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Chapter 7

GENDER EFFECTS IN MOBILE PHONE DISTRACTION FROM DRIVING

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ABSTRACT

Recent research using a driving simulation task examined the effects of conversing over a mobile phone to that of conversing with a passenger in the number of errors made by the driver. Young drivers (18-25 years) were engaged in a naturalistic conversation in these two conditions and their performance was compared to that of a group of drivers who simply listened to two-passengers conversing, or to a group that completed their drive in silence. The first study of this chapter noted a gender difference in that female drivers appeared to be more distracted when conversing on a mobile phone than did the male drivers; and that the male drivers appeared to be more distracted when conversing with a passenger. The second study examined the question of why a gender difference might exist for mobile phone conversations and varied the content of the conversation so that it was either cognitive or emotive in nature. This manipulation not only confirmed the previous finding that female drivers make more errors than do male drivers but also found that the pattern of responses, in terms of type of errors made, differed for male and female drivers. Overall, both males and females made more errors when the conversation was emotive rather than cognitive in content, especially so for the female drivers. Female drivers were particularly prone to making lateral or lane position errors and there was a tendency for the male drivers to make more errors of a longitudinal or temporal type. These studies are aimed at gaining a better understanding of the apparent gender specificity of some sources of distraction for young drivers, with a view to better targeting safety messages to this at-risk group of drivers.

INTRODUCTION

“What happens when people try to do two things at once? The answer clearly depends on the nature of the two “things”. Sometimes the attempt is successful, as when an experienced

motorist drives a car while holding a conversation.” (Eysenck, 2001, p.130).

In corroboration of Eysenck’s comment the participants in a study by Kames (1978) reported that conversing with passengers had a difficulty factor of 1.3 on a scale of 1-10 – the lowest of all the in-vehicle tasks they were asked to rate. Clearly this is perceived as being a very easy task for experienced drivers. This raises the question then of when, and why, is this seemingly effortless and everyday dual-task of conversing and driving not successful? According to the legislators of over 50 countries (Cellular-News, 2009) when the driver is using a hand-held mobile phone. The scientific literature however has demonstrated that when it comes to remote conversations it is not the mechanical act of holding the phone that is the problem, but rather it is the conversation itself that results in an impairment in driving (Brace, Young, and Regan, 2007; Caird, Scialfa, Ho and Smiley, 2004; Horrey and Wickens, 2006). If the biomechanical distraction is eliminated with a hands free phone could we expect conversing on a mobile phone to be comparable then to that of conversing with a passenger? On this point, the literature is more equivocal. Drews, Pasupathi, and Strayer (2004) found that remote conversations were in fact worse. Likewise Burns, Parkes and Lansdown (2003) found that driving performance in terms of reaction time tasks was significantly poorer for the phone condition than when the driver was talking to a passenger. The drivers in Burns et al.’s study also noted that the mental effort of the phone condition was significantly more demanding than conversing with a passenger. To explain the poorer performance in the remote conversation condition it has been proposed that passengers modulate their conversation according to the traffic conditions to assist the driver (Haigney and Westerman, 2001; McKnight and McKnight, 1993; Parkes, 1991; Spence and Read, 2003); however, Laberge, Scialfa, White and Caird (2004) and Gugerty, Rakauskas, and Brooks (2004) could find no evidence to support the modulation hypothesis.

Horrey and Wickens (2006), on the other hand, in their meta-analysis of the literature on mobile phone use and driving observed that the costs associated with a phone conversation versus a passenger conversation to be roughly equivalent; and again found no evidence of passengers modulating their conversation. The evidence suggests that it is the complexity of the conversation and not whether the other party to the conversation was present in the car, that determines the degree of distraction (Amado and Ulupinar, 2005; Nunes and Recarte 2002). Violanti and Marshall (1996) and McKnight and McKnight (1993) also found that mobile phone users who were engaged in intense conversations were significantly impaired in their ability to drive.

Strayer, Drews, Crouch, and Johnston (2005) observed that listening to the radio or books on tape did not impair driving performance, it was the act of being involved in a conversation that detracted attention away from the primary task of driving. Similarly, Recarte and Nunes (2003) found, under real driving conditions, that tasks that were limited to attending to incoming verbal information, such as listening to the radio or to another person, did not impair the cognitive and perceptual processes required for driving. It would seem that if there is no need to perform a response there is minimal distraction. Indeed Almor (2008) has recently shown that merely planning to speak, as well as actually speaking, increases distraction on a visual task by as much as four times relative to a listening only condition.

