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RUNNING HEAD: Mobile phone use

Mobile phone use while driving: An investigation of the beliefs influencing
drivers' hands-free and hand-held mobile phone use.

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Abstract

This study explored the psychological influences of hands-free and hand-held mobile phone use while driving. Participants were 796 Australian drivers aged 17 to 76 years who owned mobile phones. A cross-sectional survey assessed frequency of calling and text messaging while driving (overall, hands-free, hand-held) as well as drivers' behavioural, normative, and control beliefs relating to mobile phone use while driving. Irrespective of handset type, 43% of drivers reported answering calls while driving on a daily basis, followed by making calls (36%), reading text messages (27%), and sending text messages (18%). In total, 63.9% of drivers did not own hands-free kits and, of the drivers that owned hand-free kits, 32% did not use it most or all of the time. Significant differences were found in the behavioural, normative, and control beliefs of frequent and infrequent users of both types of handset while driving. As expected, frequent users reported more advantages of, more approval from others for, and fewer barriers that would prevent them from, using either a hands-free or a hand-held mobile phone while driving than infrequent users. Campaigns to reduce mobile phone use while driving should attempt to minimise the perceived benefits of the behaviour and highlight the risks of this unsafe driving practice.

Keywords: Mobile phone, Driving, Psychology, Beliefs, Australia

Mobile phone use while driving: An investigation of the beliefs influencing drivers' hands-free and hand-held mobile phone use.

1 Introduction

There is growing evidence that using a mobile phone (either hands-free or hand-held) while driving is an unsafe driving practice (e.g., Haigney, Taylor, & Westerman, 2000; McCartt, Hellinga, & Bratiman, 2006; Svenson & Patten, 2005; Wiesenthal & Singhal, 2005) in both urban and rural environments (Tornros & Bolling, 2006). Nevertheless, many drivers in Australia, the context of this research, and throughout the world regularly engage in this behaviour (e.g., Brusque & Alauxet, 2008; Insurance Institute for Highway Safety, 2006; McEvoy, Stevenson, & Woodward, 2006; Nelson, Atchley, & Little, in press; Pennay, 2006; Sullman & Baas, 2004; Zhou, Wu, Patrick, & Wei, in press). A recent study found that 84% of Australian drivers owned a mobile phone and, of these drivers, 47% reported using their mobile phone while driving at some time (Pennay, 2006). In addition, this study found that only 29% of drivers surveyed reported using a hands-free kit indicating that a large amount of mobile phone use while driving is conducted on hand-held mobiles. Although drivers perceive the use of a hands-free phone while driving as a safer option than using a hand-held mobile phone (White, Eiser, & Harris, 2004), many studies have found that use of either type of handset is a significant distraction for drivers and an unsafe driving practice (e.g., Matthews, Legg, & Charlton, 2003; McEvoy et al., 2005; Tornros & Bolling, 2006).

In addition to being a risky driving practice, using a hand-held mobile phone while driving is illegal in many jurisdictions. Yet, despite legislative bans, between 39% (McEvoy et al., 2006) and 73% (Pennay, 2006) of Australian drivers report using a hand-held mobile phone at some time with an observational study indicating that 1.6%

of drivers are using a hand-held mobile phone at any one time (Taylor, MacBean, Das, & Rosli, 2007). Observational studies, however, cannot measure reliably the prevalence of hands-free mobile phone use. These studies may also underestimate hand-held use (Taylor et al., 2007) as drivers may have developed strategies to minimise detection of this behaviour. Nevertheless, these figures reveal that mobile phone use while driving, irrespective of handset type, is a relatively common driving practice.

Similar to other road safety interventions to minimise illegal and unsafe driving practices, campaigns to reduce mobile phone use while driving have adopted a deterrence-based approach involving the combined use of traffic law enforcement (e.g., Queensland Transport, 2007) and educational campaigns (e.g., Australian Mobile Telecommunications Association, n.d.). The continued high level use of mobile phones while driving, however, indicates that such broad-scale approaches may be ineffective due to the range of personal and motivational factors which influence driver behaviour (Watson et al., 1996). Additionally, Harrison (1998a, 1998b) has argued that deterrence based approaches may not always be informed by psychological theory and that the impact of enforcement on people's driving offences may differ depending on the decision-making process underlying the behaviour. The present research aimed to address this limitation by drawing on the belief basis of a well-validated, theoretically based decision making model to explore in-depth the reasons drivers use a mobile phone so that more detailed information can be incorporated into the design of targeted road safety campaigns.

1.1 Theory of planned behaviour belief measures

One well-validated model (Armitage & Conner, 2001) of behavioural decision making increasingly being used in the road safety domain (e.g., Elliott, Armitage, &

Baughan, 2005; Zhou et al., in press) is the theory of planned behaviour (TPB) (Ajzen, 1991). The TPB posits that intention is the most proximal determinant of behaviour with intention influenced by an individual's attitude towards the behaviour, the individual's perception of how much others approve of behavioural performance (subjective norms), and their perception of the level of control they have over factors affecting behavioural performance (perceived behavioural control, PBC, also expected to influence behaviour directly). Underlying the direct determinants of intentions (attitude, subjective norm, PBC) are the person's beliefs about the behaviour. Specifically, attitude is informed by an individual's beliefs regarding the advantages and disadvantages of performing the behaviour (behavioural beliefs); subjective norm is determined by the perceived expectations of specific individuals and groups (normative beliefs); and PBC is informed by the person's beliefs concerning the likelihood that specific factors would prevent (i.e., barriers) or facilitate (i.e., motivators) them engaging in the behaviour (control beliefs).

