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THE INFLUENCE OF PASSENGERS ON DRIVING IN YOUNG DRIVERS WITH VARYING LEVELS OF EXPERIENCE

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Summary: Young drivers are at disproportionate risk of collision. It is unclear whether it is age or lack of driving experience that is the problem because age and experience are confounded in most studies (experienced drivers are typically much older). This study focused on drivers who were about the same age: all within the critical first years of skill development. We compared drivers just starting to drive (learner's license) with those with a full license. Young drivers are especially at risk when driving with passengers. Consequently, we were interested in how the ability to drive with passengers changes in these first years. Driving performance was measured in a driving simulator when the passenger was absent (Absent condition), and when there was a passenger who was either asking the driver questions or was silent (Talking and Silent conditions). As predicted, the experienced young drivers had lower hazard response times and fewer collisions. Similarly, as predicted, performance was worse in the Talking condition, insofar as more drivers missed their turnoff in the way-finding task (where they were required to arrive at a certain destination using signs and landmarks). However, there were also interactive effects of experience and condition. In-vehicle conversation had an especially negative effect on the least experienced drivers, producing more collisions. Conversely, the more experienced young drivers sped up when they were driving with a passenger who talked with them. There was little difference between Silent and Absent conditions for all measures. This suggests in-vehicle conversation may be the critical factor.

OBJECTIVES

Collision data reveals young drivers are at disproportionate risk compared to other age groups (Insurance Institute for Highway Safety, 2009; Transport Canada, 2011). There are a variety of possible explanations. Some focus more on driver immaturity/risk taking and others stress lack of driving experience (Borowsky et al., 2009; Lee, 2007; McKnight & McKnight, 2003). Unfortunately, it is difficult to tell because age and driver experience are confounded in most studies (the more experienced drivers are also considerably older). In this study we tested young drivers of approximately the same age who varied in driving experience. Young drivers are at especially high risk in the presence of young passengers (Lam, 2003; Simons-Morton et al., 2005) and we were interested in how the ability to drive in the presence of a passenger changed as a function of experience within the critical first years of driving. In particular, we were interested in the impact of in-vehicle conversation. Studies suggest that in-vehicle conversation may interfere with driving, though perhaps not as much as cellular phone conversation (Caird et al., 2008; Horrey & Wickens, 2006; McPhee et al., 2004). Alternatively, it is possible that the

Table 1. Participant age and driving information

Group	Age (SD)	# Years	Last Drove (days)	Time/Month
Experienced	19.3 (1.4)	3.3 (1.3)	10.7 (10.4)	16.8 (12.1)
Novice	18.5 (0.9)	1.7 (0.8)	55.1 (58.7)	10.1 (18.9)

mere presence of a passenger may impair driving performance in young drivers, as might occur if they were prone to performance anxiety or a tendency to show off.

We tested two groups of young drivers with different levels of experience, measuring their driving performance changed as a function of passenger behaviour. In one condition the passenger was asking them questions (Talking condition) and in the other, the passenger sat silently beside them (Silent condition). In a third condition the driver was alone in the vehicle (Absent condition). We predicted that for the least experienced young drivers, conversation would have especially deleterious effects on performance (hazard RT, collision rates, steering variability, speed, way-finding), though we expected that the presence of a silent passenger might also have some negative effects as compared to the Absent condition.

METHODS

Participants

58 drivers were recruited from the introductory psychology subject pool and paid in course credit. 44 completed the study (14 were dropped due to simulator sickness, 2 more were dropped for irregularities during testing). Participants were grouped based on driving experience. Although the groups were of similar age, the more experienced drivers had a full license and an average of 1.6 years more driving (Experienced group: n= 22, 9 females). The less experienced drivers only had a learner's permit (Novice group: n = 20, 11 females). See Table 1 above.