Very little research has been done to investigate the effect of the presence of passengers per se in cars and the role that passengers may play in influencing driver distraction. There is a growing body of evidence, both epidemiological and behavioral, to suggest that the presence or absence of passengers considerably influences the crash risk for young novice

drivers (Chen, Baker, Braver, and Li, 2000; Preusser, Ferguson, and Williams, 1998; Reiß and Krüger, 1995). Stutts, Reinfurt, Staplin, and Rodgman (2001) ranked passengers as the third most reported cause of distraction-related accidents at 11 percent, compared to 1.5 percent for mobile phones. It has been suggested that passengers explicitly encourage risky driving practices by young novice drivers, but the evidence is largely anecdotal. The extent to which these drivers are distracted by the conversation of passengers or by their mere presence has not been determined. If there is more than one passenger, it might be assumed that less distraction would occur if the driver is not required to attend to, or respond to any conversation in the car, however this assumption has not been empirically evaluated. The objective of the study presented in this chapter was to compare the degree of driving impairment resulting from distraction from mobile phones to the distraction caused by conversations with a single passenger, and to the distraction caused by listening only to the conversation of two passengers. The nature of the conversations was to be as natural as possible to try and emulate the type of distractions that drivers might encounter on a frequent basis. This study limited the age range of the participants so that only drivers in the 17-25 year age group were used. Younger drivers are over represented in severe crashes by a factor of 10, compared with adult drivers (Lee, 2007; Williamson, 2003); and 94% of Australians in the 18 to 39 age range regularly use a mobile phone (Wajcman, Bittman, Jones, Johnstone, and Brown, 2008).

EXPERIMENT 1

Method

Participants

Participants were 80 first year psychology students from Macquarie University. Recruitment took place on the university subject pool website and participants took part in order to fulfill a course requirement. There were 29 males and 51 females with an age range of 17 – 25 years with a mean of 19.95 years. Participants all had or had previously held a driver's license and had been driving for a period ranging from three months to eight years. All participants had mobile phones and were recruited into the study by leaving their mobile phone number as a basis for contact with the researchers. They were unaware of the true purpose of the study.

Apparatus

The apparatus used in this experiment was a fixed-base STISIM-Model 100 (version 8) driving simulator. The apparatus includes a steering wheel, a brake and an accelerator set in front of three computer screens that mimic the view through a windscreen, allowing a 135-degree field of view. The simulator allowed control, manipulation and measurement of driving variables. In this experiment the system was programmed to include a number of elements intended to simulate driving in both urban and rural environments. There were sections of open road as well as traffic lights, speed and hazard signs. Cars were regularly overtaking, emergency vehicles passing and pedestrians periodically stepping onto the road ahead. Displays on both side screens simulated side-view mirrors and a rear-view mirror was

present at the top of the centre screen. The display also included a speedometer. A siren would sound when the speed limit was exceeded or a red traffic light was run. Participants brought their own hand-held mobile phones with them to the study.

Procedure

The participants were all asked to leave their mobile phones on during testing and were randomly assigned to one of four conditions: control, one-passenger condition, two-passengers condition and a mobile phone condition. Upon allocation to one of the four conditions, participants were given a practice run on the simulator in order to become familiar with the controls and were instructed to drive as they normally would. In all conditions participants completed the same driving simulation. After the practice run the participants were told that the real experiment was beginning but that everything was the same as the practice run. In the control condition the drive was completed in silence. In the mobile phone condition a confederate of the experimenter rang the participant while they were driving, having gained their mobile phone number from their initial contact with the experimenter. The confederate followed a script under the pretence of making sure they had arrived at the laboratory at the right time and place, resulting in a brief conversation. In the two-passengers condition two confederates pretending to be fellow students waiting to undergo the experiment themselves carried out a scripted conversation about their shared experiences of the course they were doing at university. The confederates followed a script that was designed to engage the driver's attention but did not actually talk to the driver. The final condition involved one confederate, again pretending to be a peer, talking directly to the driver. The confederate followed the outline of the script that was used in the two-passenger condition.

Following the simulated drive, participants in all four conditions was asked to recall various items from the drive (such as the presence of any emergency vehicles, speed signs etc.) that they had encountered during the drive and then to complete the NASA-TLX subjective workload questionnaire (Hart and Staveland, 1988). For the three conditions involving a conversation, the participants were also asked to recall various facts from the dialogue they had either engaged in or had overheard.

