australian states and territories where participants were located.

Key finding:

Speeding and illegal phone use while driving remains high among Australian drivers.

Table 2. Percentage and number of participants located in each Australian state and territory.

	%	n
ACT	7.2%	84
NSW	24.1%	282
NT	0.6%	7
QLD	47.7%	47
SA	4.0%	557
TAS	1.1%	98
VIC	8.4%	80
WA	6.8%	13

3.3.2 Self-reported speeding behaviour

Self-reported engagement in speeding is reported in Figure 8. The mean score (*M* = 2.99; *SD* = 1.15) suggests that on average, the sample 'sometimes' engaged in speeding over the limit by 1km/h or more in the past month.

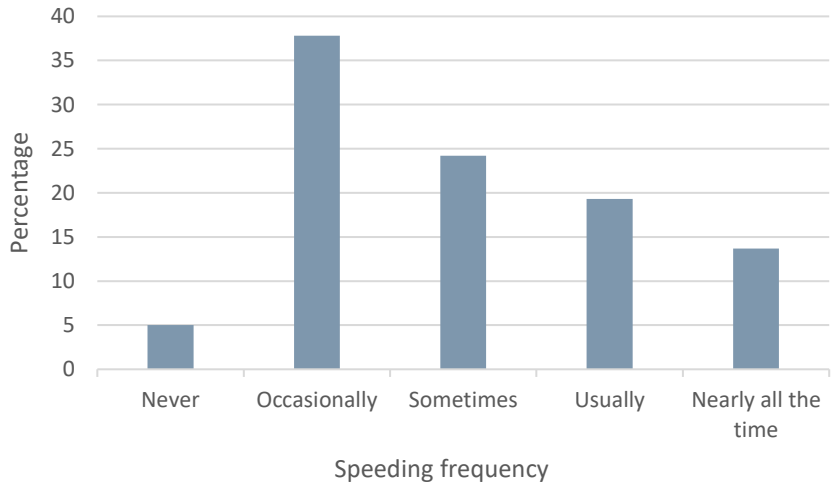


Figure 8. Self-reported engagement in driving over the speed limit by 1km/h or more in the past month

3.3.3 Differences in speeding behaviour by demographic variables

To understand the differences in those who speed and don't speed, the self-reported engagement in speeding variable was dichotomised into those who report never speeding and those who report speeding at some point. In total, 1110 participants reported speeding at some point while 58 participants reported never speeding. This variable was then used to analyse differences in age and gender between those who speed and don't speed. Independent samples *t*-tests were used on continuous variables and chi square tests were used on categorical variables.

Speeding and age

There was no significant difference between the age of drivers who admit to speeding and drivers who do not speed (p = .940).

Speeding and gender

The proportion of males and females who engaged in speeding did not differ between speeders and non-speeders (p = .545).

3.3.4 Self-reported hand-held phone use while driving

Self-reported engagement in hand-held phone use while driving is reported in Figure 9. The mean score (M = 1.38; SD = 0.69) represents a score between 'never' and 'occasionally' using a phone while driving in the last month.

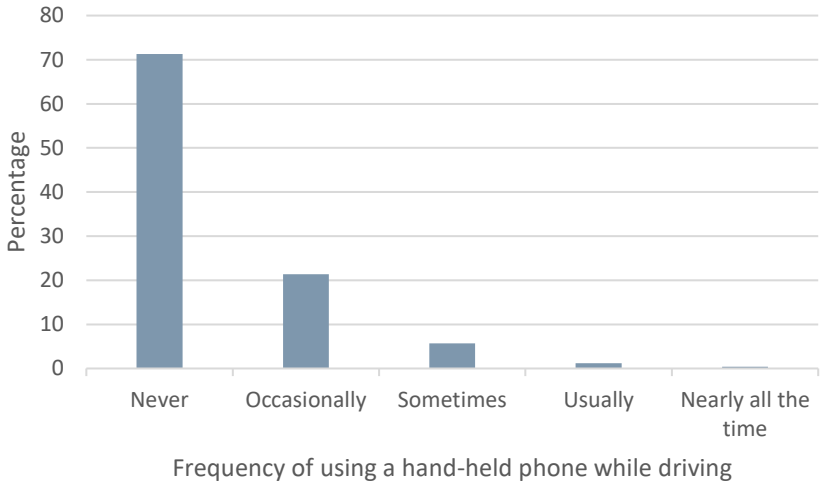


Figure 9. Self-reported engagement in handheld phone use while driving in the past month

3.3.5 Differences in phone use while driving behaviour by demographic variables

To understand the differences in those who do and don't illegally use their phone while driving, the self-reported engagement in phone use while driving variable was dichotomised into those who report never using their phone while driving and those who report engaging in this behaviour at some point. In total, 833 participants reported never using a hand-held phone while driving, while 335 participants reported engaging in this behaviour at some point. This variable was then used to analyse differences in age and gender between those who do and don't use a phone while driving. Independent samples t-tests were used on continuous variables and chi square tests were used on categorical variables.

Hand-held phone use and age

Results indicated significant differences between age in drivers who report engaging in hand-held phone use while driving (M = 39.98, SD = 19.46) and drivers who do not engage in the behaviour (M = 52.38, SD = 19.78), t(1165), 1.33, p < .001. The results suggest that younger drivers are more likely to engage in hand-held phone use while driving than older drivers.

Hand-held phone use and gender

The proportion of males and females who engaged in hand-held phone use while driving did not differ (p = .341).

3.3.6 Exposure to enforcement

The majority of the sample reported seeing overt (n = 891) and/or covert (n = 869) detection cameras during the past two weeks, with the distribution of responses displayed in Figure 10.

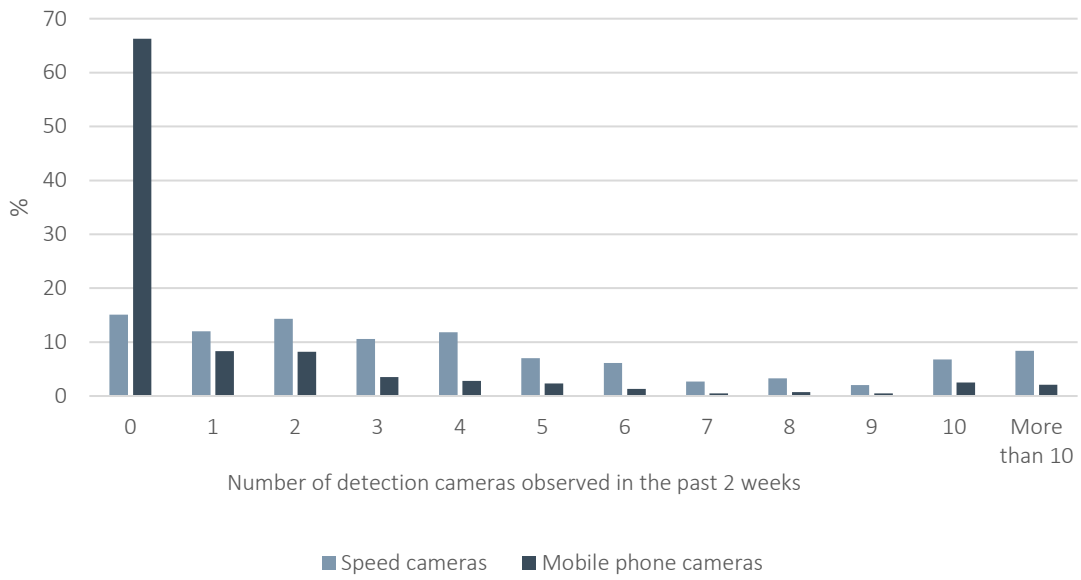


Figure 10. The frequency of detection cameras seen while driving in the past two weeks

Participants reported seeing an average of 4.54 (SD = 6.60) overt speed detection cameras over the past two weeks, with responses ranging between 0 and 70. The data was positively skewed, which can be viewed in Figure 11. Participants reported seeing approximately 1.63 (*SD* = 3.66) covert speed cameras in a two-week period, ranging from 0 to 50 cameras. Again, the data was positively skewed, which can be viewed in Figure 12.