One advantage of adopting a belief-based TPB approach is the model's ability to determine the specific behavioural, normative, and control beliefs associated with people's frequent and infrequent performance of a behaviour (Ajzen, 1991; Fishbein & Ajzen, 1975; Fishbein & Stasson, 1990). Belief-based analyses allow for the identification of differences in the behavioural influences of sub-samples of people, subsequently improving our understanding of motivational factors underlying behaviour. This information can then inform education and intervention programs (Fishbein, 1997). The belief-based approach has not previously been utilised to explore mobile phone use while driving.

Despite the lack of research determining people's beliefs about mobile phone use while driving, belief-based analyses have been used to understand other driving

violations, specifically speeding, (e.g., Elliott et al., 2005; Forward, in press; Wallén Warner & Åberg, 2008) and general mobile phone use (Walsh & White, 2006). Research on people's decisions to comply with (e.g., Elliot et al., 2005) and exceed (Wallén et al., 2008) speed limits found that behavioural, normative, and control beliefs influenced drivers' intentions to perform these legal (i.e., compliance with speed limits) and illegal (i.e., exceeding speed limits) behaviours. Specifically, in the case of Elliot et al.'s (2005) study, drivers who reported positive outcomes, normative support, and perceived they controlled their driving speed were likely to subsequently intend to comply with the speed limit. For general mobile phone use (not linked to driving behaviour specifically), Walsh and White (2006) found significant differences in the behavioural, normative, and control beliefs of people who intended to use a mobile phone at high and low levels, with high intenders reporting more positive outcomes of mobile phone use, that more people would approve of their mobile phone use, and that fewer factors would prevent them from using their mobile phone than low intenders. Taken together, these results indicate that the TPB belief-based framework provides a suitable foundation to improve our understanding of factors differentiating those drivers who frequently use a mobile phone while driving and those who do not.

1.2 The present study

The majority of previous research into mobile phone use while driving has investigated the prevalence of the behaviour and the effects on driving performance. There is little understanding, however, of why drivers continue to engage in this unsafe driving practice (Lissy, Cohen, Park, & Graham, 2000). This present research was a preliminary exploration of the beliefs underlying drivers' mobile phone use which aimed to facilitate understanding of the reasons for this behaviour. As hand-held mobile phone

use is illegal throughout Australia (the context of this study) and many other jurisdictions, drivers using both hands-free and hand-held units were analysed separately to allow a comparison of similarities and differences in motivations of the two driver groups. It must be noted that the present research was not designed to enable causal interpretations but to explore the characteristics differentiating those drivers who frequently and infrequently engage in this unsafe driving practice.

First, the study examined the self-reported prevalence of mobile phone use amongst a sample of Australian drivers. Participants were then divided into two categories, drivers who primarily used a hands-free mobile phone device and drivers who primarily used a hand-held mobile phone. Differences in the behavioural, normative, and control beliefs of drivers who frequently and infrequently used each mobile phone type were then assessed. Finally, the belief sets which increased the probability of drivers frequently using a mobile phone while driving were determined for drivers using hands-free and hand-held mobile phones respectively. Although exploratory, it was expected that drivers who frequently used either a hands-free or hand-held mobile phone while driving would report a) more positive and less negative outcomes associated with the behaviour, b) more normative approval for the behaviour, and c) fewer barriers preventing them from using a mobile phone while driving than infrequent users. The results of this study can then provide important information to inform the development of targeted intervention strategies to reduce mobile phone use while driving.

2 Method

2.1 Design and procedure

Prior to conducting the study, ethical clearance was obtained from the university's Human Research Ethics Committee. The study was a cross-sectional design in which participants completed self-report questionnaires.

In line with TPB procedures, a pilot study was conducted initially to elicit salient behavioural, normative, and control beliefs regarding mobile phone use while driving (Ajzen, 2002). This step assists in developing items which are appropriate to the behaviour and the target sample. Participants ($N = 47$) ranging in age from 18 to 60 years ($M = 31.79$, $SD = 11.30$) were recruited by a snow-balling method in which friends and colleagues of the research team distributed the questionnaires throughout their social networks. Participants were instructed that the study was examining the psychosocial factors influencing mobile phone use while driving. They were told that some questions may appear repetitive however; a slightly different piece of information was being requested in each. Further, they were instructed to read the instructions carefully and answer each item honestly and, after reading each question, write the response or circle the number that best represented their opinion. To preserve anonymity, no identifying data were obtained and participants returned the questionnaire by mail directly to the research team to maintain confidentiality of responses. Additionally, all data were analysed and reported in the aggregate so that no individual participants were identifiable. The demographic characteristics of pilot study participants were similar to participants in the main study with respect to age distribution, educational and marital status, primary driving purpose, and length of mobile phone ownership.

A questionnaire comprising open-ended questions (as specified by Ajzen, 2002) was distributed to participants in the pilot study. Behavioural beliefs were elicited by the following questions: (1) "What do you see as the *advantages* of using a mobile phone

while driving?"; and (2) "What do you see as the *disadvantages* of using a mobile phone while driving". Normative beliefs were elicited by questions in which participants listed "any groups of people who (1) would *approve*"; and (2) "would *disapprove*" of their using a mobile phone while driving. Finally, control beliefs were elicited by the questions of "Please write down any factors or circumstances that might (1) prevent or discourage (make it harder); and (2) facilitate or encourage (make it easier); for you to use your mobile phone while driving". These belief elicitation questions originally were each worded separately for calls and text messages in case that there were some different underlying motivators and barriers emerging for the two types of phone behaviours. Given that the majority of participants did not answer all the questions relating to text messaging, and of those who did, responses were similar to those for calling, however, it was not possible to design measures specific to each mobile phone behaviour. Thus, the belief based measures in the main study assessed general mobile phone use (i.e., incorporating both calling and text messaging) while driving. The six most commonly reported responses in the behavioural, normative, and control belief categories formed the belief measures in the main questionnaire study.