Measures

Driving was assessed in terms of the number of on- or off-road crashes, collisions, pedestrians hit, traffic light violations, speeding tickets, traffic light tickets, and stops at traffic lights as well as time taken to complete the simulation. As a measure of distraction, the drivers were also given a checklist to see how much of the conversation they could recall and how many items they encountered on the drive.

Results

Two measures of performance were analyzed: the total number of crashes and the total number of tickets. These variables may indicate different effects on driving. Crashes may be due to factors such as poor ability to control the wheel (lapses and errors), whereas speeding and running red lights may indicate deliberate risk taking (violations).

An Analysis of Variance (ANOVA) was performed to compare all four groups in respect to their total number of crashes. The total number of crashes score was computed by adding the number of off-road collisions, on-road collisions and pedestrians hit. While it appeared that the mobile phone group had more crashes (see Figure 1) no significant group effect was observed, $F(3, 76) = 0.329, p = 0.805$.

Groups were also compared according to the total number of tickets (traffic infringements) acquired during the simulation. Total tickets included speeding tickets and instances of running red lights. An ANOVA again revealed there were no significant differences between the groups, $F(3, 76) = 0.954, p = 0.419$. Figure 1 shows the total number of tickets and crashes across groups.

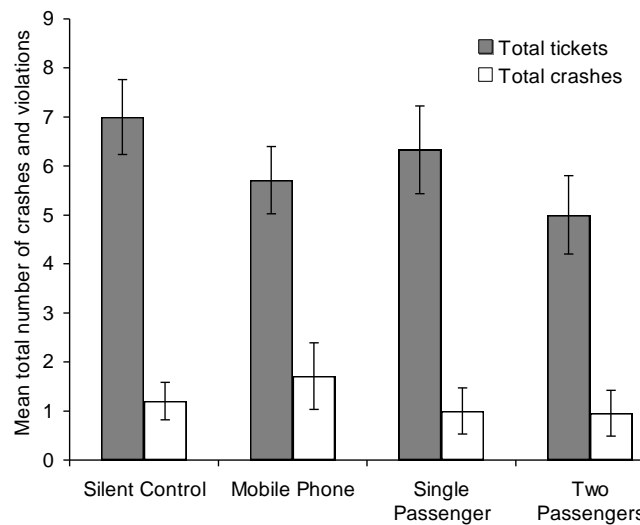


Figure 1. Mean Number of Crashes and Number of Tickets (for driving violations). Error bars represent one standard error above and below the mean.

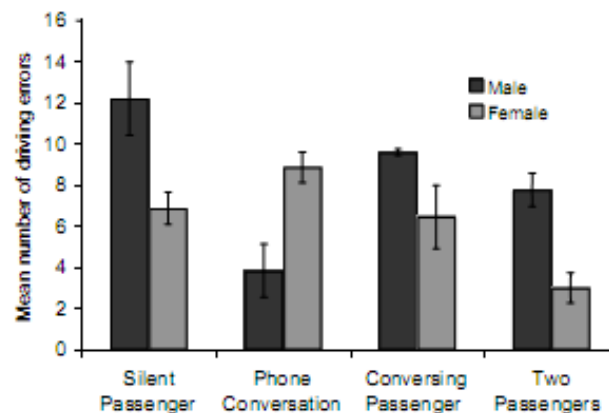


Figure 2. The mean number of errors and violations incurred by the male and female drivers. Error bars represent one standard error above and below the mean.

Given that there were no between group differences for the two types of violations (crashes and tickets), they were combined for further analysis. When the data were analyzed by gender of driver a different pattern of results emerged. Although a factorial ANOVA did not reveal a main effect for gender $F(1, 72) = 3.178, p = 0.79$; there was a significant group by gender interaction $F(1, 72) = 6.16, p = 0.001$.

In Figure 2 it can be seen that more males than females experienced crashes and violations in the control condition, but were significantly better than females when they were required to use a mobile phone and drive at the same time $F(1, 72) = 13.97, p < 0.0005$. Female drivers on the other hand appeared to be less distracted by the presence of passengers than the male drivers.

Speed is an important factor in crashes and is also a measure that has been related to workload. An independent samples t-test was performed in order to compare males and females in their time taken to finish the course. The average time taken for males was 359.38 seconds and for females it was 429.38 seconds, this faster performance of the male drivers was significant $t(78) = 4.81, p < 0.0005$. To avoid the confounding of the crash measures with the speed at which the task was performed, speed was entered into the previous data analysis as a covariate. Driving experience, as measured by the mean amount of time that participants had been driving, was also entered into the analysis as a covariate. While all participants were relatively new drivers it was expected that there might be a difference between drivers due to driving experience.