Key finding:

Most participants reported seeing both overt and covert traffic enforcement cameras, with overt cameras being viewed more frequently than covert cameras.

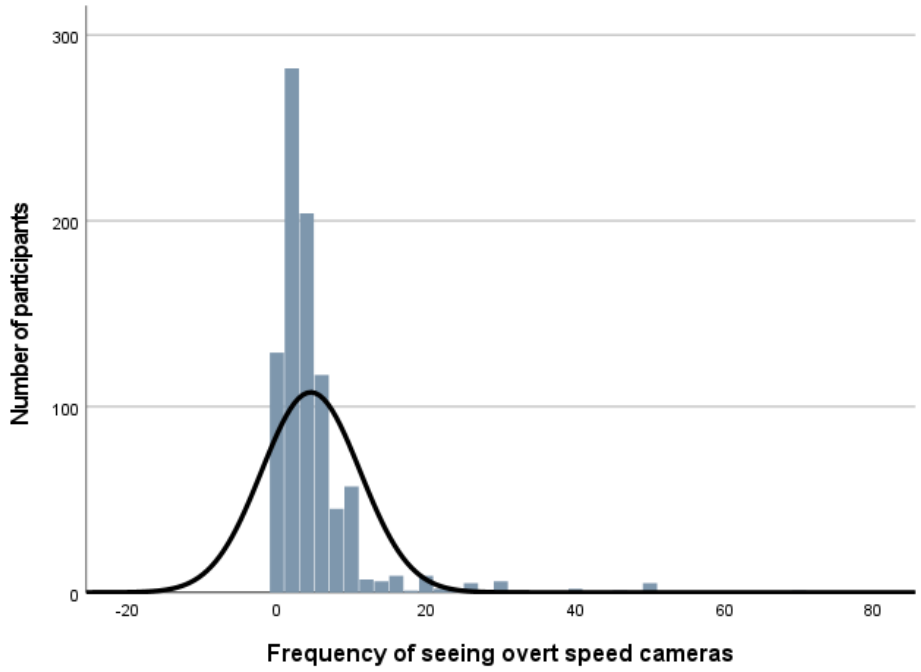


Figure 11. Distribution of overt speed detection cameras seen in the past two weeks

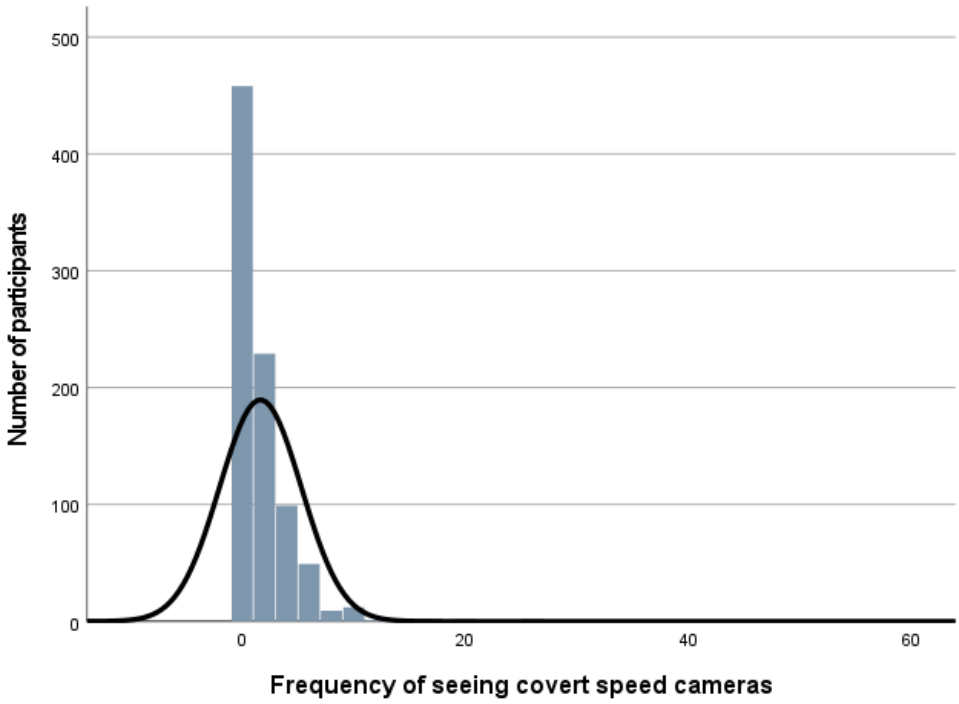


Figure 12. Distribution of covert speed detection cameras seen in the past two weeks

In comparison to speed cameras, a smaller number of participants reported seeing an overt (*n* = 326) and/or covert (*n* = 313) mobile phone detection camera in the past two weeks. On average, participants saw 2.37 overt (*SD* = 3.97; range 0-50) and 1.44 covert (*SD* = 2.67; range 0-20) mobile phone detection cameras. Figures 13 and 14 show both covert and overt cameras, the data was positively skewed.

