Driving Under the Influence of Peers

Lina Eneberg, Rebecca Faleij, Louisa Hirvonen, Otto Moström, Miguel Pirfano Kristoffersson, Theo Salminen, David Svartnäs, Linnéa Tillkvist Ekman

Abstract

Traffic security is a pressing issue in today's society, as traffic volumes continue to increase and technological advancements introduce new risks and driving behaviors. Speeding is a significant contributor toward road accidents leading to injuries as well as fatalities. This study aims to examine the effect of implicit peer pressure on speeding. A driving simulator was used to conduct an experiment where risky driving behavior was measured. The recruited participants were split into either an experiment or a control group. Both groups drove two courses in the simulator but the experiment group was exposed to an artificial leaderboard meant to represent a form of implicit peer pressure beforehand. No significant results were found for difference in speeding between the two groups, but significant results were found looking within genders. The results indicate that the relationship between implicit peer pressure and speeding may be more complex than previously thought and further research would be necessary to examine the difference in effect between demographic groups.

1. Introduction

In this section the foundations of the project will be presented. These include a description of the theoretical background, research questions, and purpose.

Road safety is a critical concern in Sweden, prompting the Swedish government to establish ambitious goals within the Vision Zero initiative. By 2030, the aim is to halve the number of traffic-related fatalities and reduce the number of serious injuries by 25% (Motion 1997/98:TU04). The Vision Zero initiative is an approach for creating safer roads and minimizing the impact of car accidents. To achieve these goals, it is crucial to understand the underlying causes of traffic accidents.

Peer pressure in driving refers to the impact of social dynamics and norms on individuals' decision-making while behind the wheel. Peer pressure can be either implicit or explicit. Implicit peer pressure encompasses the social influences that can shape driver behavior, often going unnoticed or unacknowledged. Understanding the role of implicit peer pressure is crucial for developing effective strategies to promote safe driving practices as previous studies have shown, peer pressure's effect on risky driving behavior (Gheorgiu et al., 2015).

Driving simulators are used for various of purposes, such as driver assessment, training, and research (de Winter et al., 2012). They provide access to an artificial environment where individuals can practice skills transferable to the real world (Chang, 2015).

To evaluate how prone different drivers are to risky driving, Linderholm (1997) created a survey to be able to divide different personality types into categories that reflect on their attitude towards driving. The test is called "Drivers Attitude Type Evaluator" or DATE for short. This test has proven to be of use in several cases, for instance in drivers' education, to teach students about risky driving and the causes and implications of such behaviour (Linderholm & Trivector Information AB, 2003).

To meet the aim of this study, the following research questions will be addressed:

1. How does implicit peer pressure affect speeding behaviour?
2. How is susceptibility to peer pressure affected by demographical factors such as:
    - Gender
    - Driver's attitude

This paper aims to examine the research gap of implicit peer pressure and its impact on speeding behavior among drivers. Specifically, the study will examine the relationship and the influence of peer pressure, gender, and attitudes toward safe driving practices. The expected outcomes of the study are to provide insights into how implicit peer pressure can influence driving behavior and to provide a scientific foundation for designing strategies promoting safe driving practices among different demographic groups.

2. Research approach and methods

The research for this project was conducted through an experiment consisting of letting participants drive through two scenarios in a driving simulator.

2.1 Participants and groups

A total number of 29 participants were recruited through convenience sampling. They were subsequently divided evenly into an experiment group and a control group. All participants possessed a Swedish driving license. One participant was later excluded from the data analysis.

2.2 Driving simulator

The material used in the experiment was a driving simulator consisting of driving equipment from logitech, a desktop setup with three monitors and the software Skillster.

2.3 Surveys

Two surveys were used in the experiment: a pre-experiment survey and a post-experiment survey. The first section of the pre-experiment survey collected background information about the participants, including demographical details, such as age and gender, and their previous experience with simulators. In the second section of the pre-experiment survey, participants answered questions from

the Driver's Attitude Type Evaluator (DATE) framework (Linderholm, 1997). These questions were designed to assess participants' attitudes towards driving and determine their potential risk profiles.

