# Exploring the Interaction Between Susceptibility to Peer Pressure and Listening to Podcasts on Driving Performance

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## Abstract

This study explored the effects of listening to podcasts on driving performance in a complex simulated driving environment. It also looked at the moderating effects of susceptibility to peer pressure on this relationship. A within-subjects design was used with 26 participants, who each completed two drives, one with and one without listening to a podcast. Driving performance was measured using speed, speed variability, lane swerving, and gap acceptance behaviour. No significant effects of podcast listening or peer pressure susceptibility on the core driving performance outcomes were found. General susceptibility to direct and indirect risk-encouraging peer pressure also did not moderate the effects of listening to podcasts on driving performance. Instead, individuals who were more susceptible to risk-discouraging peer pressure showed a higher speed variability while listening to the podcast. This suggests that people who are more susceptible to safety-focused peer pressure may become more distracted by podcasts while driving. Overall, this study showed that there are no indications that listening to a podcast affects driving performance. Nonetheless, certain individuals' driving performance may still be affected by podcasts, depending on their susceptibility to peer pressure. This shows that individual differences are an important factor when studying distraction while driving. Future studies could explore these factors and establish a more comprehensive view of auditory distractions, driving performance and individual differences, to reduce risks in traffic and create a safer driving environment.


*Keywords:* Driving Performance, Podcast Listening, Auditory Distractions, Dual Task Performance, Peer Pressure, Risk, Simulator, Cognitive Workload, Multiple Resource Theory

# Exploring the Interaction Between Susceptibility to Peer Pressure and Listening to Podcasts on Driving Performance

In Europe, 5 - 25% of all traffic accidents are estimated to involve driver distraction (*European Road Safety Observatory - European Commission*, 2022). However, these estimates are likely too low, since it is hard to retrospectively link traffic accidents to distractions or inattentiveness. This is supported by findings from a US study that analysed a naturalistic driving data sample of 905 crashes that led to either injury or property damage (Dingus et al., 2016). The findings showed that overall driver distraction doubled the chance of crashing and contributed to 68.3% of those traffic accidents. Over the past few decades, a lot of research has focused on visual and manual secondary tasks, like texting and adjusting in-car controls, which require the driver to take their eyes off the road (Kim & Lee, 2012; Strayer et al., 2015). However, auditory secondary tasks, such as listening to audiobooks or podcasts, have received significantly less attention.

## Auditory Distractions and Driving

Unlike visual secondary tasks, auditory tasks do not require the driver to avert their gaze from the street, which might lead to less interference with the mainly visual-manual driving demands. Evidence for this comes from the Multiple Resource Theory by Wickens (2008). According to Wickens, secondary tasks that draw from different modalities and codes of processing (e.g. visual-spatial driving and auditory-verbal listening) are less likely to interfere with each other, compared to tasks that overlap in these domains. This means that listening to a podcast, which uses the auditory modality and verbal/linguistic codes of processing, might cause less interference with driving performance than a visual secondary task such as reading text messages. However, it is important to note that central cognitive resources, such as working memory, can also be the limiting factor in this equation, which would lead to a decrease in driving performance when listening to podcasts (Held et al.,

2024). Thus, it is relevant to study to what extent listening to a podcast will have the same effect on driving performance as a visual task.

In recent years, podcasts have become a popular tool for both entertainment and education. In 2023, 450 million people listened to podcasts worldwide, with an estimated increase of over 5% each year in the coming years (*Global Podcast Listeners Forecast*, 2023). Additionally, people view commuting to work as a good opportunity to catch up on the latest news by listening to what appears to be an undistracting podcast at first glance. Research has shown that three-quarters of medical professionals prefer to stay updated on the latest findings by listening to podcasts while driving (Thoma et al., 2020). As a result and given their growing popularity, a closer look at how podcasts affect driving performance is necessary. Thus, determining whether podcast listening impairs performance on the primary driving task is important.