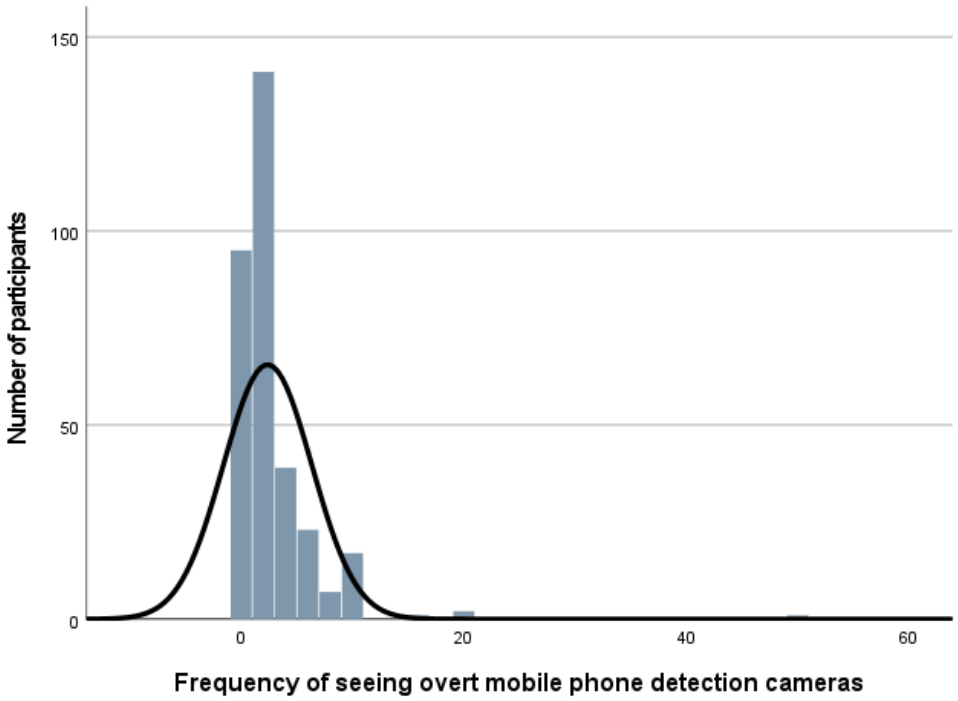


Figure 13. Distribution of overt mobile phone detection cameras seen in the past two weeks

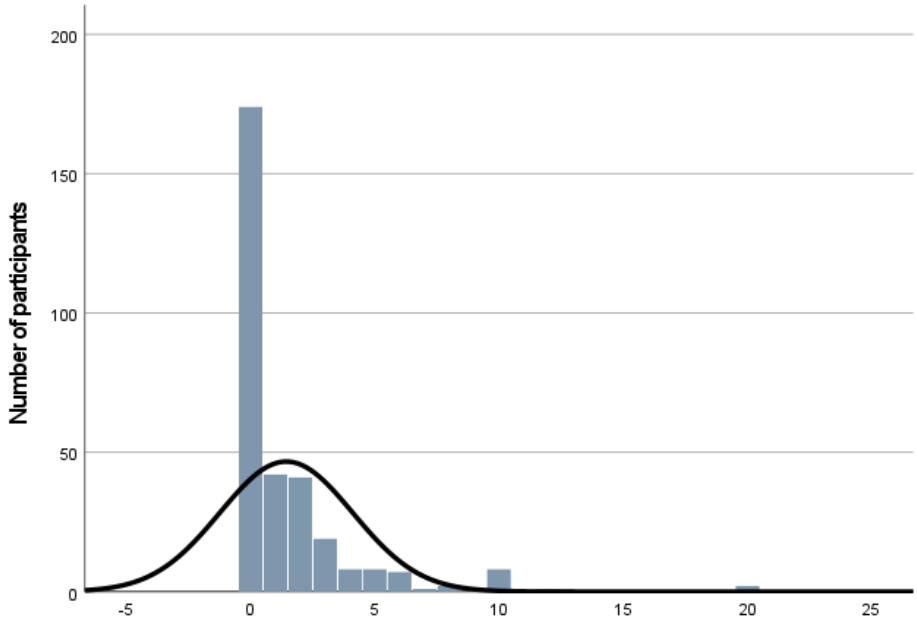


Figure 14. Distribution of covert mobile phone detection cameras seen in the past two weeks

3.4 THE IMPACT OF DIFFERENT CAMERA ENFORCEMENT SCENARIOS ON WILLINGNESS TO ENGAGE IN OFFENDING BEHAVIOUR, DETERRENT PERCEPTIONS AND RECOGNITIONS OF THE BROADER ROAD SAFETY PROBLEM

Key finding:

Combining overt and covert traffic enforcement cameras is the best enforcement strategy to reduce speeding and hand-held phone use while driving. This is because simultaneously using overt and covert traffic enforcement cameras provides the optimal combination for increasing the deterrence effect, increasing acceptance of the technology, and reducing willingness to engage in the offending behaviours.

3.4.1 Speeding

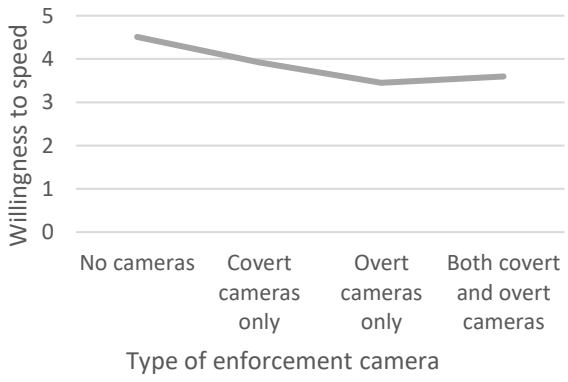
Willingness to speed

The first analysis aimed at identifying changes in willingness to speed in consideration to the four different traffic enforcement camera scenarios. A repeated measures ANOVA with a Huynh-Feldt correction found that drivers' willingness to speed was significantly different based on the type of enforcement camera scenario, $F(3, 3308) = 200.317$, $p < .001$. Drivers were most willing to speed in the no enforcement camera scenario compared to the covert camera scenario ($p < .001$, $d = .31$), overt camera scenario ($p < .011$, $d = .55$), and mixture of both covert and overt cameras scenario ($p < .001$, $d = .48$). The differences were most marked between the overt camera scenario and no camera scenario. Drivers were also significantly more willing to speed in the covert camera scenario compared to the overt camera condition ($p < .001$, $d = .24$) and mixture of both covert and overt cameras condition ($p < .011$, $d = .17$), however these differences had small effect sizes. Further, drivers were significantly more willing to speed in the mixture of both covert and overt cameras condition compared to the overt camera only condition ($p < .01$, $d = .08$), with a very small effect size. Means and standard deviations are presented in Table 3, and means are visually displayed in Figure 15.

Table 3. Willingness to speed

Scenario	*Mean (SD)*
No cameras	4.51 (1.88)
Covert cameras only	3.92 (1.91)
Overt cameras only	3.45 (1.99)
Both covert and overt cameras	3.60 (1.94)

Figure 15. Willingness to speed



Deterrence

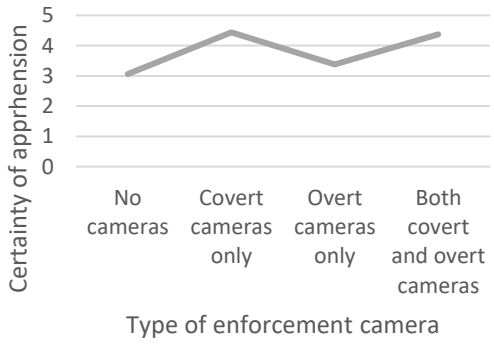
Certainty of Apprehension for Speeding

Differences in the perceived certainty of being apprehended for speeding was analysed between the different traffic camera enforcement scenarios. A repeated measures ANOVA with a Huynh-Feldt correction identified that drivers' perceptions of the certainty of being caught speeding was significantly different based on the type of scenario, $F(3, 3314) = 225.477$, $p < .001$. Post hoc analyses revealed that drivers' perceived certainty of apprehension was significantly lower in the scenario with no enforcement cameras compared to the scenario with covert cameras ($p < .001$, $d = 0.73$, showing a large effect size), overt cameras ($p < .001$, $d = 0.16$, showing a small effect size), and a mixture of both overt and covert cameras ($p < .001$, $d = 0.67$, showing a large effect size). Perceived certainty of apprehension was significantly higher in the covert camera condition compared to the overt camera condition ($p < .001$, $d = 0.49$). However, there was no significant difference in perceived certainty between the covert camera scenario and the mixture of covert and overt camera scenario ($p = .957$). Drivers did have a higher perception of the certainty of being caught in the combined covert and overt camera scenario than in the overt only camera condition ($p < .001$, $d = 0.45$). Means and standard deviations are presented in Table 4, and means are visually displayed in Figure 16.