With regard to the driver workload measures the groups were compared according to the attention that was paid to peripheral information during the simulated drive. Participants were asked to recall information about the frequency of certain items during their simulated drive. Cross tabulation of frequency of correct peripheral recall by experimental group revealed that more participants were correct in the two-passenger condition than any other condition. The two conditions in which the participants were required to talk were the least accurate in their recall of scenes encountered during their drive, but in neither case were the differences significant using Chi-Square tests.

Participants in the experimental conditions were also scored for their ability to recall events that were relevant to the secondary task of conversing. As the control condition involved no secondary task there was no memory data for this group. The other three groups were compared on these scores using a one-way ANOVA. A significant group effect was found, $F(2,56) = 4.92, p = .01$. Post hoc Bonferroni adjusted comparisons revealed the significant differences lay between the two passenger and one-passenger conditions, $t(36) = 2.24, p = .013$, and the two passenger and mobile conditions, $t(40) = 2.70, p = .012$. Participants in the two-passengers condition recalled fewer aspects of the conversation than did participants in either of the other two conditions. This suggests that participants in the two-passengers condition paid less attention to the conversation than did the participants who were actively involved in conversing in the mobile and single passenger conditions.

In order to investigate the perceived mental workload and cognitive demands associated with different driver distraction conditions, the scores from the NASA-TLX subjective workload were compared between groups using ANOVA. Results of the ANOVA revealed that there is no significant difference between groups in participants' subjective workload appraisals and the differing driving conditions $F(3, 76) = 0.12, p = .95$.

Discussion

The general pattern of results from the driving measures indicates a clear effect for gender dependent upon the different conversational tasks. The driving performance for males under the mobile phone condition actually improved and was even superior to that when they did not speak at all in the control condition. In contrast, the driving performance for females deteriorated when they were required to use their mobile phone and drive at the same time. The facilitory effect of a dual task was not maintained for males in the presence of passengers, but females, on the other hand, performed significantly better in the presence of others, especially in the presence of two passengers.

Few studies examine their data for gender effects or their interaction with distractors and even fewer find an effect. Woo and Lin (2001) found no significant gender differences in the effects of a hand-held phone conversation task on reaction times, but Briem and Hedman (1995) did find that males exhibited slightly better vehicle control than females on simulated slippery roads during both radio and hands free phone conversation tasks. It might be argued that males are more experienced in performing this dual task, given the findings of Horberry, Bubnich, Hartley, and Lamble (2001). These authors observed an average 1.5% of Australian drivers in Perth were using handheld mobile phones during the daytime. These observed users were predominantly male (78%) and under the age of 40 (64%).

Hancock, Lesch, and Simmons (2003) required their participants to stop their vehicle as quickly and as safely as possible whenever a traffic signal changed from green to red as the vehicle approached the intersection. Brake response time was significantly higher in performing this critical driving maneuver when participants were also required to press a key on the mobile phone in a “matching to sample” task. This distraction was found to have a greater influence on the female drivers than it did on the male drivers, with a disproportionate disadvantage for the older females. The poorer performance of males in the presence of passengers is consistent with the literature that males are more vulnerable on the road when they are carrying passengers. A facilitory effect of carrying passengers for young females has not been specifically noted in the literature before.

EXPERIMENT 2

The second study in this chapter focused upon the question of why a gender difference in the degree of distraction experienced by the male and female drivers was observed in the previous experiment. The literature tells us that the more cognitively engaging the conversational task is, the greater the distraction, but little has been said about the degree of emotional engagement; Goodman Tijerina, Bents, and Wierwille (1999), in reference to this void of knowledge regarding emotionally laden conversations, suggested that it “may have a deleterious impact on highway safety that is even greater than that found with cognitively demanding tasks” (p. 23). The telephone task used in Experiment 1 was not cognitively demanding; but because the participants believed that they were engaging in a genuine conversation with one of the experimenter’s research assistants it could be argued that perhaps the desire to engage socially with the caller created an emotionally-based distraction that the female drivers were more susceptible to experiencing.

The communications literature does suggest that women do invest more emotional energy into their telephone conversations than do men. Wajcman et al. (2008) noted that women tend to ring family and friends more often than do men, whereas men tend to use the phone more for work-related issues than do women. Brusque and Alauzet (2008) also noted that male drivers were much more likely to use the phone for work purposes than were female drivers, and furthermore the male drivers demonstrated a much greater willingness to use a phone while driving than the female drivers. The women who were most likely to use their phone whilst driving were the high frequency users and those who also spent a lot of time driving.