**Complexity of the Driving Environment**

Evidence from studies on audiobooks suggests that the effect of spoken audio content on driving performance depends on the complexity of the driving situation. A study by Nowosielski et al. (2018) found that listening to an audiobook (an excerpt from Harry Potter) led to faster reaction times to hazards and a reduction in speed in simple driving situations. The authors note that this reduction in speed does not necessarily indicate increased or decreased performance, but rather a compensatory action taken to deal with the increased workload. In contrast, in complex road environments, listening to an audiobook increased hazard reaction times. Although speed was generally lower in the complex condition than in the simple one, listening to audiobooks did not further decrease average driving speed in the complex environment. One limitation of this study is that it used a children's audiobook that many participants may be familiar with. This familiarity could potentially reduce the cognitive demand of the secondary task compared to more complex books or podcasts.

Furthermore, and more importantly, Nowosielski et al. (2018) did not assess information comprehension after the task, which precludes insights into the extent to which participants actually listened to the audiobook, which indicates impaired responsiveness. Another study that looked at the effect of different types of distractions on driving performance on the German Autobahn, a well-structured environment built for high-speed driving (Hermannstadter & Yang, 2013). They found that, compared to visual distractions, auditory distractions, such as listening to an audiobook, did not negatively impact most driving performance measures and even slightly improved lane-keeping ability. This aligns with data from an earlier study by Brookhuis et al. (1991), who found that telephoning while driving on quiet motorways can increase lane-keeping ability. Similarly, findings on the effect of music on driving performance show that during simple monotonous driving tasks, such as following a car, music does not impair driving performance and might even improve it (Ünal et al., 2012, 2013). In complex or high-demand driving situations, it can, however, increase lane deviations and slow reaction times (Brookhuis et al., 1991; Wang et al., 2015). A three-participant pilot study on the impact of listening to podcasts on driving performance concluded that podcasts can be distracting by reducing situational awareness and attention (Pilligundla, 2023). Given the limited empirical evidence on podcast listening while driving, it is uncertain whether their effects align with those of other auditory distractions such as audiobooks or music. However, the evidence seems to suggest that the impact of spoken audio content on driving performance largely depends on the complexity of the driving situation.

**Mental Demand**

One proposed mechanism underlying the relationship between listening to auditory stimuli and driving performance is that mental demand has an inverted U-shaped relationship with driving performance (de Waard, 1996). This means that both too little and too much

mental demand can indirectly lead to accidents by decreasing driving performance, and that the safest driving occurs in the optimal window, where the driver is engaged but not overwhelmed (de Waard & van Nes, 2021; Nowosielski et al., 2018; Wang et al., 2015). This concept is based on optimal arousal models, such as the Yerkes-Dodson Principle, which states that performance is optimal at moderate arousal but declines if it is too low or too high (Yerkes & Dodson, 1908). A more recent attention theory called Malleable Attentional Resources Theory similarly suggests that attentional capacity shrinks during underload, leading to worse driving performance (Young & Stanton, 2002). This principle offers an explanation for why listening to audiobooks and music leads to better driving performance in simple driving situations (Nowosielski et al., 2018; Ünal et al., 2012, 2013; Wang et al., 2015). Merely driving in a simple environment without any other mentally demanding activities leads to mental underload and boredom, and this in turn decreases driving performance. However, the additional mental effort from listening to auditory stimuli (e.g. from podcasts) may account for this understimulation by increasing the total mental load to an optimal range and improving performance. For individuals, such as truck drivers or commuters who must stay focused during lengthy, monotonous drives or on already familiar routes, this could have significant implications.