Table 4. Speeding certainty of apprehension

Scenario	*Mean (SD)*
No cameras	3.06 (1.72)
Covert cameras only	4.44 (2.05)
Overt cameras only	3.38 (2.28)
Both covert and overt cameras	4.37 (2.16)

Figure 16. Speeding certainty of apprehension



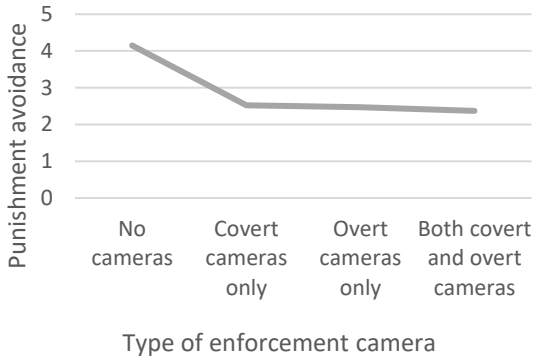
Punishment Avoidance for Speeding

Differences in the perceived ability to avoid being caught and punished for speeding were analysed between the different traffic camera enforcement scenarios. A repeated measures ANOVA with a Huynh-Feldt correction identified that there was a significant difference in perceptions towards punishment avoidance based on the different enforcement camera scenarios, $F(3, 3140) = 483.47$, $p < .001$. Post hoc analyses demonstrated that perceptions of being able to avoid punishment for speeding was significantly higher in the no camera scenario compared to the covert camera condition ($p < .001$, $d = 0.97$), overt camera condition ($p < .001$, $d = 0.94$), and mixture of both covert and overt camera condition ($p < .001$, $d = 1.06$). Perceptions of punishment avoidance were also significantly higher in the covert camera condition compared to the mixture of both covert and overt cameras, ($p < .001$, $d = 0.10$), yet this was a small effect. There was no significant difference in punishment avoidance between the covert and overt cameras conditions ($p = 1.00$), or between the overt and mixture of both covert and overt conditions ($p = .269$). Means and standard deviations are presented in Table 5, and means are visually displayed in Figure 17.

Table 5. Speeding punishment avoidance

Scenario	*Mean (SD)*
No cameras	4.15 (1.79)
Covert cameras only	2.52 (1.58)
Overt cameras only	2.47 (1.79)
Both covert and overt cameras	2.37 (1.55)

Figure 17. Speeding punishment avoidance



3.4.2 Hand-held phone use and driving

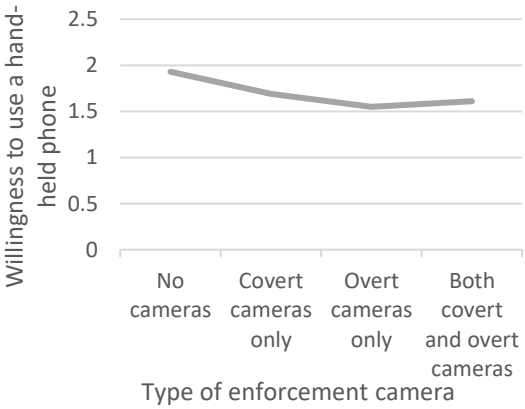
Willingness to use a phone while driving

Differences in the perceived willingness to use a hand-held phone while driving were analysed between the different traffic camera enforcement scenarios. A repeated measures ANOVA with a Huynh-Feldt correction identified a significant difference in willingness to use a hand-held phone while driving between scenarios, $F(2.70, 3150.14) = 61.194$, $p < .001$. Drivers were most willing to use a hand-held phone in the no camera condition, with significantly higher willingness in this condition compared to the covert camera ($p < .001$, $d = 0.17$), overt camera ($p < .001$, $d = 0.29$) and mixture of covert and overt cameras condition ($p < .001$, $d = 0.24$). Drivers were significantly more willing to illegally use their phone while driving in the covert camera condition compared to the overt camera condition ($p < .001$, $d = 0.12$) and the mixture of both overt and covert cameras condition ($p < .01$, $d = 0.07$), however effect sizes were small. There was no significant difference in willingness to use a hand-held phone while driving in the overt and mixture of both and overt and covert cameras conditions ($p = .155$). Means and standard deviations are presented in Table 6, and means are visually displayed in Figure 18.

Table 6. Willingness to drive with a hand-held phone

Scenario	*Mean (SD)*
No cameras	1.93 (1.50)
Covert cameras only	1.69 (1.23)
Overt cameras only	1.55 (1.11)
Both covert and overt cameras	1.61 (1.14)

Figure 18. Willingness to drive with a hand-held phone



Deterrence

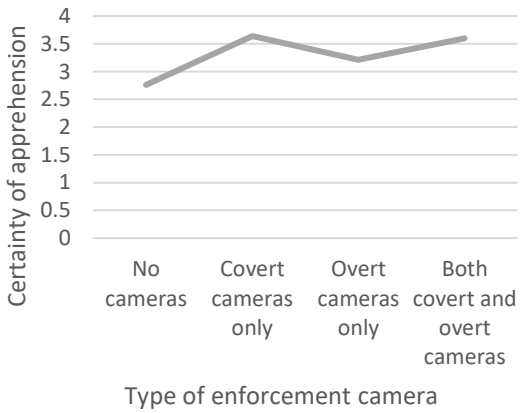
Certainty of Apprehension for Phone Use While Driving

Differences in the perceived certainty of being apprehended for using a hand-held phone while driving were analysed between the different traffic camera enforcement scenarios. A repeated measures ANOVA with a Huynh-Feldt correction identified a significant difference in perceived certainty of being apprehended for hand-held phone use while driving between the scenarios, $F(3, 3363) = 92.792$, $p < .001$. Drivers had the highest perceived chance of being caught for this offence in the mixture of both overt and covert cameras scenario, with significantly higher certainty of apprehension in this scenario compared to no camera enforcement ($p < .001$, $d = 0.45$) and overt camera enforcement ($p < .001$), $d = 0.21$). There was no significant difference between covert camera enforcement and the mixture of both overt and covert cameras enforcement. Perceived certainty of apprehension was also significantly higher in the covert camera enforcement scenario than in the no camera scenario ($p < .001$, $d = 0.42$) and the overt camera scenario ($p < .001$, $d = 0.18$). Drivers also had a significantly higher perceived chance of being caught in the overt camera scenario than in the no camera scenario ($p < .001$, $d = 0.21$). Means and standard deviations are presented in Table 7, and means are visually displayed in Figure 19.