The main study assessed demographics; type and frequency of mobile phone use while driving; and behavioural, normative, and control beliefs relating to mobile phone use while driving. The data were collected over a 4 day period in early December, 2006. Participants were recruited and completed the surveys in food-courts of large service stations on the main highway north and south of Brisbane, Queensland. Participants were instructed that the purpose of the research project was to improve understanding of psychological factors influencing mobile phone use by Australian drivers. They were told that the research team requested their assistance in providing information about

their mobile phone use. Further, they were instructed that participation would involve completion of a written questionnaire and was expected to take approximately 10 minutes. Similar to the pilot study, strict confidentiality and anonymity procedures were utilised with no participant being able to be linked to their responses. No identifying information was collected, completed questionnaires were placed in unmarked envelopes, and all data were analysed in the aggregate.

2.2 Participants

Participants were required to hold a current driver's licence and to use a mobile phone at least once a day at any time (i.e., in the car or elsewhere). Of the 1250 people approached who were eligible to participate, 801 completed the questionnaires (64.1% response rate). The most common reason for non-participation was lack of time. Prior to data analysis, five cases were removed as they either did not use their mobile phone at all or did not drive. The data from the remaining 796 (443 male, 351 female, 2 unknown) drivers aged 17 to 76 years ($M = 36.80$ years, $SD = 14.33$ years) were analysed. Participant characteristics are reported in Table 1.

Insert Table 1 about here

Most drivers were licensed for more than 10 years (64%) with 83.5% of participants having open licences (i.e., an unrestricted licence issued to experienced drivers that does not feature any of the special restrictions applied to newly licensed, provisional drivers). On average, participants drove 17.8 hours per week ($SD = 14.20$ hours; range = 1 to 90 hours). Thirty-eight percent of participants drove mainly for business purposes, 24% drove for equal personal and business, and 38% drove mainly

for personal purposes. The majority of participants had tertiary qualifications and were employed full-time. Demographic characteristics are similar to those obtained in large scale research among Australian drivers (Pennay, 2006) and government statistics (Queensland Transport, 2009; Roads and Traffic Authority, 2007) in that a similar proportion of drivers with open licences (e.g., 88% of New South Wales and 90% of Queensland drivers hold an open licence, and 82% of drivers held an open licence in Pennay's study) and male participants (e.g., 52% of Queensland drivers and 56% of New South Wales drivers are male) were recruited. It is believed, therefore, that the participants in this research are broadly representative of the Australian driving population.

Slightly more than a third of the participants owned a hands-free mobile phone kit and, of the drivers owning hands-free devices, the majority did not use it all of the time. Sample participants were split into two groups: hands-free users (drivers who reported using their hands-free kit most or all the time, 25%) and hand-held users (drivers who reported using a hand-held mobile phone most or all the time, 75%).

2.3 Measures

2.3.1 Mobile phone use while driving

Initially, participants' use of a mobile phone for any purpose (send or receive text messages, answer or make a call) while driving was assessed using 1 item scored (1) *more than once a day*, (2) *daily*, (3) *1 or 2 times a week*, (4) *1 or 2 times a month*, (5) *1 or 2 times in 6 months*, (6) *once a year*, (7) *never*. Four items then assessed the frequency of the specific behaviours of answering calls, making calls, sending text messages, and reading text messages while driving respectively. Questions were presented with the stem "How often do you do the following on your mobile phone

while driving?” followed by each specific behaviour, for example “send a text message”. Items were scored (1) *more than once a day*, (2) *daily*, (3) *1 or 2 times a week*, (4) *1 or 2 times a month*, (5) *1 or 2 times in 6 months*, (6) *once a year*, (7) *never* (see Table 2). Due to low numbers of participants in some categories, the seven categories for frequency of use were collapsed into three (once a day or more, less than once or twice a week, and never) for reporting and analysing the frequency of each specific type of mobile phone use while driving.

Insert Table 2 about here

To assess the prevalence of hands-free mobile phone use, participants indicated whether they owned a hands-free kit (scored *yes*, *no*) and, if yes, how often they used it while driving, scored (1) *hands-free all the time* to (7) *hand-held all the time* (Table 1).

2.3.2 Behavioural, normative, and control beliefs

Behavioural, normative, and control beliefs were each assessed by 6 items scored (1) *extremely unlikely* to (7) *extremely likely*. As stipulated by Fishbein and Ajzen (1975), questions assessed the target behaviour in terms of target, action, time and context. A stem was presented followed by a list of items for each belief category. For behavioural beliefs, participants were asked to rate how likely it would be that three *advantages* (e.g., using time effectively) and three *disadvantages* (e.g., being involved in a crash) would occur if they used their mobile phone while driving in the next week. To assess normative beliefs, participants rated how likely it was that six referents (e.g., friends) would *approve* of their using a mobile phone while driving in the next week. Control beliefs were measured by participants rating how likely six factors (e.g., police

presence) would *prevent* them from using their mobile phone while driving in the next week. The stems and full list of items are shown in Table 3.

Items in each belief set were summed and averaged to create three composite measures; behavioural beliefs ($\alpha = .78$), normative beliefs ($\alpha = .92$), control beliefs ($\alpha = .89$); for logistic regression analyses. For the behavioural beliefs measure, items measuring disadvantages were reversed for consistency with items measuring the advantages of using a mobile phone while driving.