Apparatus and Stimuli

Participants were tested in a Drive Safety DS-600c fixed based driving simulator: a full car surrounded by screens for a 300-degree wraparound virtual driving environment. Three unique but comparable 12-minute drives were created to three small towns: Kimball, Ordway, and Longmont. All had two-lane rural roads but the scenery varied. Each had light traffic, directional signs, and speed limit postings (70 and 80 kph). There were also periodic hazards: objects that suddenly came into the path of the vehicle from either the right or left. (Hazard RT and collisions were measured.) Each drive required participants to find their way to a specific town (e.g., Kimball), making use of the directional signs and a landmark (e.g., a service station). At the beginning of each drive, drivers were told the name of town that was their destination, and they were also told to follow the signs and turn right or left at a specific landmark (shown in a screen shot). Each drive included 6 choice points; 2 required the driver to make a turn. Half of the intersections had signs with town names. The other half had landmark buildings. Way-finding was measured by looking at missed turns (driving straight through a choice point intersection), wrong turns (turning left instead of right, or vice versa at a choice point intersection) and extra turns (turning at intersections they were not instructed to turn at). If drivers made an error, the

simulator automatically put them on the correct path with no error feedback. (Extra turns or wrong turns were rare, and consequently the focus will be on missed turns.)

Procedures

Testing was conducted by a female research intern (a third-year undergraduate who served as passenger in the vehicle) and a 32-year old male simulator technician in a different room. After the introductions, drivers were asked to complete questionnaires on their age, sex, and driving history. They were then given a 5-minute practice drive to get used to the simulator. Then the drivers completed the drives. In the Talking condition, the female passenger asked them a series of scripted questions, such as, "What is your favourite television show?" and "What happened in the last episode you watched?" In the Silent condition, the passenger sat quietly in the car with the driver. In the third condition the passenger was absent from the car (Absent). Each drive began with the driver being given instructions on how to get to a certain town (e.g. Kimball). They were told the name of the town and also shown a landmark and told that they had to turn right or left at the landmark. Condition order was counterbalanced as the order they experienced the three drives. Performance was measured in terms of hazard RT, collisions, standard deviation of lateral position (SDLP: an index of steering), driving speed, and way-finding performance.

RESULTS

Statistical analyses involved factorial mixed analysis of variance, with driving experience (novice, more experienced) as the between subjects factor and passenger condition (talking, silent, absent) as the within subject factor. The Greenhouse-Geisser correction on degrees of freedom was used if there was evidence of violations of the sphericity assumption. *LSD* Post-hoc tests of means were used as needed. Effect size is indicated by partial eta squared (η^2).

Hazard RT showed the expected advantage for the experienced drivers, with significantly higher HRT for the more inexperienced ($F(1,40) = 26.4$, $p < .001$, $\eta^2 = .40$) though no other significant effects emerged (Figure 1) and the trends were surprising, with silent passengers slowing hazard RT about as much as talking passengers (slightly more for the more experienced group). However, the effect of condition was more evident from the collision data (Figure 2). The difference between the more and less experienced drivers was most pronounced in the Talking condition (Experience X Condition interaction: $F(1.58, 63.25) = 3.25$, $p = .056$, $\eta^2 = .08$), with the novice drivers having more collisions in the talking condition ($p < .05$). Both experience and condition had an effect on steering ($F(1,40) = 13.7$, $p = .001$, $\eta^2 = .26$; $F(2,80) = 14.2$, $p < .001$, $\eta^2 = .26$) as can be seen in Figure 3, though there was smaller SDLP in the Talking condition ($p < .05$). This reduction in SDLP cannot be accounted for by reductions in speed, because as shown in Figure 4, driving speeds were significantly faster in the Talking condition ($F(2,80) = 3.04$, $p = .053$, $\eta^2 = .07$), with the discrepancy between the posted limit and actual driving speed highest for the experienced drivers ($F(1,40) = 3.54$, $p = .067$, $\eta^2 = .08$). Condition also had an effect of way-finding performance ($F(1.68, 67.08) = 6.23$, $p = .005$, $\eta^2 = .14$) insofar as there were more missed turns when drivers were talking to the passenger than the other conditions ($p < .05$) but in this case the manipulation on experienced and inexperienced drivers had no effect (Figure 5).