Table 7. Certainty of apprehension for phone use while driving

Scenario	*Mean (SD)*
No cameras	2.76 (1.81)
Covert cameras only	3.64 (2.33)
Overt cameras only	3.21 (2.37)
Both covert and overt cameras	3.72 (2.42)

Figure 19. Certainty of apprehension for phone use while driving



Punishment Avoidance for Phone Use While Driving

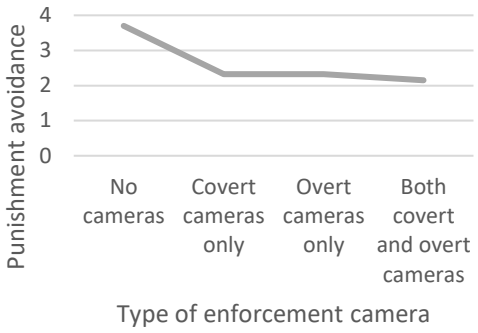
Differences in perceived ability to avoid being caught and punished for using a hand-held phone while driving were analysed between the different traffic enforcement camera scenarios. A repeated measures ANOVA with a Huynh-Feldt correction identified perceptions of punishment avoidance were significantly different between the scenarios, $F(3, 3044) = 347.473$, $p < .001$. Drivers were significantly more likely to believe they would be able to avoid punishment in the no camera enforcement scenario compared to the covert camera scenario ($p < .001$, $d = 0.78$), overt camera scenario ($p < .001$, $d = 0.75$) and mixture of both overt and covert cameras scenario ($p < .001$, $d = 0.89$), with all differences exhibiting a large effect size. Drivers believed they were more likely to avoid punishment in the covert camera scenario compared to the mixture of overt and covert cameras scenario ($p < .001$, $d = 0.11$). There was no significant difference in perceived punishment avoidance between

the covert and overt camera scenarios (p = 1.00). Drivers perceived they were significantly more likely to avoid punishment in the overt camera only scenario compared to the mixture of both overt and covert cameras scenario (p < .01, d = 0.10). Means and standard deviations are presented in Table 8, and means are visually displayed in Figure 20.

Table 8. Punishment avoidance for phone use while driving

Scenario	*Mean (SD)*
No cameras	3.70 (1.95)
Covert cameras only	2.32 (1.57)
Overt cameras only	2.32 (1.74)
Both covert and overt cameras	2.15 (1.51)

Figure 20. Punishment avoidance for phone use while driving



3.4.3 Recognition of the impact of the traffic enforcement cameras on the road safety problem

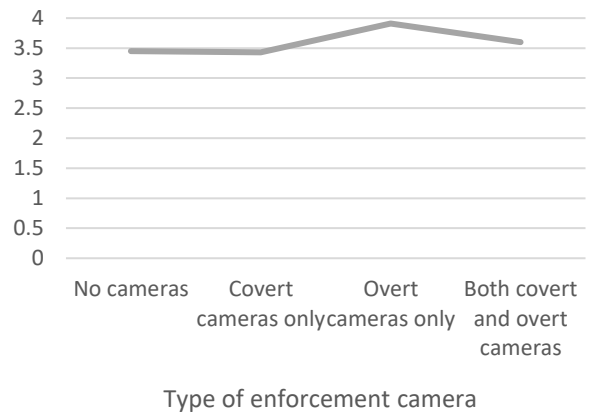
Perception that the traffic enforcement camera scenario would decrease their chance of having a crash

Differences in the perceptions that the traffic enforcement camera scenario would decrease participants' chance of having a crash were analysed between each scenario. A repeated measures ANOVA with a Huynh-Feldt correction identified there was a significant difference in drivers' perceived likelihood that the traffic enforcement scenario would decrease their chance of having a crash, between the four different scenarios, F(3, 3322) = 35.090, p < .001. The overt camera scenario and mixture of both overt and covert cameras scenario were found to have the highest perceived likelihood of decreasing drivers' chance of crashing, with no significant difference in these two conditions (p = .054). The overt camera scenario was significantly higher than the no camera condition (p < .001, d = 0.21), and covert camera condition (p < .011, d = 0.22). There was also no significant difference in perceived likelihood of a reduced crash risk between the no camera condition and covert camera condition (p = 1.00). Drivers believed the combined covert and overt cameras condition significantly lowered their crash risk compared to the no camera condition (p < .001, d = 0.16), however the effect size was small. Drivers also believed the mixture of both overt and covert cameras lowered their crash risk significantly more than the covert camera condition (p < .011, d = 0.16). Means and standard deviations are presented in Table 9, and means are visually displayed in Figure 21.

Table 9. Likelihood that the enforcement scenario would decrease chance of crashing

Scenario	*Mean (SD)*
No cameras	3.45 (2.06)
Covert cameras only	3.43 (2.16)
Overt cameras only	3.91 (2.22)
Both covert and overt cameras	3.78 (2.19)

Figure 21. Likelihood that the enforcement scenario would decrease chance of crashing



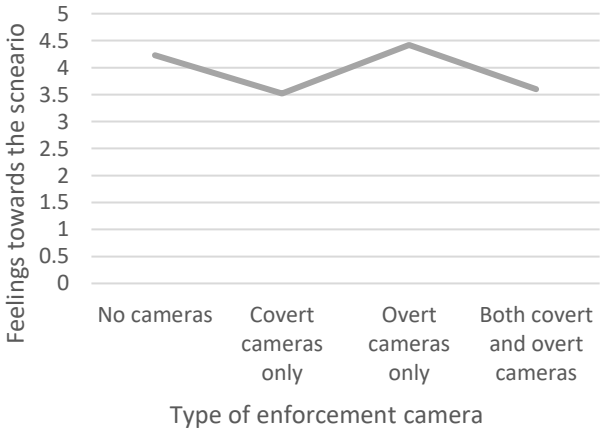
Feelings towards camera enforcement

Differences in the feelings towards the various traffic enforcement camera scenarios were analysed between each scenario (with a score of 1 representing very negative feelings towards the cameras and a score of 7 representing very positive feelings towards the cameras). A repeated measures ANOVA with a Greenhouse-Geisser correction identified a significant difference in drivers' feelings towards the camera enforcement scenarios, $F(2, 2470) = 113.779$, $p < .001$. The overt camera scenario was the most accepted, with significantly more favourable feelings towards this scenario than the no camera scenario ($p < .01$, $d = 0.10$), covert camera scenario ($p < .001$, $d = 0.43$) and mixture of both covert and overt camera scenario ($p < .001$, $d = 0.35$). Drivers were also significantly more accepting of the no camera scenario than the covert camera scenario ($p < .011$, $d = 0.34$) and mixture of covert and overt cameras scenario ($p < .011$, $d = 0.26$). The combined covert and overt cameras scenario was perceived significantly more positively than the covert camera scenario ($p < .011$, $d = 0.08$). Means and standard deviations are presented in Table 10, and means are visually displayed in Figure 22.