Insert Table 3 about here

3 Results

3.1 Analyses

Data were analysed using SPSS 14. Frequency analyses were conducted to determine the level and type of mobile phone use while driving. Two series of multivariate analyses of variance (MANOVA) were conducted with Bonferroni adjustments applied at the univariate level to control for Familywise Type I error. The first series determined those beliefs that differed between drivers who frequently and infrequently engaged in hands-free mobile phone use while driving. The second series assessed differences in beliefs between drivers who frequently and infrequently used a hand-held mobile phone while driving. In either type of phone use, high frequency of use was defined as daily or more whereas low frequency of use was defined as less than daily. Finally, logistic regression analyses were conducted to investigate the influence of the belief sets on frequency on either hands-free or hand-held mobile phone use.

3.2 Mobile phone use while driving

Overall, 77% of drivers reported using their mobile phone for any purpose while driving (send or receive text messages, answer or make a call), with approximately 40% of drivers using their phone while driving daily or more, 37% of drivers using their phone while driving less than once or twice a week. Twenty-three percent of drivers reported never using their mobile phone for any purpose while driving. Of the specific mobile phone behaviours, the most frequently reported behaviour performed daily or more while driving was answering a mobile phone call (43%), followed by making a mobile phone call (36%), reading a text message (27%), and sending a text message (18%).

As shown in Table 2, drivers using hands-free mobile phones reported answering and making more mobile phone calls while driving on a daily basis than drivers using hand-held phones. Chi square analyses revealed significant differences across the categories with respect to answering, $\chi^2(2, N = 785) = 85.87, p < .001$, and making, $\chi^2(2, N = 779) = 85.47, p < .001$ calls. Approximately 70% of drivers using hands-free mobile phones and 33% of drivers using hand-held phones reported using their mobile phone while driving to answer and make calls on at least a daily basis. Additionally, hand-held mobile phone users were more likely to report never using their mobile phone while driving for answering a call (22%) and making a call (37%) than hands-free users (7% and 14%, respectively). Thus, the type of handset appears related to frequency of calling while driving.

In contrast, hands-free and hand-held users reported similar levels of reading and sending text messages while driving with chi square analyses revealing no significant differences in these behaviours between user groups; sending, $\chi^2(2, N = 761) = 0.98, p = .612$, or reading, $\chi^2(2, N = 762) = 0.79, p = .672$, text messages while driving.

Approximately 30% of drivers in both categories reported using their mobile phone to read text messages while driving on a daily basis (with approximately 35% of drivers reporting that they never would) and about 20% of drivers in both categories reported sending a text message while driving (with about 55% of drivers stating that they never would). Thus, handset type does not appear related to frequency of text messaging.

Please note that, irrespective of these frequency data presented, the results in the current study indicate that the majority of mobile phone use while driving is conducted on hand-held phones due to the larger proportion of drivers in this category.

3.3 *Behavioural, normative, and control beliefs*

3.3.1 *Hands-free mobile phone users*

Significant multivariate effects were found for differences in behavioural, $F(6, 174) = 6.04, \Lambda = .828, p = .000$; normative, $F(6, 172) = 2.87, \Lambda = .909, p = .011$; and control, $F(6, 173) = 2.87, \Lambda = .910, p = .011$; beliefs of frequent and infrequent hands-free mobile phone users. Examination of the univariate effects revealed that participants who frequently or infrequently used a hands-free mobile phone while driving differed on specific behavioural, normative, and control beliefs (see Table 3).

For behavioural beliefs, frequent and infrequent users of hands-free mobile phone while driving only differed significantly on one out of the six behavioural beliefs. Specifically, frequent users were more likely than infrequent users to report that using time effectively was an advantage of mobile phone use while driving. Frequent and infrequent users of hands-free mobile phones did not significantly differ on the likelihood that the remaining two advantages and three disadvantages would occur if they used their mobile phone while driving in the next week.

Frequent and infrequent users of hands-free mobile phones while driving differed on four out of six normative beliefs. Frequent users were more likely than infrequent users to report that friends, family members, and work colleagues would approve of their using a mobile phone while driving in the next week. There was no significant difference between perceptions of approval from partners, other drivers or police between drivers who engaged in hands-free mobile phone use while driving frequently and infrequently.

Participants who used a hands-free mobile phone device while driving frequently and infrequently differed on five out of six control beliefs. Infrequent users were more likely than frequent users to report that external (e.g., police presence) and risk (e.g., risk of an accident) factors would prevent them from using their mobile phone while driving. The only control belief that did not differentiate between the groups was lack of a hands-free kit. Thus, overall, drivers who frequently use a hands-free mobile phone while driving are more likely, than infrequent users, to report that mobile phone use while driving facilitates effective use of time, that a number of important people in their lives would approve of their using a mobile phone while driving, and that fewer barriers would prevent them from using a mobile phone while driving.

The results of logistic regressions undertaken to examine which beliefs increased or decreased the probability of frequently using a hands-free mobile phone while driving are reported in Table 4. As a set, behavioural, normative, and control beliefs reliably distinguished frequent and infrequent users of hands-free mobile phones while driving, $\chi^2(3, N=184) = 36.54, p < .001$. The combination of predictors accounted for 24.9% (Nagelkerke R^2) of the variance in predicting the odds of being a frequent user of a hands-free mobile phone while driving. Moderate classification was obtained with

72.8% of all users being correctly classified (86.4% frequent; 46% infrequent). As can be seen, normative beliefs significantly increased the probability of being a frequent user whilst control beliefs significantly decreased the probability of being a frequent user of a hands-free mobile phone while driving. Behavioural beliefs did not predict frequency of use amongst hands-free users. Thus, higher levels of perceived social approval for mobile phone use while driving were associated with a higher likelihood of frequently using a hands-free mobile phone while driving, whilst stronger concerns about perceived barriers to this behaviour were associated with a lower likelihood of use.