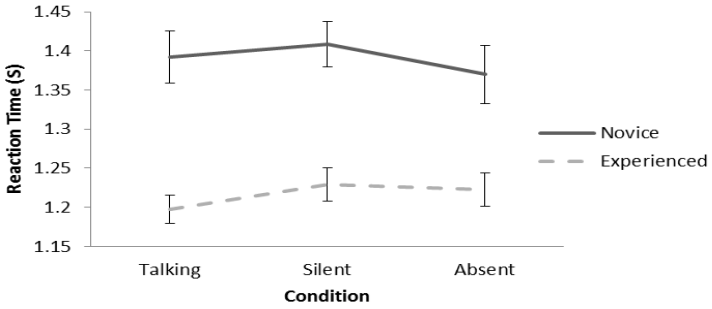

Figure 1. Experienced drivers had significantly faster reaction times than novices

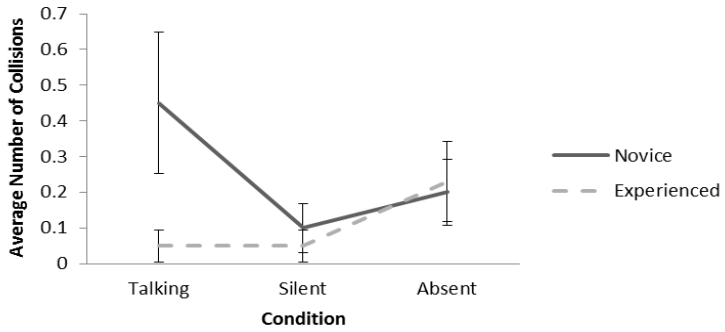

Figure 2. Novice drivers had significantly more collisions in the Talking condition than experienced drivers

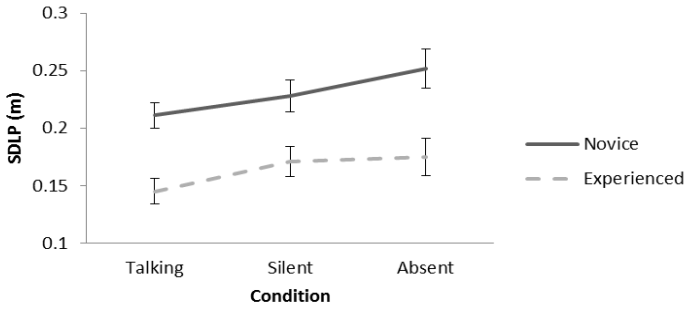

Figure 3. Novices swerved more than experienced drivers, with the least overall swerving found in the Talking condition, and most in the Absent condition

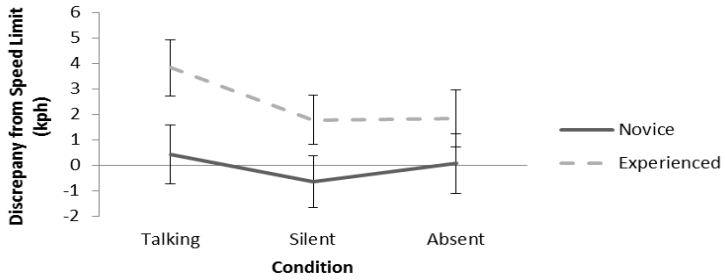

Figure 4. Experienced drivers drove fastest in the Talking condition, while novices maintained a steady speed across all three conditions

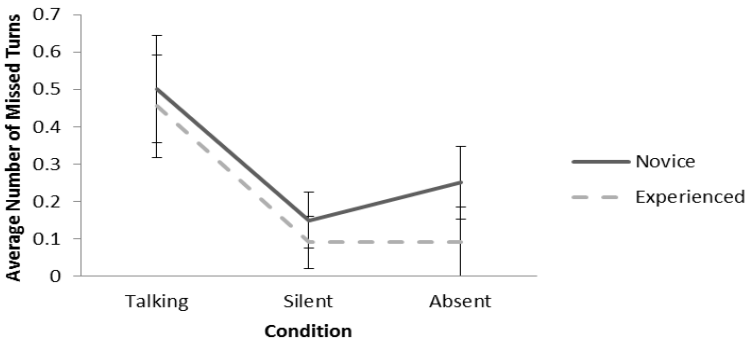

Figure 5. Drivers made the most mistakes getting to their destination in the Talking condition