Table 10. Feelings towards enforcement camera scenarios

Scenario	*Mean (SD)*
No cameras	4.23 (1.90)
Covert cameras only	3.52 (2.21)
Overt cameras only	4.42 (2.00)
Both covert and overt cameras	3.69 (2.21)

Figure 22. Feelings towards enforcement camera scenarios



3.4.4 Demographics of drivers who are more willing to engage in offending behaviours in each traffic enforcement camera scenario

To understand the characteristics of participants who were more willing to engage in the offending behaviours in each traffic camera enforcement scenario, a series of *t*-tests were conducted.

Key finding:

Overall, younger drivers were more willing to use a hand-held phone while driving and older drivers are more willing to speed in most traffic camera scenarios. Males were consistently more willing to speed in all scenarios while there was no significant difference in willingness to use a phone while driving between genders in all scenarios.

No traffic enforcement cameras

The first analysis aimed at identifying any differences in willingness to engage in the offending behaviour when there are no traffic enforcement cameras by age and gender, with means presented in Figures 23 and 24. Younger drivers (M = 4.86, SD = 1.88) were significantly more willing to speed in the no camera scenario than older drivers (M = 4.39, SD = 1.87), $t(1165) = 3.64$, $p < .01$, hedges g = .25. Younger drivers (M = 2.49, SD = 1.71) were also significantly more willing to use a hand-held phone while driving in the no camera scenario compared to older drivers (M = 1.74, SD = 1.32), $t(397) = 6.7$, $p < .001$, hedges g = .52. Males were significantly more willing to speed (M = 4.67, SD = 1.89) when there were no traffic enforcement cameras compared to females (M = 4.29, SD = 1.85), $t(1166) = 3.43$, $p < .001$, hedges g = .20. There was no significant difference in willingness to use a hand-held phone while driving in the no camera enforcement scenario between genders.

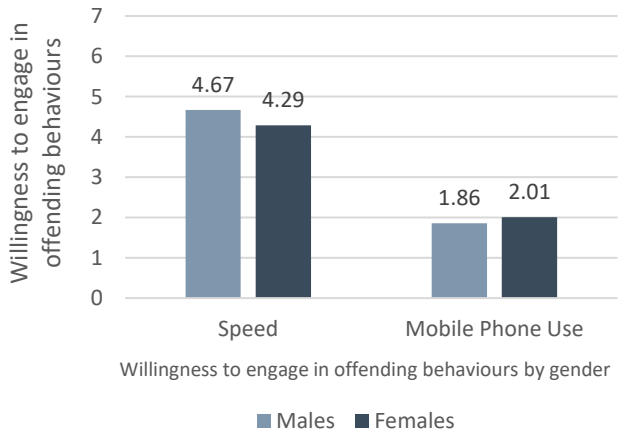


Figure 23. Willingness to engage in offending behaviours when there is no traffic enforcement camera between genders

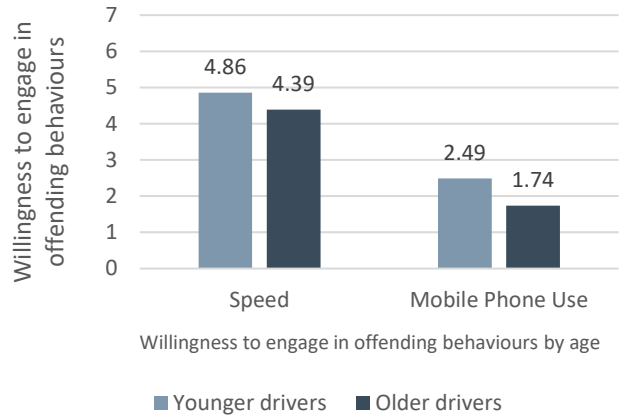


Figure 24. Willingness to engage in offending behaviours when there is no traffic enforcement camera between ages

Covert traffic enforcement cameras

Differences in willingness to engage in the offending behaviour when there are covert traffic enforcement cameras were analysed by age and gender, with means presented in Figures 25 and 26. There was no significant difference in willingness to speed in the covert camera scenario between age groups, $p = .868$. Younger drivers ($M = 2.16$, $SD = 1.57$) were more willing to use hand-held phone while driving in the covert camera scenario compared to older drivers ($M = 1.53$, $SD = 1.06$), $t(367) = 6.28$, $p < .001$, hedges g = .52. Significant differences were found between males ($M = 4.22$, $SD = 1.91$) and females ($M = 3.54$, $SD = 1.83$) willingness to speed in the hidden traffic enforcement camera scenario, $t(1114) = 6.17$, $p < .001$, hedges g = .36. That is, males were more willing to speed in the scenario than females. No significant differences were found between genders and willingness to engage in hand-held phone use while driving.

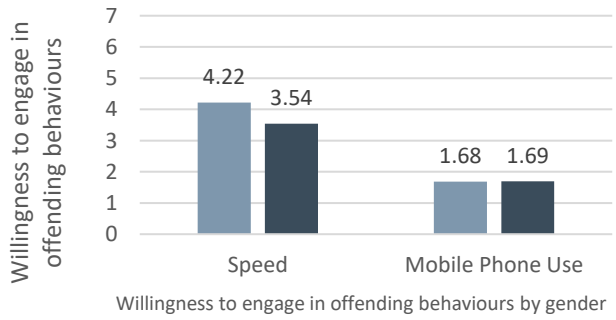


Figure 25. Willingness to engage in offending behaviours when there are covert cameras between genders

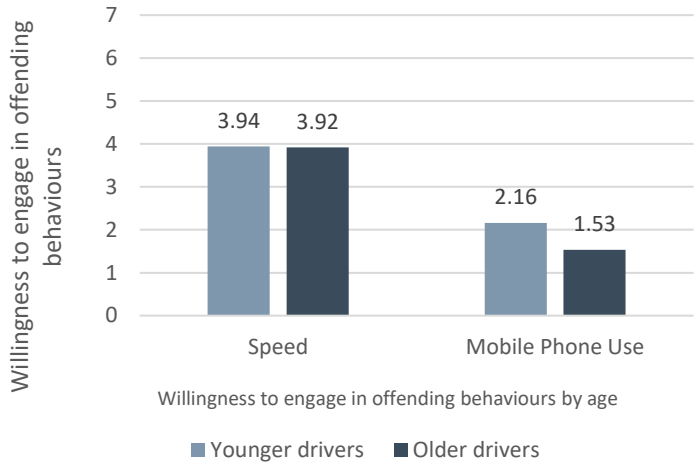


Figure 26. Willingness to engage in offending behaviours when there are covert cameras between ages

Overt traffic enforcement cameras

Differences in willingness to engage in the offending behaviour when there are overt traffic enforcement cameras were analysed by age and gender, with means presented in Figures 27 and 28. Firstly, older drivers (*M* = 3.52, *SD* = 1.99) were significantly more willing to speed than younger drivers (*M* = 3.21, *SD* = 2.0) in this condition, $t(1165) = -2.26$, $p < .05$, hedges g =-.15. Further, significant differences were found between younger (*M* = 1.77, *SD* = 1.35) and older drivers' (*M* = 1.48, *SD* = 1.01) willingness to engage in hand-held phone use while driving, $t(389) = 3.38$, $p < .05$, hedges g = .27. In other words, younger drivers were more willing to use a hand-held phone while driving in the overt camera scenario. Males (*M* = 3.75, *SD* = 2.09) were more willing to speed in the overt camera scenario than females (*M* = 3.06, *SD* = 1.80), $t(1152) = 5.98$, $p < .001$, hedges g = .35. However, no significant differences were found between genders and willingness to engage in hand-held phone use while driving.