On the other hand, complex driving situations combined with additional stimuli may lead to mental overload and impair driving performance. Studies have shown that complex road environments negatively impact driving performance, leading to more crashes (Taylor et al., 2000, 2002; van der Horst & de Ridder, 2007). A study by Paxion et al. (2014) has shown that complex driving situations are correlated with higher mental workload, especially in novice drivers. Following the Yerkes-Dodson Principle of the inverted U-curve, this increased mental demand may lead to the increased occurrence of crashes (de Waard, 1996; de Waard & van Nes, 2021; Wang et al., 2015). Cognitive overload can impair driving

performance by hindering tasks that require active mental engagement, such as hazard recognition and decision-making (Engström & Markkula, 2017). Introducing a demanding secondary task, such as listening to podcasts or audiobooks, may then lead to even further mental overload and decrease driving performance (Nowosielski et al., 2018; Strayer et al., 2015; Ünal et al., 2012, 2013). However, certain secondary tasks are more impairing than others, therefore leading to mental overload and impairing performance more rapidly (Strayer et al., 2015). For example, audiobooks were less distracting than a conversation, whereas listening to the radio essentially led to no measurable impact on performance. However, podcasts may differ from radio in an important way: listeners often select podcast content based on personal interest, which could increase their cognitive involvement. This might make podcasts more distracting in complex driving situations. Therefore, it is important to further explore the effect of different types of distractions, such as listening to podcasts, on driving performance in complex driving environments.

**Susceptibility to Peer Pressure**

Young drivers below 30 years of age are 2 – 4.5 times as likely to be involved in a car crash as older individuals, which is partially accounted for by the increased susceptibility to peer pressure (Fernandes et al., 2010; Grace et al., 2020; Scott-Parker et al., 2012; Shope & Bingham, 2008; Tefft, 2017). Studies have shown that risk-taking behaviours are much more common when young drivers are accompanied by their peers (Rhodes et al., 2015; Ross et al., 2016; Silva et al., 2016). In reality, this implies that drivers who are influenced by their peers to drive faster may also end up driving faster and consequently increase their risk of accidents (Shepherd et al., 2011). Trógolo et al. (2022) developed a peer pressure and risky driving questionnaire that looks at both direct risk-encouraging and -discouraging and indirect peer-pressure. Findings show that while risk-encouraging direct peer-pressure is significantly associated with self-reported risky driving, risk-discouraging behaviour does not show a

significant correlation (Li et al., 2025; Trógolo et al., 2022). Most importantly, however, indirect peer pressure had the strongest predictive value out of the three subcategories. This suggests that perceived norms of peers may play a significant role in shaping risk-taking behaviour and subsequently driving performance.

To conclude, this study aims to explore whether scores on the peer pressure and risky driving scale developed by Trógolo et al. (2022) and translated into English by Li et al. (2025) can moderate the effects of listening to podcasts on the driving performance of young drivers in complex driving environments. While the earlier reviewed literature suggests a negative main effect of listening to podcasts on driving performance in complex environments due to mental overload, no studies have yet examined how this relationship may be influenced by the susceptibility to peer pressure (de Waard, 1996; de Waard & van Nes, 2021; Hermannstadter & Yang, 2013; Nowosielski et al., 2018; Pilligundla, 2023; Ünal et al., 2012, 2013; Wang et al., 2015). However, recent studies suggest that high scores on the peer pressure and risky driving scale are correlated with higher self-reported risky driving behaviour (Li et al., 2025; Trógolo et al., 2022). These findings point to the possibility of an increased susceptibility to peer pressure exacerbating the negative effects of listening to podcasts on driving performance in complex driving tasks. Gaining more insights into the relationship between listening to podcasts and driving behaviour, and how this relationship is influenced by the susceptibility to peer pressure, can help improve traffic safety via multiple routes. First, the obtained data can be used to raise awareness among drivers about how secondary tasks, such as listening to podcasts, may interact with individual traits to influence driving performance. Secondly, it can help inform policies and vehicle design choices by providing more information about how, and which, secondary tasks interfere with driving performance. Lastly, it can be used to inform and guide future research aimed at traffic safety.