The post-experiment survey allowed participants to further detail their experience of using the simulator, for example, how easy to learn they found it, how realistic they perceived it to be, and if they encountered any issues related to simulator sickness during the experiment. Finally, they were also asked to estimate how safe their driving is and how susceptible to peer pressure they believe they are.

2.4 Experiment design

The experiment began with a moderator welcoming the participant to the experiment and asking them to fill out a pre-experiment survey. Afterwards, the participant drove along a warm-up course in order to get accustomed to the simulator's controls. The warm-up course did not have an explicit goal, the participant could drive as they wished. After the warm-up, they received instructions from the moderator to drive the test course as they normally would in regular traffic conditions. To complete the course, the participant had to reach a roundabout after following a straight road for about 3-4 minutes. Finally, after completing the experiment course, the participant was asked to fill out a post-experiment survey.

Leaderboard

If a participant belonged to the experiment group, the moderator, prior to the experiment course, would show them a fake leaderboard for 30 seconds consisting of fake participant ID numbers, their gender, and the time it took them to complete the course. This was meant to introduce an element of implicit peer pressure which potentially could affect the driving behavior of the participant. There were two versions of the leaderboard, one represented a group of young male participants and one a group of young female participants. The choice between which leaderboard to show was based on the gender of the participant to attempt to represent their peer group.

2.5 Data collection

The data collected from the participant, other than the survey answers, was the time it took for them to complete the course, the amount of speeding instances, and details about their speeding, such as how fast they were driving and the duration for which they drove above the speed limit.

3. Results

This section contains the gathered quantitative results from the experiments and the pre- and post-experiment surveys.

3.1 Group composition

The mean age for the control group (N = 14) was 26.1 years, (SD = 8.88). For the experiment group (N = 14) the mean age was 22.6 years (SD = 2.99). No significant difference in age was found between the control group and the experiment group, as shown by an independent t-test, Mann-Whitney U = 87.5, p = .641.

Based on their responses to the Driver Attitude Type Evaluator, the participants were sorted into four DATE categories. In the control group 8 participants (28.57%) were classified as responsibility seekers, 3 (10.71%) were classified as sensation seekers, 1 (3.57%) as a risk taker, and 2 (7.14%) as safety seekers. The experiment group consisted of 5 (17.86%) responsibility takers, 3 (10.71%) sensation seekers, 4 (14.29%) risk takers, and 2 (7.14%) safety seekers. No significant difference in the distribution of DATE categories was found across the groups (p = .540)

The mean driving experience for the control group was 6.57 years (SD = 6.15). For the experiment group the mean driving experience was 3.64 years (SD = 2.21)

When questioned about their weekly driving habits, 24 participants (85.71%) reported driving less than 30 minutes per week, 2 (7.14%) reported driving 0.5-1.5 hours a week, and 2 (7.14%) reported driving 1.5-2.5 hours per week. As for monthly driving habits, 22 participants (78.57%) reported driving 5 times or less every month, 3 (10.71%) reported driving 6-10 times per month, 2 (7.14%) reported driving 10-15 times per month, and 1 (3.57%) reported driving more than 20 times a month. A Fisher's exact test indicates that these driving habits (both weekly and monthly) are approximately equal between the control group and experiment group, (p = .730, and p = .789).

16 participants (57.1%) reported spending less than an hour per week playing video games. 4 participants (14.3%) reported spending 1-3 hours per week playing video games, 3 (10.7%) reported spending 6-10 hours per week on video games, and 5 (17.9) reported spending more than 10 hours a week on video games. In further questioning, 1 participant (3.57%) answered that they often play racing games. 13 participants (46.43%) responded that they play racing games on occasion, and 14 (50.0%) reported that they never play racing games. No significant difference could be found between the test groups in their gaming habits nor their tendency to play racing games.