Insert Table 4 about here

3.3.2 *Hand-held mobile phone users*

Similar to hands-free mobile phone users, significant multivariate effects were found for differences in behavioural, $F(6, 544) = 38.14, \Lambda = .704, p = .000$; normative, $F(6, 551) = 24.20, \Lambda = .791, p = .000$; and control, $F(6, 552) = 12.13, \Lambda = .884, p = .000$; beliefs of participants who frequently and infrequently used a hand-held mobile phones while driving. Examination of the univariate effects revealed that frequent and infrequent users of hand-held mobile phones while driving differed on the majority of the behavioural, normative, and control beliefs (see Table 3).

Participants who used a hand-held mobile phone frequently and infrequently differed significantly on four out of six behavioural beliefs. Frequent users were more likely than infrequent users to report that two advantages (using time effectively and receiving information) and, interestingly, two disadvantages (being distracted from driving and being caught and fined by police) were likely to occur if they used their

mobile phone while driving. There was no significant difference between frequent and infrequent users of hand-held mobile phones in whether receiving assistance in an emergency or being involved in a crash were likely outcomes of using a mobile phone while driving in the next week.

For normative beliefs, frequent users of hand-held mobile phones while driving reported significantly higher levels of approval from all referent groups than infrequent users. Although perceived levels of approval were relatively low amongst both frequent and infrequent users of hand-held mobile phones, frequent users were more likely than infrequent users to report that friends, family members, partners, work colleagues, other drivers and police would approve of their using a mobile phone while driving in the next week.

Frequent and infrequent users of hand-held mobile phones while driving significantly differed on four out of six control beliefs. Frequent users were less likely than infrequent users to report that risk of fines, risk of an accident, lack of a hands-free kit and heavy traffic would prevent them from using their mobile phone while driving in the next week. There was no significant difference between drivers who used a hand-held mobile phone frequently or infrequently on whether demanding driving conditions and police presence would prevent their using their mobile phone while driving. Overall, frequent users of hand-held mobile phones while driving were more likely than infrequent users to report both more advantages and disadvantages from their using their mobile phone while driving; perceive stronger approval from other people for using a mobile phone while driving; and believe that fewer barriers would prevent them from using a mobile phone while driving in the next week.

The results of the second logistic regression (see Table 4) indicated that the combination of behavioural, normative, and control beliefs reliably distinguished frequent and infrequent users of hand-held mobile phones while driving, $\chi^2(3, N=572) = 86.94, p < .001$, accounting for 19.7% (Nagelkerke R^2) of the variance in predicting the odds of being a frequent user. Moderate classification was obtained with 72.8% of all users being correctly classified (30.6% frequent; 90% infrequent). Behavioural and normative beliefs increased the probability of being a frequent user whilst control beliefs decreased the probability of being a frequent user of a hand-held mobile phone while driving. Thus, a higher likelihood of frequently using a hand-held mobile phone while driving was associated with believing more favourable outcomes would result from using a mobile phone while driving and perceiving higher levels of social approval for this behaviour. Stronger concerns about perceived barriers to mobile phone use while driving were associated with a lower likelihood of frequently using a hand-held mobile phone while driving.

4 Discussion

The aims of the current study were two-fold. First, this study aimed to assess the frequency and type of mobile phone use while driving amongst a sample of Australian drivers. A second aim was to improve our understanding of the influence of behavioural, normative, and control beliefs on drivers' decisions to engage in this behaviour.

4.1 Mobile phone use while driving

Consistent with other self-report studies (e.g., Gras et al., 2007; Pöysti, Rajalin, & Summala, 2005) a large proportion (> 70%) of participants reported using a mobile phone while driving. This percentage is in contrast to some Australian studies (e.g., Pennay, 2006), however, which suggest that only 47% of Australian drivers reported

using their mobile phone while driving at some time. Furthermore, the percentage of drivers in the current study who reported using their mobile phone on a daily basis or more (40%) is larger than other studies such as Sullman and Baas (2004) who found that only about 14% of drivers use their phone often or all the time while driving.

In line with previous studies revealing that people are more likely to use their mobile phone while driving for calling than text messaging (e.g., Gras et al., 2007), participants in the current study most frequently reported using their mobile phone to answer calls, followed by making calls, reading text messages and sending text messages while driving. The majority of participants did not own a hands-free kit and, of those who did, approximately half did not use it most of the time. Thus, similar to other research (e.g., Sullman & Baas, 2004) most drivers in this sample used a hand-held mobile phone while driving. Participants using a hands-free mobile phone while driving had a higher reported frequency of answering and making calls than hand-held mobile phone users, a finding which concurs with previous research (e.g., Gras et al., 2007; Pöysti et al., 2005; Sullman and Baas, 2004) showing that frequency of mobile phone use was higher among participants who owned a hands-free kit or device. This finding is of concern as there is a growing body of research indicating that hands-free mobile phone use while driving may be no safer than using a hand-held mobile phone (e.g., Matthews et al., 2003; McEvoy et al., 2005) due to the distracting nature of the conversation (Amado & Ulupinar, 2005; Tornros & Bolling, 2006). However, the number of drivers in this study who used their hands-free kit most or all of the time was relatively small (25%) compared to the numbers who predominantly used a hand-held mobile phone while driving (75%), indicating that most call related behaviour while driving is conducted on hand-held phones. Together, these findings are alarming as,

although using a mobile phone for calling irrespective of handset type is an unsafe driving practice, hand-held mobile phone use while driving is illegal throughout Australia. Consequently, a large number of drivers are not only engaging in a risky driving practice, they are doing so illegally.