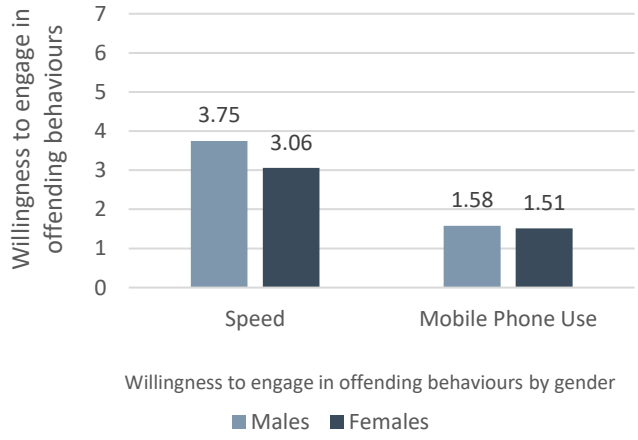


Figure 27. Willingness to engage in offending behaviours when there are overt cameras between genders

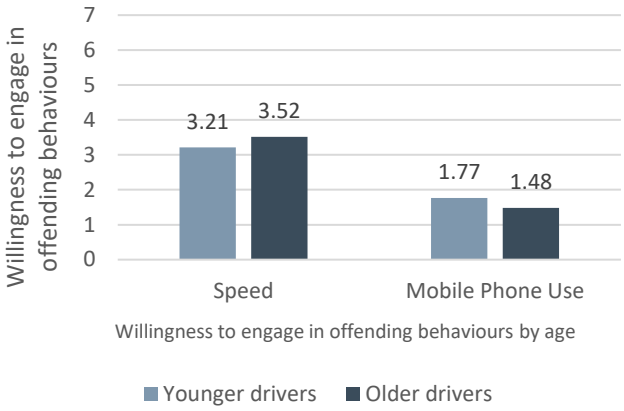


Figure 28. Willingness to engage in offending behaviours when there are overt cameras between ages

Both covert and overt traffic enforcement cameras

Differences in willingness to engage in the offending behaviour when there are both overt and covert traffic enforcement cameras were analysed by age and gender, with means presented in Figures 29 and 30. There were no significant differences between younger and older drivers' willingness to speed in the combined covert and overt camera scenario. However, significant differences were found between younger drivers (M = 1.86, SD = 1.37) and older drivers (M = 1.53, SD = 1.04) willingness to engage in hand-held phone use while driving, $t(394) = 3.72$, $p < .05$, hedges g = .29, with younger drivers more willing to use a hand-held phone than older drivers. Significant differences were also found between genders and willingness to speed in the scenario, $t(1133) = 6.93$, $p < .001$, hedges g = .40. Specifically, males (M = 3.93, SD = 1.98) were more willing to speed than females (M = 3.16, SD = 1.81). However, no significant differences were found between genders and willingness to engage in hand-held phone use while driving.

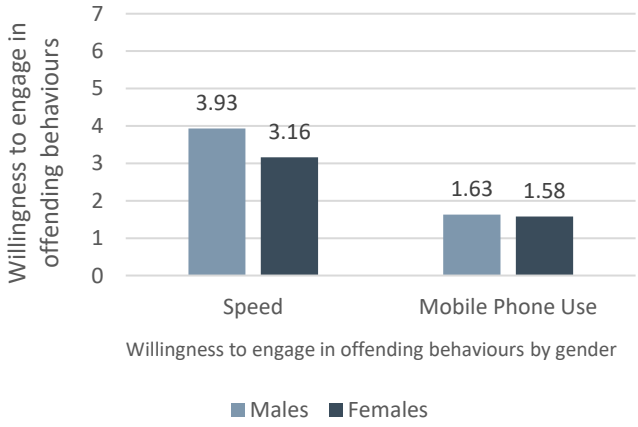


Figure 29. Willingness to engage in offending behaviours when there are both covert and overt cameras between genders

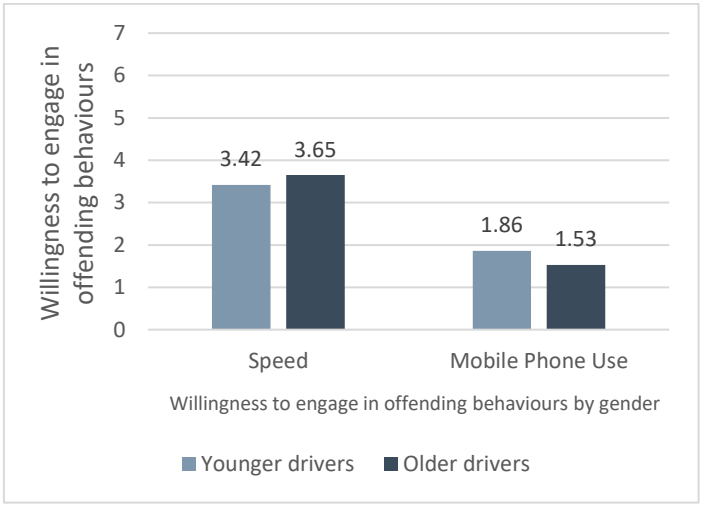


Figure 30. Willingness to engage in offending behaviours when there are both covert and overt cameras between genders

4. Discussion

This project aimed to identify the road rule camera enforcement approach that has the most salience in creating a strong deterrent effect against mobile phone use while driving and speeding violations. Overall, the findings from both Study 1 and Study 2 suggest that a combination of both overt and covert traffic enforcement cameras provide the optimal combination to (1) maximise deterrence, (2) decrease engagement in offending behaviour and (3) be perceived as acceptable by drivers, for both speeding and phone use while driving enforcement. However, as identified in Study 1, since mobile phone detection cameras are new to the ACT, it is suggested that the implementation of these cameras should be combined with a high-profile advertisement campaign to allow the mixture of overt and covert cameras to gain the most acceptance and have a higher impact on reducing offending behaviour.

