Can You Talk and Drive Safely at the Same Time? An Examination of Gender Differences in Driving Performance of Young Drivers Observed whilst Conversing with a Passenger or on a Mobile Phone.

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ABSTRACT

Crash risk of young drivers is affected by the presence of passengers and by mobile phone use. We asked whether conversing is the primary cause of both these types of distraction for young drivers. Through the use of confederates, we examined the driving performance of young male and female drivers (aged 18-25) on a driving simulator as they conversed either with a "passenger" or with an unexpected "caller" on the driver's own mobile phone. In another two conditions the driver merely listened to the conversation between two "passengers", or else they carried a silent "passenger".

Males and females show a quite different pattern of responses to these sources of distraction. As might be expected, the number of driving errors committed by the female drivers increased whilst they were engaged in conversation on their mobile phone, but talking to a passenger produced no more errors than did driving in either of the two non-conversing conditions. In contrast, the male drivers not only made fewer errors whilst talking on the mobile phone than they did whilst conversing with a passenger, they also made fewer errors whilst conversing on the mobile phone than they did in either of the two conditions in which they were not required to talk. Results highlight a need to obtain 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

Driving and talking at the same time had never been emphasised as a problem until the advent of the mobile phone. Indeed the ability to both talk and drive is referred to by Michael Eysenck, a prominent cognitive psychologist, as a successful example of multi-tasking:

> "What happens when people try to do two things at once? The answer obviously depends on the nature of the two "things". Sometimes the attempt is successful, as when an experienced motorist drives a car and holds a conversation at the same time..." (as cited by Howard & Connell, 1998)

The successful execution of this dual task has since come under the scrutiny of many researchers and legislators. There is general consensus amongst legislators that whilst drivers cannot successfully use a hand-held phone and a vehicle at the same time, they can nevertheless still talk and drive at the same time. Indeed, with the exception of Israel, Portugal, New Delhi and Singapore, no restrictions have been placed on the use of hands-free mobile phones in any other country (LTSA, 2003). Contrary to the position taken by legislators, researchers are beginning to question whether engaging in any telephone conversation, hand-held or not, impairs driving ability (Strayer, Drews, Crouch, & Johnston, 2005).

Since then, further research has been directed toward examining the validity of the legislators' stand on hands-free phone use with a particular emphasis upon the relative difference in the impairment of driving seen in users of hand-held phones relative to those using hands-free phones (McEvoy & Stevenson, 2006). Recently, Strayer et al (2005) concluded that there is no difference in the degree of interference produced by the two devices. The impairment seen in the driving task, in both situations, was comparable to that of a driver being intoxicated with a blood alcohol level of 0.08. Interestingly, it is not the act of listening that causes the deterioration in performance.

Strayer et al. observed that listening to the radio or books on tape did not impair driving performance, but being involved in a conversation did detract 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. Once a response is required Nunes and Recarte (2002) found no difference between talking on a phone and talking to a passenger – it was the complexity of the conversation that determined the degree of interference. Likewise, Drews, Psupathi and Strayer (2004) found that when their participants were engaged in naturalistic conversations with their passengers, references to the traffic conditions tended to be incorporated into the conversation and this shared experience reduced the interference effects on the driver. In contrast, when the conversation was more complex and not conversational in nature, Laberge, Scialfa, White and Caird (2004) failed to find any evidence that passengers would modulate their conversation according to the conditions of the traffic, and the drivers in their study fared no better than when they were engaged in similar conversations via a mobile phone. 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. This impairment is consistent with the notion that there is a finite amount of attention, and once attention is deployed to one modality, it necessarily extracts a cost on another modality. Shomstein and Yantis (2004) examined human brain activity during attention shifts between visual and auditory tasks and found that when attention was shifted from the visual modality to the auditory one, it resulted in an increase in activity in the auditory cortex and a decrease in activity in the visual cortex and vice versa. This implies that drivers have a reduced capacity to process visual information if they are concurrently conversing, as presumably their finite attentional resources are switched from visual attention on driving responses to auditory attention required for carrying on a conversation on the phone. Atchley and Dressel (2004) have shown that for individuals performing these two tasks at the same time, there is a limitation on their ability to process visual information that is in their peripheral field of vision. They suggest that a reduced functional field of view may be one means by which crash risk is increased with the use of mobile phones while driving.