In contrast to calling, the self-reported frequency of reading and sending text messages was similar for drivers using hands-free and hand-held phones. Although the frequency of these behaviours was relatively low, sending and reading text messages while driving is particularly problematic as drivers are not only manipulating their phone but also spend up to 400% more time looking away from the road (Hosking, Young, & Regan, 2005). The lower numbers of drivers who text message indicates that there may be two driver groups, those who call and text message while driving, and those who call but do not text message. Further research is required to identify any differences between these two driver groups.

4.2 Behavioural, normative, and control beliefs

Similar to other studies adopting a belief based approach to understand speeding (Elliott et al., 2005; Wallén et al., 2008) and general mobile phone use (Walsh & White, 2006), significant differences were found between the behavioural, normative, and control beliefs of frequent and infrequent users of both types of mobile phone handsets. The pattern of differences in the specific influential beliefs for frequent and infrequent users, however, varied across the two driver groups, suggesting that different factors underlie drivers' use of hands-free and hand-held mobile phones.

4.2.1 Hands-free mobile phone users

Although significant multivariate effects were found for the behavioural, normative, and control beliefs of frequent and infrequent hands-free mobile phone users,

only normative and control beliefs affected the probability that drivers would use their hands-free mobile phone frequently. In the present study, only one behavioural belief differed between user frequency groups for hands-free mobile phones with frequent users being more likely than infrequent users to report that time efficiency was a benefit from performing this behaviour. The absence of a larger number of behavioural beliefs differentiating frequent and infrequent users of hands-free phones while driving may indicate that both driver groups are similarly aware of the favourable and unfavourable outcomes of using a mobile phone while driving. Similar to previous research (White et al., 2004), participants did not perceive that using a hands-free mobile phone was a risky driving practice as the likelihood of negative outcomes from the behaviour was perceived as relatively low. The potential for hands-free mobile phone use while driving to be no safer than using a hand-held mobile phone (Matthews et al., 2003; McEvoy et al., 2005), however, suggests that the implementation of strategies to increase awareness of the risks of this behaviour for all drivers may be warranted. Nevertheless, the results of the present study for behavioural beliefs overall suggest that inclusion of a cost-benefit analysis (favourable versus unfavourable outcomes) alone in campaigns to reduce the frequency of hands-free mobile phone use may be ineffective.

Results in this study indicate that social approval affects frequency of using a hands-free mobile phone while driving. Frequent and infrequent users significantly differed on half of the listed normative beliefs and normative beliefs, as a set, increased the probability of frequently using a hands-free mobile phone while driving. Furthermore, of all the belief sets, normative beliefs emerged as the most influential predictor (i.e., largest beta weight) of frequency of hands-free mobile phone use while driving. The findings suggest that it is closer (e.g., friends, family), rather than more

distant people (e.g., other drivers, police) who are most influential on drivers' decisions to use their hands-free phone while driving. It appears, then, that drivers who frequently use a hands-free mobile phone while driving may do so as they believe a number of people close to them believe it is a good thing for them to do. Consistent with other research developing interventions based on normative beliefs to combat driving violations such as speeding (e.g., Parker, Stradling, & Manstead, 1996), it may be useful to incorporate themes of social influence processes, such as designing messages that emphasise disapproval from significant others (e.g., "Your friends don't want you to be dying to talk to them") as an effective method of minimising hands-free mobile phone use while driving.

Finally, as expected, perceived barriers (control beliefs) reduced the likelihood of being a frequent user of a hands-free mobile phone while driving, a result consistent with Zhou et al. (in press) who found that greater perceptions of control (i.e., PBC) increased young learner drivers' intentions to use a hands-free mobile phone while driving. Frequent and infrequent users differed also on the majority of the individual control beliefs. Interestingly, in the current study, the risks of fines and police presence differentiated frequent and infrequent hands-free users even though hands-free mobile phone use is not an illegal behaviour. These results may reflect the finding that some drivers who predominantly use hands-free phones also engage in some hand-held use as they reported text messaging at similar levels to hand-held drivers.

Although infrequent users of hands-free mobile phones reported that the risk of an accident would prevent them from using their mobile phone while driving, there was a relatively low level of agreement, amongst both frequent and infrequent hands-free users, that an accident was a likely outcome of using a mobile phone while driving

(behavioural beliefs). Taken together, these findings suggest the importance of making drivers more aware of the risks of using their hands-free mobile phone while driving (i.e., the distraction potential; Matthews et al., 2003; McEvoy et al., 2005; Tornros & Bolling, 2006), to discourage the likelihood they will engage in frequent use (see also Zhou et al., in press). Additionally, as the impact of demanding driving conditions and heavy traffic differentiated frequent and infrequent hands-free users, strategies highlighting the unexpected challenges inherent in most driving situations may reduce this behaviour.

4.2.2 *Hand-held mobile phone users*

Similar to hands-free users, significant multivariate effects were found for the behavioural, normative, and control beliefs of frequent and infrequent users of a hand-held mobile phone while driving. In addition, all three belief sets were associated with the probability of being a frequent user of a hand-held mobile phone while driving, with control beliefs emerging as the most influential (i.e., largest beta weight) predictor of frequency of use. This finding is in contrast to hands-free users where behavioural beliefs did not affect the probability of frequently using the mobile phone while driving. Frequent hand-held users were more likely than infrequent users to believe that using time effectively and receiving information would result if they used their mobile phone while driving. Thus, similar to previous research (Lissy et al., 2000) and to hands-free users, using a hand-held mobile phone while driving is perceived to be beneficial for time management.