CONCLUSIONS

This study showed two things. First, there were notable differences in performance as a function of experience, even though the drivers differed in age by less than a year and in experience by less than two years on average. The less experienced drivers had significanlty higher hazard RT and SDLP than the more experienced drivers despite having significantly lower speeds. Second, this study shows that passengers do have an effect on performance, though there was little difference between the Silent Passenger and Absent Passenger conditions for any of the indices of driving, which suggests that the critical factor is in-vehicle conversation. This study shows that even the most innocuous of conversations, simply answering a list of questions from a complete stranger, is enough to compromise driving performance in young drivers. All of the young drivers, regardless of their experience, made signficantly more way-finding errors (missed more turns) in the Talking condition.There is some evidence that the more experienced young drivers dealt with the challenge of in-vehicle conversation a little better than the less experienced drivers insofar as the difference in the number of collisions between experienced and inexperienced drivers was especially pronounced in the Talking condition. Suprisingly, in-vehicle conversation seemed to reduce steering variability, though alarmingly, it seemed to increase driving speed. From Figure 4, it seems this is especially notable in the more experienced drivers, who were significantly more discrepant from the posted speed limit.

This study began with a quesiton of how experience affects performance in the critical first years of driving in young adults, particularly as it relates to the abilty to deal with the attentional demands of passengers in the vehicle. Our results suggests that that there are improvements in basic driving skills within the first 2 years, but there are also changes in terms of the ability to deal with the attentional demands of carrying out a conversation while driving. All of the young drivers had difficulties way-finding while talking to a passenger, but for the least experienced young drivers, the most basic of in-vehicle conversation was enough to result in collisions. It is important to note that this study probably underestimates the magnitude of the problem. There was an advantage to having a stranger as the passenger in terms of experimental control, insofar as there was no need to worry about social and emotional factors associated with pre-existing relationships, but conversations between individuals who know one another would no doubt be more emotionally engaging (and more distracting) than simply answering a list of questions (Dula et al., 2011). This study is also limited insofar as it only tested the impact of conversation with a young female passenger. Research suggests that the risk of collision is higher in the

presence of male passengers (Simons-Morton et al., 2005). There may be differences in norms of conversational interaction between males and males, males and females, and females and females as it relates to how much time the listener spends looking at the speaker and vice versa. Furthermore, there may be a sexual dynamic between driver and passenger that could complicate the issue. For example White and Caird (2010) showed that the presence of an attractive female increased the number of looked but didn't see episodes in young male drivers. All of these factors point out the need to manipulate both the sex of the driver and the passenger.

At this point, we have only focused on the behaviour of the driver, but it may be as important to look at the behaviour of the passenger (Charlton, 2008). For young drivers, the risks are higher when passengers are also young (Lam, 2003; Simons-Morton et al., 2005). The cause for this may be either age or experience related. There may be social dynamics (peer pressure, competition) that may cause young drivers to perform worse with young passengers, but the effects may also be related to driving experience. Younger passengers are less likely to be experienced drivers, and perhaps more experienced drivers are more likely to appreciate the dangers on the road (Borowsky, Oron-Gilad, & Parmet, 2009). Thus, a passenger with more driving experience may have the good sense to stop conversation when the conditions become difficult, whereas a passenger with less driving experience might not. As well, older drivers may have a better memory of how poor their own driving performance was as a novice. (They may have been in their own collisions.) Consequently, they may act more like a co-pilot or driving coach rather than a mere passenger.

This study had a number of limitations. Although we did find evidence of experience effects, the two groups of drivers did not differ by that much in their experience, and only a very narrow age range was tested. Eye movement analysis would have helped us pin down whether the effects observed occurred because the drivers were looking at the passenger instead of looking at the road, at least in the Talking condition. Nonetheless, this study shows that for young inexperienced drivers, even a minimal amount of conversation with a complete stranger is enough to cause some deficits in driving performance. It may take a certain amount of experience to automatize driving tasks to the point that conversation with a passenger no longer poses a safety concern. This highlights the wisdom of graduated licensing programs that take the precaution of restricting the presence of young passengers with young drivers within the first year of obtaining their license (Williams, 2007).

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