Experiment 2 was designed to examine whether the emotional content of a conversation could account for the gender difference observed in the mobile phone condition in the previous experiment. We contrasted performance of both male and female participants under three different driving conditions. In the control condition they drove without conversing, in the cognitive condition they drove and conversed about where and what they had been doing on a particular day (autobiographical recall task, similar to that used by Recarte and Nunes, 2003) using a hand-held phone; and in the emotional condition they drove and conversed about a personal moral dilemma that was posed to them by one of the experimenters' confederates. All participants knew that they would receive a phone call, and that an assistant of the researcher would make it. A male and female caller of similar age to the participants placed the calls, counterbalancing the gender of the driver with that of the caller. After participants had completed each of the conditions, they were asked to rate how effortful each task had been to do.

Method

Participants

The participants in the study were 48 first year psychology students from Macquarie University. Recruitment took place on the university subject pool website and participants took part in order to fulfill a course requirement. There were 26 females and 22 males with ages ranging from 17 to 26 ($M = 21$, $SD = 2.46$) and a range of driving years from 1 to 13 years ($M = 4$, $SD = 2.82$). Participants all owned mobile phones and were told the purpose of the study was to investigate driver error while using a mobile phone in city and rural driving conditions.

As the literature indicates there is little overall difference between the cognitive distraction effects of hand-held and hands-free mobile phones, this study used a hand-held Panasonic cordless phone to investigate driver distraction. The cordless phone was used to ensure there was no degradation in sound quality that could occur with a mobile phone in the laboratory, thereby inadvertently increasing the cognitive load on the drivers (Kawano et al., 2005). The hand piece had a "talk" button, which was pressed by the participant to answer the phone call. The participants were required to pick up the phone to carry out the conversation.

Apparatus and Stimuli

The apparatus used in this experiment was a fixed-base STISIM-Model 400. This model included a simulated vehicle cab with fixed seat, steering wheel, dashboard, brake and accelerator pedals, and in other respects was similar to the simulator used in Experiment 1.

Each participant carried out three drives in this experiment. Three different drives were specifically designed and programmed for this purpose. Each drive was five kilometers and with a similar drive environment or background consisting of a mix of urban and rural environments. There was a combination of two and three lanes of traffic each way. Speed limits of 60 and 90 kilometers per hour (kph) were set. The 90 kph was the closest setting available to that regularly found in Australian speed zonings of 80 or 110 kph on rural roads.

The NASA-TLX workload questionnaire was given to the participants between conditions to assess how effortful each task had been to do; and following the final condition the participants filled in a questionnaire providing details about their driving history and mobile phone use.

Procedure

Experimental Phone Conditions

There were two phone conditions used as distracter tasks in the experimental conditions and one control condition with no phone task. The cognitive condition was a series of four autobiographical recall tasks requiring the participants to give detailed answers to where they were and what they were doing at particular times on particular days in the past two weeks.

To replicate the role of emotion in contributing to the levels of distraction a phone call may cause on the task of driving, three moral dilemmas were selected from a series of hypothetical scenarios which were adapted from a previously published set (Greene, Nystrom, Engell, Darley, and Cohen, 2004). The personal moral dilemmas required the drivers to tell the caller how they would react in three different hypothetical situations that had been selected for their high rating on emotional salience (Koenigs et al., 2007). The dilemmas concerned the making of life and death decisions, in which the same question was posed of whether it was better to take the life of one individual in order to save the lives of many others in three different contexts. One scenario posed the problem of a runaway trolley and the need to turn a switch to deliberately kill one man but save the lives of two other men; a second scenario referred to the need to identify which of two vials contained a vaccine that would save the lives of millions, after it had become confused with a deadly poison, by injecting two men with one of the two substances; and the third dilemma asked the participants whether they would be able to smother their own crying baby so as not to alert enemy soldiers standing outside the cellar door where they and all the inhabitants from their village were hiding.

Results

A mixed 2 X 3 repeated measures analysis of variance (ANOVA) was carried out to investigate the effect of the three conversation conditions on driving performance measured by the total number of errors made in each condition. The main effect for the conversing condition was significant, $F(2, 45) = 22.33, p < .0005$. There was also a significant interaction between conversation condition and gender $F(2, 45) = 4.58, p = .013$. The pattern of

differences for the three conditions was therefore different for males and females, as is shown in Figure 3.