When asked about their previous experience with driving simulators, 11 participants (39.3%) reported having previous experience with driving simulators, and 17 (60.7%) did not. Of the ones with previous simulator experience, 8 belonged to the control group and 3 to the experiment group. There was no significant difference in the proportion of participants with simulator experience between the test groups (p = .12).

3.2 Implicit peer pressure and speeding

The mean maximum speed above the speed limit reached by the control group (N = 14) was 8.29 km/h, (SD = 5.20). For the experiment group (N = 14) the mean maximum speed above the speed limit was 11.9 km/h, (SD = 8.22). No significant difference in maximum speed above the speed limit was found between the two test groups, ($t(26)$ = -1.37, p = .09, *Cohen's d* = -.520).

The mean time spent speeding for the control group was 25.4 seconds, (SD = 26.6). For the experiment group the mean time spent speeding was 34.5 seconds (SD = 31.7). There was no significant difference found in the total duration speeding between the test groups, (Mann-Whitney U = 82.5, p = .245, *Cohen's d* = -.312).

3.3 Speeding and driving within the moped group

There were 12 (42.86%) participants who encountered the slow-driving moped during their test, 6 of these belonged to the control group and 6 to the experiment group. There was a significant difference in total time spent speeding between the participants that did encounter the moped (M = 15.62, SD = 25.64) and the ones who did not (M = 42.33, SD = 26.71) ($t(40)$ = -32.0, p = .009). A significant difference was also found for total instances of speeding between the participants trapped behind the moped (M = 1.77, SD = 1.74) and the participants not trapped (M = 4.07, SD = 2.12), ($t(37)$ = -2.0, p = .005).

Further, there was a significant difference in the total time (in seconds) it took to complete the course for the participants that were stuck behind the moped (M = 305.85, SD, 31.07) and the ones who were not (M = 238.47, SD = 20.05), ($t(11)$ = 72.0, p = .001).

3.4 Speeding and peer pressure within genders

When looking at only male participants, the mean maximum speed above the speed limit for the control group (N = 7) was 6.57 km/h, (SD = 4.61). For the experiment group (N = 7) the mean maximum speed above the speed limit reached 14.43 km/h, (SD = 6.92). There was a significant difference in maximum speed above the speed limit between the test groups when limiting them to only male participants, ($t(12)$ = -2.50, p = .014, *Cohen's d* = -1.335).

The mean time spent speeding for males in the control group was 18.43 seconds, (SD = 18.16). For the male participants in the experiment group the mean time spent speeding was 44.43 seconds, (SD = 31.50). There was a significant difference in the total duration of speeding between the control group and the experiment group when looking at only male participants, ($t(12)$ = -1.89, p = .041, *Cohen's d* = -1.011).

When looking at only female participants, the mean maximum speed above the speed limit for the control group (N = 7) was 10.0 km/h, (SD = 5.51). As for the experiment group (N = 7), the mean speed above the speed limit was 9.29 km/h, (SD = 9.11). No significant difference was found in maximum speed above the speed limit supporting our hypothesis that the participants in the control group would attain a lower maximum speed above the speed limit than the ones in the experiment group, (Mann-Whitney U = -6.50, p = .974, rank biserial correlation = .639). However, there was a significant difference in the opposite direction, (Mann-Whitney U = 6.50, p = .038, rank biserial correlation = .639).

The mean time spent speeding for female participants in the control group was 32.29 seconds, (SD = 32.95). The mean time spent speeding for the female participants in the experiment group was 24.57, (SD = 31.0). There was no significant difference in the total duration spent speeding between the control and experiment groups when only looking at female participants, (Mann-Whitney U = 19.5, p = .759, rank biserial correlation = .2041).

3.5 Gender differences

The mean value for self-reported susceptibility to peer pressure for female participants (N = 14) was 2.71, (SD = .914). For male participants, (N = 14) the self-reported mean value was 2.0, (SD = .679). There was a significant difference in self reported susceptibility between the female and male participants, (Mann-Whitney U = 55.0, p = .0018, rank biserial correlation).