On the other hand, drivers who frequently used a hand-held mobile phone while driving were also more aware of the risks of the behaviour than infrequent users as they reported a higher likelihood of being distracted from driving and being caught and fined

by the police if they used their phone while driving. However, results indicate that, although they are aware of the risks, frequent hand-held mobile phone users continue to use their mobile phone while driving. One potential explanation for this finding may be that the perceived benefits of using a mobile phone while driving are believed to outweigh the risks of this behaviour (White et al., 2004). Some support for this assertion has been found in previous research (Nelson et al., in press; White, Eiser, Harris, & Pahl, 2007) which suggests that, even though people are aware of the risk of using a mobile phone while driving, they still engage in the behaviour if they perceive that a call is important. It appears that strategies designed to reduce hand-held mobile phone use while driving should downplay the perceived advantages of the behaviour and emphasise the need for better time management and trip preparation. A cost-benefit analysis challenging drivers to consider whether the favourable outcomes (e.g., time effectiveness) outweigh the unfavourable outcomes (e.g., distraction) may also be effective for this group of drivers.

Frequent and infrequent users of hand-held mobile phones while driving differed on all of the listed normative beliefs. Although the levels of perceived approval from others for using a mobile phone while driving was relatively low, frequent hand-held users reported significantly higher levels of approval from important others for their using a mobile phone while driving than infrequent users. The importance of approval from important (e.g., family and friends; Elliot et al., 2005; Wallén et al., 2008) and similar (e.g., same gender and age; Forward, in press) others on intentions to commit driving violations, such as speeding, has been demonstrated in previous research also. In contrast to the absence of findings for hands-free phone use which is most likely due to the legality of the behaviour, infrequent hand-held drivers reported significantly lower

levels of approval from police and other drivers than frequent users. Thus, it appears that infrequent hand-held users consider the disapproval of others more when deciding to use their phone than frequent users and/or frequent hand-held users have developed strategies to minimise detection of their hand-held mobile phone use so as to limit others' disapproval. Overall, the strong effect of normative approval on frequent hand-held mobile phone users reveals that including a consideration of others' (dis)approval in strategies to reduce general mobile phone use while driving could be effective (see also Parker et al., 1996). For instance, similar to drink driving campaigns (e.g., "bloody idiot", Transport Accident Commission, 2007), drivers who use their hand-held mobile phone while driving could be referred to as irresponsible. Alternatively, if adopting a more positive approach, reinforcing approval for the decision not to use a hand-held mobile phone while driving may be effective.

For control beliefs, frequent and infrequent hand-held users differed on whether risk of fines, risk of an accident, lack of a hands-free kit, and heavy traffic would prevent them from using their mobile phone while driving. Frequent users were less affected by the identified barriers to using a hand-held mobile while driving than non-frequent users. The finding that frequent hand-held users were not deterred by the lack of hands-free kit indicates these drivers will continue to use a hand-held mobile phone while driving even though it is an illegal behaviour in many jurisdictions. Future research could investigate whether, similar to speeding, hand-held mobile phone use is not seen as a real crime (Corbett, 2000). Alternatively, it may be useful to consider whether successful avoidance of being caught and fined for using a hand-held mobile phone while driving has an impact on continued performance of the behaviour (e.g., Watson, 2004).

Additionally, the risk of fines and risk of an accident acted as a barrier for infrequent hand-held users. Both frequent and infrequent users of hand-held phones, however, rated the likelihood of crashing and of being caught and fined by police when using their mobile phone while driving as relatively low (behavioural beliefs). In combination, these findings suggest that increasing awareness of the risks of using a hand-held mobile phone while driving by publicising the number of accidents and relevant infringements may make the dangers of this behaviour more salient to frequent users, potentially reducing this behaviour. Although police presence did not differentiate frequent and infrequent hand-held mobile phone users, there was a high overall level of agreement that police presence would prevent their using a mobile phone while driving, suggesting that increasing awareness of police campaigns targeting this behaviour may be effective.

4.3 Limitations and future research

There are some limitations of the study. The study was a cross-sectional design which utilised a self-report methodology. Both of these approaches have been criticised for artificially inflating the relationship between TPB constructs and behaviour which subsequently reduces the causal interpretations of TPB research (Armitage & Conner, 1999; Rothengatter, 2002). However, as the present research did not seek to identify causal relationships but instead served as a preliminary exploration to improve our understanding of differences between frequent and infrequent users of mobile phones while driving, this approach was considered suitable to assist in the development of ongoing research and the design of strategies to facilitate behaviour change (Fishbein, 1997). Additionally, beliefs were assessed in relation to mobile phone use while driving in general rather than differentiating between calling and text messaging behaviours.

Given the lower (although still concerning) rates of text messaging by drivers, it may be that different beliefs are relevant to calling and text messaging while driving. Further research should seek to identify whether there are differences in the characteristics of drivers who call but do not text message and drivers who engage in both behaviours. As younger people have been found to text message while driving more frequently than older mobile phone users (Pennay, 2006), use of a youth specific sample may also provide valuable information on how to reduce this behaviour amongst a cohort already at a higher risk of crashing (see also Nelson et al., in press).