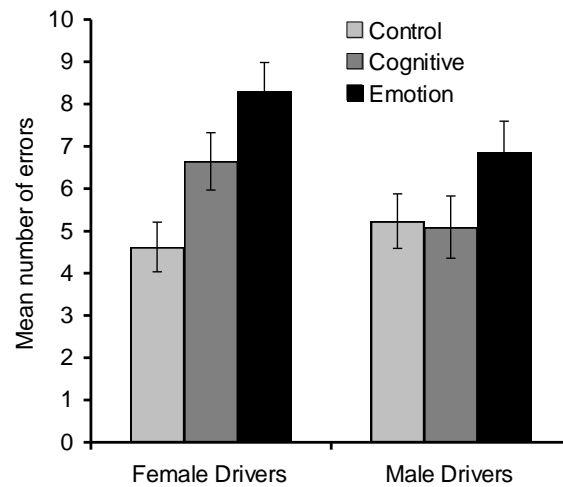


Figure 3. Mean number of errors made by male and female drivers during three different phone-task conditions. Error bars represent one standard error above and below the mean.

A set of comparisons, setting a decision wise error-rate of $\alpha = .05$, revealed that there was a significant difference between the control and the cognitive conditions $F(1, 46) = 5.28, p < .026$; between the control and the emotional conditions $F(1, 46) = 42.69, p < .0005$ and also between the cognitive and the emotional conditions $F(1, 46) = 19.29, p < .0005$.

Of particular interest was whether the difference between the male and female drivers in any of the three conditions was significant. The results showed there was a significant difference between males and females in the control and the cognitive conditions $F(1, 45) = 6.90, p = .012$ and between the control and the emotional conditions $F(1, 45) = 3.55, p = .015$, but not between cognitive and emotional conditions $F(1, 45) = .02, p = .880$ (see Figure 3).

To investigate where the differences occurred for each gender, planned tests of simple effects for condition and gender were carried out. Females made significantly less errors in the control condition compared with the cognitive condition $t(46) = 3.64, p = .001$; significantly less errors in the control condition compared with the emotional condition $t(46) = 6.69, p < .0005$ and significantly less errors in the cognitive condition compared to the emotional condition $t(46) = 3.13, p = .003$. For males there was a significant difference between the control and the emotional condition $t(46) = 2.73, p = .009$ and between the cognitive and the emotional condition $t(46) = 3.09, p = .003$ however there was no significant difference between the control condition and the cognitive condition $t(46) = .22, p = .824$. In fact the mean number of total errors for the control condition for males was slightly more than in the cognitive condition. Age and number of years of driving and were entered as covariates but were highly non-significant and did not change the effect of the interaction between gender and driving conditions.

Driving performance deteriorates when a secondary task is imposed upon drivers in a number of consistent ways (Young, Regan, and Hammer, 2003). In keeping with Young et al.'s classification, the performance measures recorded in this experiment were subsequently sub-divided into three categories for further analysis to see if driver workload affected control

of the vehicle differently for male and female drivers. The two main categories were: maintenance of the vehicle's lateral position on the road and longitudinal control of the vehicle as determined by speed maintenance and control. Lateral control of the vehicle was measured in this experiment by the number of off-road collisions, centre line crossings and road edge excursions. Longitudinal control of the vehicle was measured by the number of collisions with other cars and the number of pedestrians that were hit. This latter measure provides an estimate of a delayed response to the sudden appearance of hazards.

With regard to lateral errors, the results of interest were that female drivers did make more lateral errors in the emotional condition than the male drivers, although in the control condition the opposite outcome was achieved $F(1,46) = 4.29, p = .044$. Female drivers made significantly fewer lateral errors in the control condition than they did in the emotional condition $t(46) = 3.24, p = .002$ and significantly fewer lateral errors in the cognitive condition than they did in the emotional condition $t(46) = 3.38, p = .002$. There were no significant differences in lateral errors for male drivers between any of the three conditions.

With regard to the longitudinal errors, the female drivers again made significantly more errors in both the cognitive condition $t(46) = .299, p = .004$, and in the emotional condition $t(46) = 4.10, p < .0005$, than they did in the control condition, with the emotional condition producing significantly more errors than the cognitive condition $t(46) = 2.01, p = .051$.

In contrast male drivers did not make any more longitudinal errors in the cognitive condition than they did in the control condition, but they did in the emotional condition relative to both the control condition $t(46) = 2.23, p = .030$ and to the emotional condition $t(46) = 2.29, p = .027$.