When asked to assess their own familiarity with driving and ability to drive safely, female participants provided a mean value of 3.29, (SD = .994) and 2.79, (SD = .975), respectively. For male participants the mean values reported were 3.71, (SD = .994) and 3.50, (SD = .855), respectively. No significant difference was found in self-reported familiarity with driving between the female and male participants (Mann-Whitney U = 75.0, p = .276, rank biserial correlation = .235). However, there was a significant difference in self-reported driving safety between the female and male participants (Mann-Whitney U = 62.5, p = .041, rank biserial correlation = .362).

Female participants reported having a more difficult time learning to use the driving simulator (M = 2.57, SD = .852) than men (M = 1.50, SD = .76). There was a significant difference in the reported difficult level of learning to use the simulator between the female participants and the male participants (Mann-Whitney U = 33.0, p = .002, rank biserial correlation = .663). There was also a significant difference found in the reported naturalness of controlling the simulated vehicle between female (M = 2.29, SD = .825) and male participants (M = 3.14, SD = 1.03), (Mann-Whitney U = 49.0, p = .017, rank biserial correlation = .50).

3.6 Gaming habits and perception of the simulator

A positive correlation was found between the participants gaming experience and perceived naturalness when controlling the simulated vehicle ($r(26)$ = .391, p = .04). Additionally, a negative correlation was found between participants gaming experience and the reported difficulty level of learning to use the simulator, ($r(26)$ = -.503, p = .006).

3.7 Experience of using the simulator

7 participants (25.00%) reported experiencing negative side-effects during the experiment, whereas 2 (7.14%) reported being unsure and 19 (67.68%) experienced none at all. When prompted to describe the side-effects, 8 participants (28.57%) responded by describing symptoms of motion sickness such as nausea and dizziness.

When asked to rate the realism of the simulator, 11 participants (37.9%) gave it a score of 3. 10 participants (34.5%) gave it a 4 and 5 (17.86%) gave it a 2. The main concern reported when the participants were asked to pinpoint what factors made the simulator feel unrealistic was the unnatural responses received from the controls in the simulator. When asked to rate how natural the vehicle felt to control, 13 participants (44.8%) rated their experience as a 3, 8 participants (27.6%) gave it a 2 and 3 (10.71%) reported a 1. Once again, the response from the controls was brought up as the main reason why the simulator was perceived as difficult to control.

Participants were asked to rate how difficult the system had been to learn. 9 participants (31.0%) gave it a score of 5. Meanwhile 11 (37.9%) rated it as a 4 and 7 (25.0%) as a 3.

3.8 DATE categories and speeding

The mean maximum speed above the speed limit for the responsibility taker DATE category (N = 13) was 7.00 km/h, (SD = 7.26). The mean maximum speed above the speed limit for the sensation seeker (N = 6) was 12.50 km/h, (SD = 12.5). The mean maximum speed above the speed limit for the risk taker (N = 5) was 16.40 km/h, (SD = 5.18). The mean maximum speed above the speed limit for the safety seeker (N = 4) was 8.50 km/h, (SD = 3.87). For these categories a significant difference in the maximum speed above to speed limit was found (Chi square = 11.10, p = .011, df = 3, 2 = .411). By conducting pairwise comparisons the statistically significant difference could be pinpointed to the two categories responsibility taker and risk taker, (W = 3.85, p = .033). No significant difference was found between the remaining pairs, (p ¿ .05).

The mean total speeding duration for the responsibility taker DATE category (N = 13) was 16.62 seconds, (SD = 19.16). The mean total speeding duration for the sensation seeker (N = 6) was 43.50 seconds, (SD = 35.77). The mean total speeding duration for the risk taker (N = 5) was 44.80 seconds, (SD = 35.51). The mean total speeding duration for the safety seeker (N = 4) was 34.25 seconds, (SD = 28.36). No significant difference was found among the four categories Chi square = 6.34, p = .096, df = 3, 2 = .235.