4.4 Conclusion

Mobile phone use while driving is a common yet preventable driving risk. This study provides insight into the beliefs underlying Australian drivers' decisions to engage or not engage in the use of mobile phones while driving for both hands-free and hand-held units. Across both types of mobile phone use while driving, frequent and infrequent users could be differentiated by their beliefs about others' (dis) approval of, and their own perception of barriers that may impede, use of their mobile phone while driving. In addition, for hand-held phone use while driving, the impact of both expected costs and benefits of using a mobile phone while driving distinguished between frequent and infrequent users. Results from this study can inform targeted campaigns designed to minimise the occurrence of this unsafe, and, in the case of hand-held phones, illegal driving practice.

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Table 1

Participant characteristics

		Frequency	Percent
Marital status	Single	280	35.3
	Married/De-Facto	474	59.7
	Separated/Divorced/Widowed	39	5.0
Highest education level	Grade 10	148	18.7
	Grade 12	189	23.9
	Diploma/Certificate	250	31.6
	University degree	204	25.8
Work status	Full-time employment	405	51.1
	Part-time employment	110	13.7
	Self-employed	117	14.8
	Student	54	6.8
	Not in the workforce	107	13.5
Own a hands-free kit	No	508	63.9
	Yes	287	36.1
If yes, how often do you use hands-free while driving?	Hands-free all the time	143	49.1
	Hands-free most	55	18.8
	Equal	36	12.2
	Hand-held most	24	8.3
	Hand-held all	33	11.3

Table 2

Percentage of participants using a mobile phone while driving according to hand-set type

	Hands-free ¹	Hand-held ²
<i>Answer a call</i>	<i>n</i> = 196	<i>n</i> = 589
Once a day or more	70.9	33.4
Less than once or twice per week	22.5	44.4
Never	6.6	22.2
<i>Make a call</i>	<i>n</i> = 190	<i>n</i> = 589
Once a day or more	63.7	27.2
Less than once or twice per week	22.6	36.3
Never	13.7	36.5
<i>Read a text message</i>	<i>n</i> = 183	<i>n</i> = 579
Once a day or more	27.9	26.3
Less than once or twice per week	38.8	36.7
Never	33.3	37.0
<i>Send a text message</i>	<i>n</i> = 179	<i>n</i> = 582
Once a day or more	15.6	18.9
Less than once or twice per week	28.0	26.6
Never	56.4	54.5

¹ Drivers who report using a hands-free mobile phone most or all of the time

² Drivers who report using a hand-held mobile phone most or all of the time

Table 3

Mean values for beliefs of drivers according to handset type and frequency of use (daily or more versus less than daily)

	HANDS-FREE			HAND-HELD		
	<i>Frequent</i>	<i>Infrequent</i>	<i>p</i> value ¹ difference	<i>Frequent</i>	<i>Infrequent</i>	<i>p</i> value ¹ difference
	M	M		M	M	
<i>Behavioural beliefs</i>	<i>n</i> = 145	<i>n</i> = 36		<i>n</i> = 288	<i>n</i> = 270	
How likely is it that your using a mobile phone while driving in the next week would result in the following?						
Using time effectively	5.37	3.31	.000	4.56	2.36	.000
Being distracted from driving	3.73	3.53	.581	4.50	3.68	.000
Being involved in a crash	2.46	3.08	.060	3.49	3.17	.075
Receiving information (e.g., directions, important news)	4.12	3.22	.023	4.34	2.75	.000
Receiving assistance in an emergency	3.28	3.33	.890	3.48	3.28	.248
Being caught and fined by the police	2.07	2.58	.121	3.63	2.98	.000
<i>Normative beliefs</i>	<i>n</i> = 145	<i>n</i> = 34		<i>n</i> = 288	<i>n</i> = 270	
How likely is it that the following people or groups of people would approve of your using a mobile phone while driving in the next week?						

	Mobile phone use					
Friends	4.50	3.35	.006	3.98	2.33	.000
Family members	4.37	3.06	.002	3.26	1.99	.000
Partner/boyfriend/girlfriend	4.34	3.24	.009	3.67	2.11	.000
Work colleagues	4.77	3.26	.000	3.95	2.29	.000
Other drivers	3.78	3.18	.128	3.24	1.94	.000
Police	2.99	2.62	.371	2.21	1.58	.000
<i>Control beliefs</i>	<i>n = 146</i>	<i>n = 34</i>		<i>n = 285</i>	<i>n = 274</i>	
How likely are the following factors to prevent you from using a mobile phone while driving in the next week						
Risk of fines	3.90	5.71	.000	4.46	5.38	.000
Demanding driving conditions (e.g., weather, changing lanes)	4.90	6.06	.005	5.42	5.82	.018
Risk of an accident	4.74	5.91	.005	5.06	5.80	.000
Police presence	4.53	5.88	.002	5.76	5.75	.954
Lack of hands-free kit	5.08	5.24	.735	3.91	5.06	.000
Heavy traffic	4.31	5.47	.006	4.67	5.47	.000

Note. Scaled from 1 *extremely unlikely* to 7 *extremely likely*.

¹ Please note that to control from Familywise Type I error, a Bonferroni adjustment was applied. *p* value cut-off = .008

Table 4

Logistic regression analyses predicting the probability of frequently using a mobile phone while driving

Analysis	Variable	β	SE	Wald	Sig	Exp(β)	CI	
							Lower	Upper
Hands-free								
	Behavioural	0.27	0.21	1.73	.189	1.31	0.97	1.95
	Normative	0.27	0.10	7.61	.006	1.31	1.09	1.60
	Control	-0.41	0.11	13.40	.000	0.67	0.53	0.83
Hand-held								
	Behavioural	0.52	0.12	17.28	.000	1.68	1.31	2.14
	Normative	0.38	0.06	35.69	.000	1.46	1.30	1.65
	Control	-0.15	0.06	7.01	.008	0.86	0.77	0.96