An analysis of the time taken to complete the drives under the three task conditions, revealed that relative to the silent control condition the drivers took significantly longer to complete the task in both the cognitive condition $F(1, 46) = 9.35, p = .004$ and in the emotional condition $F(1, 46) = 25.80, p < .0005$; furthermore the drivers took significantly longer to complete the drive in the emotional condition than they did in the cognitive condition $F(1, 46) = 4.46, p = .040$. Interestingly there was no significant interaction with gender $F(2, 45) = 1.04, p = .362$, indicating that both the male and female drivers adapted to the demands of the phone task by slowing their driving to a similar degree. This result is paralleled in the finding that there were no significant differences in the number of speeding tickets given between conditions or between the male and female drivers over the course of the drives.

The participants' responses to the NASA-TLX measure of how effortful they found the two tasks to be under the dual task conditions can be seen in Figure 4. With regard to the driving task (left panel) both male and female drivers found the driving task in the emotion condition to be significantly more effortful than in the cognitive condition $F(1, 46) = 5.28, p = .026$. On a scale of 1-10 the female drivers reported a higher subjective workload than males in both the cognitive condition $F(1, 46) = 4.436, p = .041$ and the emotional condition $F(1, 46) = 4.328, p = .043$. There was a significant main effect $F(1,46) = 4.42, p = .041$ between the measure of subjective workload for the conversation experienced in the two conditions. In the cognitive condition mean subjective workload for conversation was significantly higher for female drivers $F(1, 46) = 5.76, p = .020$ as well as in the emotional condition $F(1, 46) = 4.23, p = .045$.

In a subjective assessment of the difficulty of various components of the dual task (conversing, searching for pedestrians whilst conversing, keeping within lane while

conversing and keeping to the speed limit) the only significant gender difference that participants reported was for keeping within their lane while conversing; that is, maintaining lateral control of the vehicle whilst driving $F(1,46) = 14.667, p < .000$.

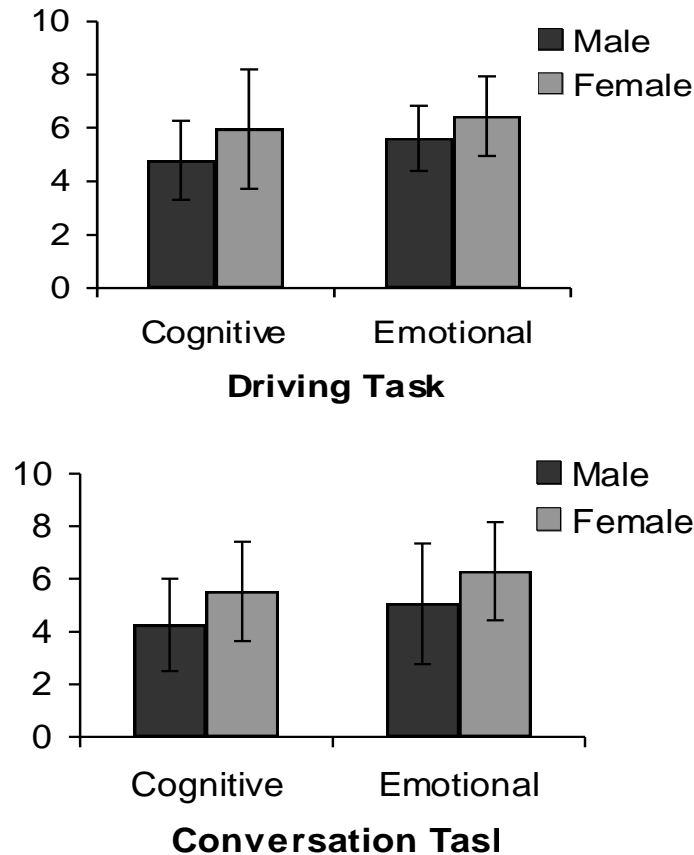


Figure 4. Mean score of subjective workload on the six dimensions of the NASA-TLX for the driving task (top panel) and the conversation task (bottom panel). Error bars represent one standard deviation above and below the mean.

Discussion

The nature of the conversation is an important factor in determining the degree of distraction experienced by the drivers. Conversations that evoke an emotional response detract the drivers' attention away from driving to a greater extent than the cognitive conversation. Goodman et al.'s (1999) speculation regarding an emotionally laden communication appears to be supported by our findings, but with a qualification that this effect is more pronounced for female drivers than it is for male drivers. In a similar fashion to the pattern of results observed in Experiment 1, the male drivers again appeared to derive some small benefit from the dual task, but in the cognitive conversation condition only. No such benefit however, was observed in the emotional conversation condition. The size of the decrement in driving performance between the two conversation tasks is similar for both the

male and female drivers, the problem for the female drivers is that this decrement is over and above that which is already apparent in the cognitive phone task relative to the no-conversation driving condition. This apparent greater difficulty that the female drivers have with performing the dual task, is partly an artifact from the finding that the female drivers made slightly fewer errors in the no-conversation driving only task than did their male counterparts.