The evidence so far is mixed regarding the impairment to driving that results from conversing with a passenger compared to that of talking to someone on a mobile phone. Furthermore, very little research has been done to investigate the role and the effect of the presence of passengers *per se* in cars. There is a growing body of evidence, both epidemiological and behavioural, to suggest that the presence or absence of passengers considerably influences the crash risk for young novice drivers (Chen, Baker, Braver, & Li, 2000; Preusser, Ferguson & Williams, 1998; Reiß & Krüger, 1995). It has been suggested that passengers explicitly encourage risky driving practices, 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 the conversation, however this assumption has not been empirically evaluated.

The objective of this study 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 younger drivers were used. Younger drivers are over represented in crash statistics (Williamson, 2003), and the penetration of new technology use amongst Australians is relatively high (DICTA, 2005). According to The Allen Consulting Group (2005) 94 per cent of Australians would have a mobile phone by June 2006, this is an increase from an estimated 81 percent from the previous year. Furthermore, as the Victorian Road Safety Committee (2006) has pointed out a camera and a radio function on a mobile phone are now standard features and users will soon be able to download music and live television to their handset, and "as mobile phone capabilities are enhanced, the opportunity for a driver to be distracted by the device is also increased." (p. 32).

From a future educational perspective, this relationship between the effects of various types of driver distraction on drivers when they are young and most at risk of crashing is most important to investigate.

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 fulfil 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 the 'STISIM' (version 8, model 100) driving simulator developed by Systems Technology Incorporated. 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 in miles per hour. A cardboard strip containing recalibration to kilometres per hour was attached below the existing 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.

Procedures

After providing informed consent and brief demographic details, the participants (regardless of condition) were asked to leave their mobile phones on during testing. Participants were randomly assigned to one of four conditions: control, one passenger condition, two passenger condition and a mobile phone condition. Upon allocation to one of the four conditions, participants were given a practice run on the STISIM drive simulator in order to gain confidence 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. Variables in the simulator environment were manipulated once the experimental drive began. In the silent (control) condition the course was completed without interference from either a confederate posing as a "passenger" or from a phone call. In the mobile condition an experimenter outside of the room phoned the participant while they were driving. The experimenter followed a script under the pretence of making sure they had turned up to the study 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 carried on 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 didn't 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, but of course could not mimic it directly.

Following the simulated drive, the control group was asked to recall/indicate various items (emergency vehicles, speed signs etc.) that they encountered during the drive and then to complete the NASA-TLX subjective workload questionnaire (Hart & Staveland, 1988). For the one passenger, two passenger and mobile conditions, participants were asked at the end of the drive not only to recall/indicate various items (emergency vehicles, speed signs etc) like the control group, but also participants in these three groups were also asked to recall six short questions pertaining to the confederate conversations. Like the control group, participants in the one passenger, two passenger and mobile phone conditions were also asked to complete the NASA-TLX subjective workload questionnaire. Debrief forms were administered to all participants at the end of the experimental session.

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 analysed: 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 looked like the mobile 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 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.