4. Discussion

In this chapter of the report both the results and method will be discussed in the context of these questions and if they meet the study's purpose. Lastly, the chapter will discuss potential changes that could have been made and recommendations for future studies in this area.

4.1 Result discussion

This section will consist of an analysis of our results, specifically their applicability and what they could indicate for the present study in the context of the research questions.

Group composition

The present study acknowledges that both the experiment and control group had comparable compositions, indicating that any observed differences are likely due to exposure to the leaderboard, and not socio-demographical factors. However, the participant population predominantly consisted of younger drivers with relatively low driving experience, thereby limiting the generalizability of the study.

Implicit peer pressure and speeding

While previous research regarding peer pressure and speeding indicates that participants of the experiment group are likely to drive in a riskier manner, the results of this study did not show significant differences in speeding behaviour between experiment and control groups in the general population. Taken on its own, this suggests that implicit peer pressure may have no effect on speeding, or a more limited effect than anticipated. Possible causes could be that implicit peer pressure is less salient than explicit peer pressure, or that the leaderboard lacked any necessary personal information to exert any significant pressure on the participants.

Implicit peer pressure and speeding within genders

A significant difference was found when observing the effect of implicit peer pressure on speeding between male and female participants. Male participants exposed to the leaderboard exhibited higher maximum speeds and longer durations of speeding, which aligns with the expectations for the general population. However, female participants achieved unexpected results, as the control group showed higher maximum speeds. This indicates that the leaderboard may have had a positive effect on the driving safety of female participants, but further research is needed in order to understand the relationship between gender, implicit peer pressure, and speeding behaviour.

Speeding among DATE categories

Due to the small sample size, this study could not draw any definitive conclusions about differences in speeding behaviour between DATE categories. However, significant differences were found between the responsibility takers and risk takers, with the latter exhibiting longer speeding durations, as well as reaching higher speeds above the limit. This aligns with our expectations, as the risk taker is the most likely to admit to speeding, while the responsibility taker can be regarded as the most risk-conscious category.

Simulator accessibility

The prevalence of simulator sickness was identified as an issue for the study, with 25% of participants reporting negative side effects, such as nausea or dizziness. While these symptoms did not directly impact the participants' driving performance, they highlight the need to address simulator-related factors to mitigate such effects. Additionally, a difference in the difficulty level of using the simulator was observed between male and female participants. This could potentially be due to the fact that the female participants spent a significantly smaller amount of time gaming per week, but further research would be required to explore these variables' impact on simulator-based studies.

The moped issue

During the experiments, 12 of the participants were observed driving behind a moped in the test course, six of them being in the control group and six in the experiment group. Since the speed limit of the moped was 40 km/h, its presence affected participants' driving behaviour, leading to queues in traffic, and hesitation in overtaking. This external factor may therefore have impeded a number of possible occurrences of risky behaviour and speeding that could have been observed otherwise. Since the participants who encountered this issue were evenly distributed between the groups, we however still believe that the results are valid when studying behavioural differences.

4.2 Method discussion

When designing an experiment, there can be a substantial number of lessons learned in hindsight. This section will discuss the design of the present study's method, how well it serves to fulfill the study's purpose and factors that could

affect its applicability. Finally, it will cover the sustainability of the method design.

Driving simulator

The effectiveness of a driving simulator for driving training is in part dependent on its fidelity (de Winter et al., 2012). Although similar motor operations are required to manoeuvre the car in the simulator and a real car, the simulator's haptic feedback is lacking compared to real life. Increasing the fidelity of the simulator by implementing a moving base system that could recreate haptic feedback could be a way to increase individuals' risk perception.

Factors affecting the relationship between leaderboard exposure and performance

The effect of leaderboards on engagement and performance has been linked to trait competitiveness (Amo et al., 2019). Previous research indicates that competitiveness also may increase the prevalence of risky driving behaviour (Blows et al., 2005). Because of this, it could have been beneficial to control for trait competitiveness in the participant population and examine how it may have affected the results. Unfortunately, such a comparison was deemed infeasible for this study due to the relatively small participant population and resource limitations.