The analysis of the types of errors that the drivers made when performing the dual task, showed that the female drivers appear to not only have greater difficulty in maintaining the vehicle within their lane than the male drivers, but they also displayed greater difficulty in avoiding collisions than the male drivers.

The male drivers, had no difficulty in maintaining their lane position in either phone condition, but in the emotional phone condition the male drivers displayed reduced reaction times in response to sudden and unexpected events resulting in more collisions than they incurred in either the control or the cognitive conditions.

The dual task did increase the mental workload of the drivers, this was apparent in the additional length of time it took for them to complete the drives under the cognitive and emotional phone task conditions, and this was similar for both the male and female drivers.

Both men and women drove significantly more slowly in the cognitive condition than they did in the control condition and slower still in the emotional phone task. The additional effort to complete the drive while conducting an emotional phone conversation was reflected in the higher ratings given by the female drivers on the NASA-TLX. We also observed in the history of the drivers' actual experiences of using a mobile while driving that the women did report that they had experienced greater difficulty in maintaining lane position while performing the dual task, a finding that adds support to the validity of these results gained under simulated conditions.

CONCLUSION

Taken together, our findings show that the dangers of driving and conversing on a mobile phone are a multi-dimensional problem. The degree of difficulty in performing this dual-task not only depends on the nature of the conversation but also upon who is doing the driving. Emotional conversations should clearly be kept out of the car and a future study could examine whether the same is true for an emotional conversation with a passenger. Given the results from Experiment 1 that the male drivers did tend to be more distracted by conversing with a passenger than they were by a mobile phone conversation, then this trend might well be exacerbated if the conversation was of an emotional nature.

The second significant outcome of this chapter is that the gender of the driver is clearly an important factor in determining the degree of distraction that this dual-task elicits. The female drivers both exhibited and admitted that it required more mental effort for them to perform the dual-task than did the male drivers, and given that more female drivers were able to recall the name of the person who called them, this finding suggests that perhaps more of their attentional resources were being directed to the secondary task than the male drivers were doing. The observation that the male drivers tended to make slightly fewer errors in the cognitive phone condition than they did in the control condition suggests that they were able

to summon some additional attentional resources (cf. Kahneman, 1973) to perform the dual task benefiting their primary task of driving as well being able to conduct the conversation; whereas no such “spare” resource was available for the female drivers to call upon when they had to perform the dual task.

Stutts et al. (2001) refer to a survey in the United States that has revealed that whilst the vast majority of mobile phone users believe that using a phone is a distraction and increases the likelihood of a crash, a large proportion of these same respondents nevertheless admit to using their phone while driving. This inconsistency between belief and behavior would seem to suggest that an optimism bias is operating such that the drivers are not identifying with the risk they incur each time they talk and drive at the same time. A worrying aspect to these results is the deterioration in performance for the female drivers when they were required to perform a simple, short, natural conversation on their own mobile phones. If female drivers were to hold the belief that they are safer drivers than males, they might not be identifying with the media warnings of the dangers of using their mobile phone whilst driving their car. Lesch and Hancock (2004) found a negative relationship between female drivers’ confidence to perform a mobile phone task whilst driving and performance. The more confident the women felt in their capacity to use the phone and drive at the same time, the poorer was their performance on the task. In contrast the male drivers’ level of confidence matched their ability to perform the task at the same time. Since it is well known that male drivers are more at risk of being involved in a serious road crash, most media campaigns employ male actors to depict the wrong-doer. Perhaps the authors of these campaigns should include female actors and tailor their campaigns to target women as well as to men and also to encourage those individuals who inadvertently make the phone calls to drivers to be aware of the dangers that they are placing the drivers under. A limitation that can be leveled at the generality of the results from in this chapter is the unnaturalness of the situation. We recognize that driving a simulator and conversing with a complete stranger is not a true reflection of what is happening on our roads. However, it is hoped that the degree of control over the events that occur during the drive, and the consistency in the way that the conversation takes place, offers sufficient advantages to offset the disadvantages of the artificiality of the situation, thus guiding future research toward resolving a genuine problem.

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