Taken together, the following hypotheses are proposed:

1. Hypothesis: Listening to the podcast while driving in a complex environment, compared to driving without listening to a podcast, will be associated with reduced driving performance, indicated by increased lane swerving, increased speed, more speed variability, longer waiting times to accept a gap and riskier gap acceptance decisions.
2. Hypothesis: In a complex driving environment, higher scores on risk-encouraging peer pressure (both direct and indirect) will be associated with reduced driving performance, indicated by increased lane swerving, increased speed, more speed variability, longer waiting times to accept a gap and riskier gap acceptance decisions.
3. Hypothesis: In complex driving environment, higher scores on risk-encouraging peer pressure (both direct and indirect) will exacerbate the effects of listening to a podcast, compared to not listening to a podcast, on driving performance, indicated by increased lane swerving, increased speed, more speed variability, longer waiting times to accept a gap and riskier gap acceptance decisions.

## Methods

### Participants

The present study aimed for a final sample size of 24 participants. The only prerequisite for participation was to hold a driving licence. No financial compensation was provided for participation, but all participants signed a consent form, in line with the university's ethical guidelines. Based on the guidelines of the Psychology Ethics Committee of the Faculty of Behavioural and Social Sciences at the University of Groningen, this study was exempted from ethics review.

## Materials

### *Questionnaire*

The Qualtrics software was used for administering the questionnaires, which participants filled out on a laptop throughout the experiment (*Qualtrics XM*, 2025). In addition to gathering demographic data, including participants' age and gender, the first part of the questionnaire also asked about a variety of driving experience aspects. Participants were asked to rate their own driving skills, how long they have been a licensed driver, how often, on average, they drive each month, as well as how often and what kinds of podcasts they listen to while driving. Following this, participants had to complete questionnaires that measured the moderating variable susceptibility to peer pressure using the Peer Pressure and Risky Driving Scale as well as neuroticism using the revised version of the psychoticism scale (Eysenck et al., 1985; Trógolo et al., 2022). This first part of the questionnaire was designed to give a broad overview of the participants, along with pertinent information about their backgrounds and personalities for the study.

The second and third surveys were identical, but they were given out at various points during the experiment. The aim was to assess the participants' evaluation of their experiences for each simulated driving trial. The questionnaire was based on a number of variables chosen from earlier studies. Initially, participants rated their level of activation during the task using a continuous slider, ranging from 0 ("Not aroused") to 10 ("Very aroused"). The driving task was then evaluated on a scale of 0 to 10, with 0 denoting "no effort," 5 denoting "some effort," and 10 denoting "extreme effort." Using a scale of 0 ("Exceptionally poor") to 10 ("Exceptionally well"), with 5 denoting "Normal," participants also evaluated their driving performance for each trial. One additional questionnaire that only pertained to the podcast condition was used to test whether participants paid attention to the secondary task.

### *Driving Simulator & Virtual Driving Environment*

The study utilised a research-grade driving simulator developed by STSoftware (*ST Software*, n.d.). This simulator supports experimental simulations and enables real-time data collection during the driving trials. To enhance realism, it is equipped with integrated engine sound systems and a motion platform. Additionally, the simulator features five screens that create a 240-degree field of view. In this study, the simulator was operated using an automatic gear.

The simulation was designed to guide participants through urban and rural environments, with a final destination called ‘Venekerk’. The simulation had a variety of different tasks, such as paying attention to road signs, waiting for cars and bicycles to pass, navigating intersections, and taking turns at junctions. Part of the route and the gap acceptance tasks were adopted from a previous study by Sporrel et al. (2024). During the gap acceptance task, two variables were measured. Firstly, the accepted gap time, which reflects the time between the two cars of the accepted gap and secondly, the minimum distance of the approaching car to the participant when crossing. Additional variables the simulator recorded standard deviation of lateral positions, indicating lane swerving, as well as speed and speed variability for several sections of the drive.

Two sections (2 and 4) were chosen for analysis. In Section 2, participants mostly drove straight on a rural road at 80 km/h, followed road signs. There was some oncoming traffic, but the road was wide, which meant that they did not specifically have to make room for oncoming cars. This section came right after the first gap acceptance task, which may have added a bit of mental load. Section 4 was later on during the drive and closer to a town, with a lower speed limit of 60 km/h, and came just before an intersection where participants had the right of way. Both sections had steady driving demands, which made it suitable for comparing driving performance measurements.