Studies on the effects of leaderboards across different groups also show differences between individuals with varying personality traits. Findings suggest that individuals who score high on the personality trait extroversion may experience leaderboards more positively (Jia et al., 2017). This would be an interesting approach in future studies.

A point of criticism for this study could be that the participants were never explicitly asked about the experienced effect the leaderboard had on them. If such a question was included in the post experiment survey, it could have allowed for a broader analysis of the leaderboard's effect on performance. However, since the first research question was specifically about it's effect on speeding behavior, we believe that the current level of analysis is still sufficient to answer it.

Leaderboard design

Since leaderboards have been shown to be able to have a positive influence on performance (Huang & Hew, 2015; Schlömmer et al., 2021), they could potentially also be used as a form of positive peer pressure in driving education. For this to be effective, the leaderboard would need to be designed in a way that simulates positive peer pressure. Few studies appear to have examined the effect of leaderboard design on performance in an educational context. Such research would be necessary for the application of leaderboards in simulators such as Skillster.

Participants

As the recruitment was done within the respective friend groups of the researchers, this led to having mainly students in their early 20's, with only a few outliers in the age of 30 and above, participating in the experiments. The homogeneity of the sample made it difficult to study whether for example age or driving experience are factors that would affect the results. A wider distribution of subjects would also make the results more applicable to the general public.

Sustainable development

We have not spent any money on environmental matters due to the fact that we had no monetary budget for this project. On the other hand, we have not affected the environment that much due to the fact that we used a simulator which only uses electricity as a resource. Furthermore, most cars use fossil fuels and emit toxic gases that are bad for our health and the environment, which made the simulator seem like the more sustainable choice for conducting this project (Tierney & Bird, 2020). If this project shows significant results, this may lead to driving schools and other projects to choose a driving simulator over the use of a car.

Future research

Further research studying the effect of implicit peer pressure on various driving behaviours would be highly valuable to determine whether it is a risk factor that needs to be considered during driving education or not. This could involve both looking at the effect of leaderboards in other contexts or examining how other forms of implicit peer pressure may alter behaviour.

It would be interesting to further examine how different DATE groups are impacted by implicit peer pressure. Due to the low sample size, such comparisons were not possible in this study. Such findings would be highly valuable, as they could provide a foundation for how driving education can be improved to increase different individuals' risk awareness and to, in the long-term, decrease the traffic mortality among young novice drivers.

Another interesting area of research is how the leaderboard design can affect performance. Although there have been attempts at categorizing leaderboards based on various functional and visual aspects, there is a lack of research which takes an in-depth approach to how graphical elements of a leaderboard may motivate or demotivate individuals. If gamification were to turn into an increasingly accepted and prevalent didactic method, it would be beneficial to gain a greater understanding of how it can be used to promote positive learning outcomes.

Finally, further simulator research should aim to explore the connection between driver performance within the simulator and the level of simulator fidelity.

5. Conclusion

The present study shows no statistical difference in speeding behavior between those exposed to implicit peer pressure and those who were not. However, there were significant differences in it's effect between genders. According to the results, male participants showed a higher susceptibility to implicit peer pressure whilst females showed an inverse effect where those who were exposed generally had lower maximum speed than those who were not. Female participants also reported the simulator as harder to learn than the male participants. 25% of the participants reported experiencing symptoms of simulator sickness.

So what implications could be drawn from these results? We believe that, because of the lack of statistical differences

in speeding behavior, the applicability of the study is lessened when it comes to using it for traffic safety regulation. The results are however meaningful for future studies regarding simulators, for example when researching fidelity and it's effect on simulator sickness or simulator accessibility for certain demographical groups.

Finally we believe that, since built-in digital screens in the dashboards of cars are becoming more common, it is imperative that the displayed information's effect on driving behavior is carefully considered. Further studies in this area could prove beneficial in classifying certain information as either positive or negative influences on safe driving. This would directly be a meaningful finding for everyone present in traffic.

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