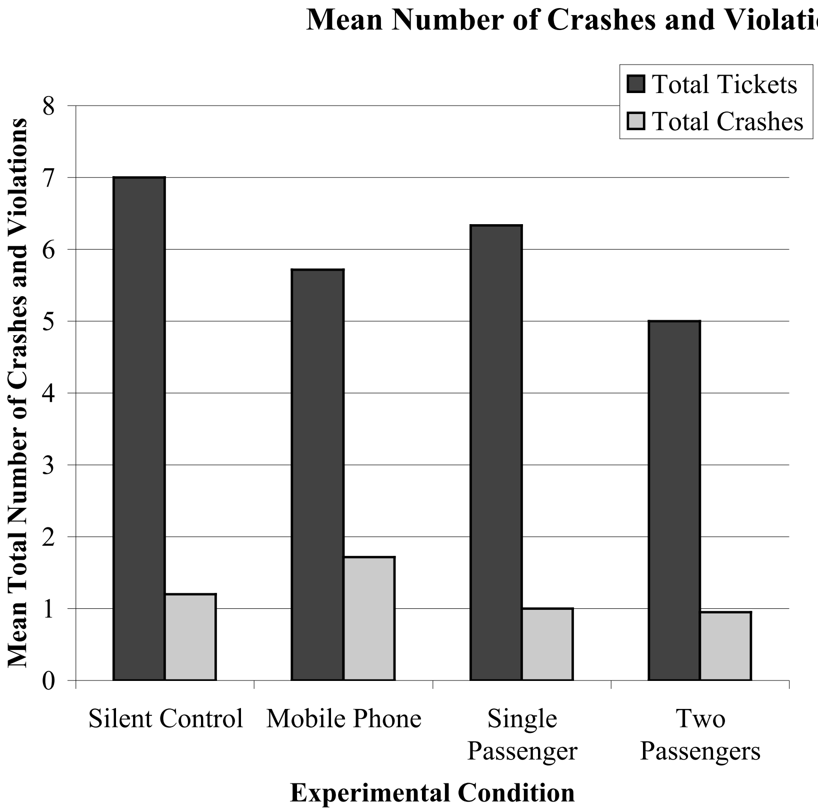

Figure 1. Mean Number of Crashes and Number of Tickets (for driving violations).

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 analysed 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 $F(1,72) = 6.16$, $p=0.001$.

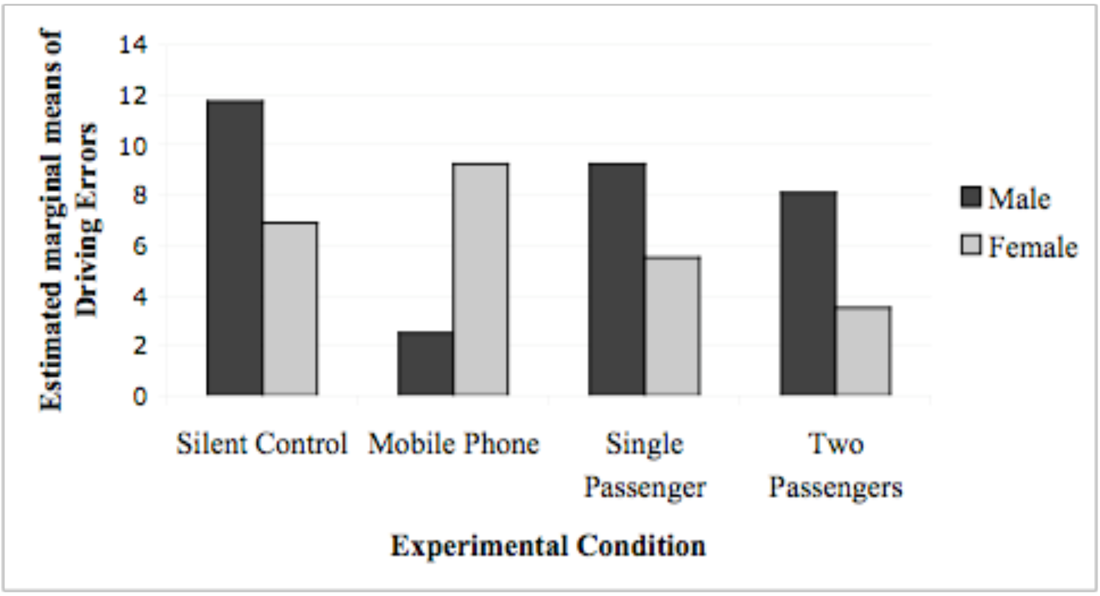

Figure 2. Means of Total Crashes and Violations

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 did 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 may 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, $F(2,56) = 4.92$, $MSE = 9.66$, $p = .01$. 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 passenger condition recalled fewer aspects of the conversation than did participants in either of the other two conditions. This suggests that participants in the two passenger 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 $F(3,76) = .116$, $p=.951$.

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 & 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 manoeuvre 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.

Stutts, Reinfurt, Staplin and Rodgman (2001) refer to a survey in the United States that has revealed that whilst the vast majority (84%) of mobile phone users believe that using a phone is a distraction and increases the likelihood of a crash, the same respondents report however that 61% of them use their mobile phone while driving and around 30% use their phone frequently or fairly often. A National Highway Traffic Safety Administration survey completed in January 2001 found that 54% of motor vehicle drivers in the United States usually have a mobile phone in their vehicles or carry mobile phones when they drive. Almost 80% of these drivers leave their phone turned on while driving, and 73% report having talked on the phones while driving.

This inconsistency between belief and behaviour 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. 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.

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