Study 1 provides important depth to understanding why a combination of both overt and covert cameras can be considered the optimal enforcement method for both speed and mobile phone detection cameras. Covert cameras had the perceived advantage of being able to deter drivers from engaging in the offending behaviours over a longer period of time compared to overt cameras. This is supported by previous speed camera research that found more variance in speed when overt cameras were implemented (Keenan & Maunsell, 2003; Marciano et al., 2015). Further, previous studies have also found that speeding and crashes were reduced on a larger proportion of high-speed roads when overt speed cameras were changed to covert cameras in conjunction with warning signs (Keall et al., 2001; 2002). The results from Study 1 also suggest that the use of signs that warn drivers enforcement cameras may be present would be beneficial for covert speed and mobile phone enforcement cameras. Specifically, the use of such signs are suggested to 1) increase awareness that drivers have a chance of being caught breaking the road rules to increase the deterrent effect (especially if the signs are used on the larger road network) and 2) increase acceptance of the cameras as drivers may perceive the use of warning signs with covert cameras to be less 'sneaky'. In addition, the use of warning signs for covert cameras were also suggested to be useful in the context of updated technology that can notify drivers of the location of the technology e.g., via applications such as Google maps, Waze etc. Considering that such technology is readily available, it was suggested that the use of covert cameras may then have a similar effect to overt cameras, yet without the increased acceptance. However, the use of warning signs was suggested to counterbalance that effect at least somewhat, such that drivers would still have a higher acceptance of the cameras, even if they were told via the technology that there was a covert camera present. Notably, many participants still believed that the technology that can notify drivers of enforcement cameras would not always be accurate and therefore could not be completely relied upon. Study 1 also identified that the use of some overt speed and mobile phone detection cameras in addition to the covert cameras were suggested to be beneficial in areas that were identified to be a high crash risk to ensure drivers would obey the road rules at that time. However, it should also be noted that implementing effective road designs and engineering solutions that reduce crash risk in those areas should also be considered. The use of some overt cameras was also suggested to be useful for increasing drivers' acceptance of the camera program.

For speeding, Study 2 demonstrated that drivers were least willing to speed in an overt camera only condition, yet they were more deterred by the covert only camera condition, suggesting that drivers would only obey the speed limit in the area that the overt camera was present, while covert camera enforcement would act as a more sustained deterrent over a larger period of time. However, willingness to speed in the covert camera

condition remained high, while willingness to speed was significantly lower in the combined covert and overt camera condition. Notably, drivers perceived certainty of being caught for speeding remained high for the combined overt and covert camera condition, with no significant difference between this condition and the overt only condition (which had the highest certainty of apprehension score), suggesting that this combination of enforcement cameras acted as a good deterrent. The combination of overt and covert speed enforcement cameras as the optimal deterrent method is further supported by the finding that this condition had the lowest punishment avoidance score in Study 2, meaning drivers believed they were less likely to speed and avoid being caught and punished for the behaviour in this condition. This is a promising finding considering previous road safety research has consistently found punishment avoidance is one of the strongest predictors of continued engagement in offending behaviour (e.g., Fleiter & Watson, 2006; Freeman et al., 2017; Truelove et al., 2019).

Findings in relation to the optimal camera enforcement method was similar for phone use while driving. Study 2 demonstrated that when considering the combination of 1) drivers' willingness to engage in the offending behaviour, 2) perceived certainty of being apprehended for the offence and 3) perceptions of punishment avoidance, the use of both covert and overt mobile phone detection cameras was revealed to be the best solution. Unsurprisingly, drivers were more accepting of the no enforcement camera scenario and overt camera enforcement scenario. Despite this, drivers still recognised the combination of overt and covert cameras as one of the most beneficial scenarios to road safety by decreasing their chances of having a crash.

However, it is important to note that a number of additional factors need to be considered for the effectiveness of mobile phone detection cameras in relation to driver acceptance of the technology. It has been demonstrated that high acceptance of a rule is related to higher compliance with that rule (Tyler, 2003). While visibility of cameras (or warning signs for cameras) could serve as a reminder that the offending behaviour was illegal and enforced, Study 1 identified that there is still a perceived disconnect between a behaviour being illegal and risky. Consequently, the relationship between the two needs to be strengthened. As such, it was suggested that the implementation of mobile phone detection cameras should be combined with extensive advertisement campaigns that illustrate the reasoning behind the installation of the cameras (i.e., the road safety risk) and makes drivers aware that they have a higher chance of being caught for the offence. In Study 1, many ACT participants noted that they were unaware a trial for the cameras had been conducted, highlighting the need for increased exposure. Further, it was identified in Study 1 that a number of drivers would take action to avoid being distracted *before* the drive if they were more aware of mobile phone detection cameras. Specifically, some participants stated they would purchase a cradle to put their phone in while driving or take the steps to put their phone in their glovebox or boot to avoid the temptation and ultimately avoid being sanctioned. However, some participants also stated they needed clarification around the laws for using a cradle while driving, as they were unsure of the legality of this behaviour.

Given the resources required for implementing enforcement cameras, it is also important to know how they may impact different populations. In relation to the characteristics of drivers who were more willing to engage in offending behaviours in the various traffic enforcement scenarios, it was found that overall, younger drivers were more willing to use a hand-held phone while driving and older drivers were more willing to speed in some of the camera enforcement scenarios. This is consistent with previous literature suggesting that younger drivers engage in hand-held phone use while driving more frequently than older drivers (Lyon et al., 2021; Stefanidis et al., 2022). Further, previous findings indicate that individuals who have more driving experience

(e.g., older drivers) were more likely to speed (Mohamad et al., 2019). In contrast, younger drivers were more willing to speed in the no enforcement camera scenario, suggesting that all types of speed cameras are more effective at reducing speeding behaviour specifically among younger drivers (as opposed to older drivers). These findings are supported by previous research that indicates younger drivers are likely to continue speeding if they have not been caught (Truelove et al., 2021a), which reiterates the importance of traffic enforcement cameras. For gender, males were more willing to speed in all scenarios while there was no significant difference in willingness to use a phone while driving between genders in all scenarios. This is supported by previous research that suggests males are more likely to engage in riskier driving behaviours (such as speeding and drug driving) than females (Oviedo-Trespalacios & Scott-Parker, 2018; Mills et al., 2021a; Mills et al., 2021b). These findings highlight how traffic enforcement cameras may have different effects on drivers based on personal factors.

4.1 CONCLUSION

As phone use while driving and speeding are high risk behaviours that remain prevalent among drivers, it is necessary to continue to find ways to effectively prevent drivers from engaging in these behaviours. Automated enforcement cameras have potential to further reduce these behaviours, yet it is important to identify how best to implement this technology to maximise their effectiveness. This project identified that a mixture of both overt and covert cameras can be suggested to be the most beneficial way to implement these cameras. Further, it was identified that these cameras need to be combined with educational campaigns to connect the idea that legal enforcement is in place to reduce dangerous behaviours in the whole network, instead of for the purpose of revenue raising. In addition, it was identified that drivers need to be made more aware of the specific rules related to phone use while driving so that they are more aware of what they are allowed to do, such as the use of a phone in a cradle. These findings can help inform best practice of the mobile phone detection cameras that are being implemented in the ACT and beyond.

RECOMMENDATIONS

- A mixture of both covert and overt enforcement cameras is recommended for both mobile phone and speed enforcement
- Overt cameras should be placed in high-risk areas
- Covert cameras should be accompanied by warning signs on the wider road network
- Advertisement campaigns should be used in conjunction with enforcement cameras to connect the idea that this enforcement approach is used to prevent dangerous behaviour
- Drivers need to be made more aware of the mobile phone detection cameras so they can take steps to avoid being tempted by their phone while driving
- Drivers also need to be made more aware of the specifics of the law surrounding phone use while driving

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