The accepted gap time during tactical manoeuvres, such as crossing the opposite lane in traffic, is a relevant and established measure of driving performance as it reflects a driver's decision-making process and their willingness to accept risk (Brookhuis et al., 1991; Sporrel et al., 2024). Choosing a smaller gap is generally considered a riskier decision (Brookhuis et al., 2004). Similarly, the second gap acceptance variable, the distance to the approaching car in the opposite lane at the time of crossing, serves as an indicator of how critical that crossing decision was (Ünal et al., 2012). Mean speed, on the other hand, is considered part of the strategic level of the driving task because drivers have to make strategic choices about their velocity and adapt to the environment (Brookhuis et al., 1991). Standard Deviation of speed reflects how consistently participants can regulate their speed and often indicates how smooth the drive is (Ünal et al., 2012). Having higher speeds and more speed variability are associated with risky behaviour (Nowosielski et al., 2018). Lastly, the standard deviation of lateral position (SDLP) is a measure of lateral driving control at the operational level (Brookhuis et al., 1991). It reflects how well a driver can maintain their position within the lane. Higher levels of SDLP indicate poorer driving performance that is often connected to distraction, fatigue or other impairments that affect the control of the vehicle (Brookhuis et al., 1991; de Waard & van Nes, 2021; Ünal et al., 2013).

***Podcast***

For the experimental driving condition, a podcast was chosen for the participants to listen to throughout the entirety of the drive. This podcast was: Travel with Rick Steves, episode 742 Sharks; Beyond Havana; Pompeii starting at minute 6:53 (*Program 742*, 2024). The selection of this podcast was based on requiring audio content that was presumably unknown to most participants, as well as the content being interesting enough to pay attention to and subsequently answer questions about, whilst not being stimulating to the point where

participants would no longer pay attention to the drive. Thus, a topic about travel, which contained no profanity or overly intense stimuli but was still educational, seemed appropriate.

**Procedure**

Before starting the experimental trials, participants were introduced to the driving simulator and asked to complete a test drive in a practice environment. This allowed them to familiarise themselves with the simulator, the controls, and the feeling of driving in a computer-generated environment. Participants were able to practice until they felt comfortable starting the actual trial.

After the practice session, the experimental trial began, which was conducted in a different environment from the previous practice trials. Participants were given headphones, either with or without a podcast playing, and were instructed to follow the road signs to 'Venekerk'. At the end of the drive, they were asked to park the car and fill out another short questionnaire about their experience with the drive, and if applicable, a few questions about the podcast. The entire experimental procedure was repeated for the second drive, in which participants were subjected to the condition they had not yet encountered. One condition took approximately 6-8 minutes.

**Design**

This study used a within-subjects, repeated-measures design, one drive while listening to the podcast and one drive without auditory input. To minimise carry-over effects, this study counterbalanced the order in which the participants were exposed to the two different conditions of the independent variable.

## Results

After the data collection, four of the initial 31 participants (20 females, 11 males) had to be excluded from the analysis due to measurement errors. Another participant withdrew after the test drive due to motion sickness. Thus, the following results from the data analysis

were derived from a final sample of 26 participants (18 females, 8 males). The participants had different nationalities (German = 17, Dutch = 4, Other = 5), with an age range of 19-29 ($M$ = 22.9, $SD$ = 2.13). On average, participants drove 5.6 days ($SD$ = 6.79) a month, with driving experience ranging from 1-12 years ($M$ = 4.5, $SD$ = 2.29).

## Effects of Podcast Listening

### *Effects on Speed*

To assess the effect of listening to podcasts on the average driving speed of participants, section two was selected due to fewer task-related confounds, such as an inconsistent speed profile due to an upcoming intersection. This was done to reduce potential interference with the speed data. In this section, the speed limit was 80 km/h. Average speed and confidence intervals are shown in *Figure 1*. It can be observed that participants drove on average 1.1 km/h slower when listening to podcasts, compared to driving without the podcast. However, the difference between the values is small and non-significant. Furthermore, in both conditions, participants drove significantly slower than the speed limit set by the road signs. Thus, listening to podcasts did not impact average driving speed, $F$ (1, 25) < 1, $p$ = 0.35.

### *Effects on Driving Performance*

To measure the effect of listening to a podcast on driving performance, the standard deviation of speed (SD-speed), the standard deviation of lane position (SDLP), the accepted gap time and the distance to the approaching car in metres when crossing the accepted gap were compared across the two experimental conditions, and two segments using a repeated measure ANOVA. *Figure 2* displays that the means of the standard deviation of speed of the two conditions show merely any difference, with the results from the podcast condition showing a slightly smaller speed variability in both sections of the drive, compared to the no-podcast condition. Similarly, *Figure 3* shows only a small difference in mean SDLP between

the podcast and the no-podcast condition in both conditions. Interestingly, in section two, the podcast participants had a higher SDLP of 0.0058 meters, whereas in section four, the no-podcast condition showed a 0.0027-meter higher SDLP. For the gap acceptance task, there is no difference between the two experimental conditions in the size of the gap people accepted. In the podcast condition, however, when participants accepted a gap, they kept 0.8219 meters more distance to the approaching car (*Figure 4*). However, none of the measures of driving performance yielded statistically significant results (see *Table 1*). This indicates that listening to podcasts while driving does not influence speed variability, lane swerving, and gap acceptance behaviour.

***Figure 1***

*Mean speed across different podcast conditions*

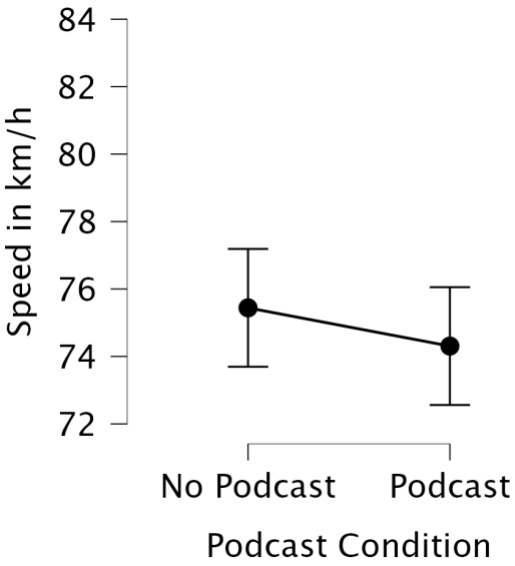
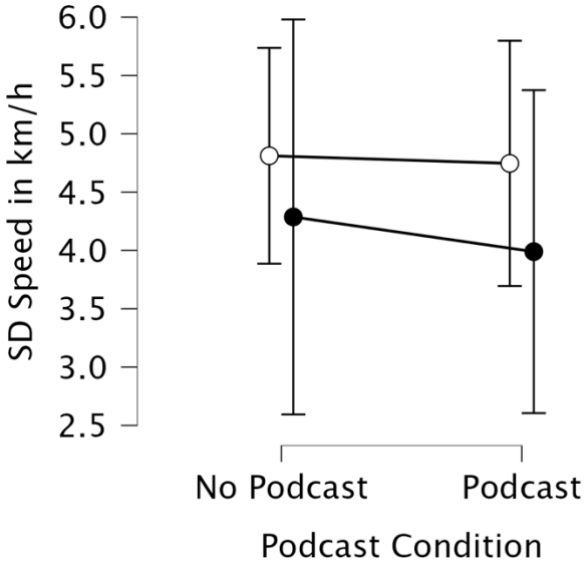



***Figure 2***

*Mean speed variability across different podcast conditions and driving sections*




*Note:*

- ○ Section 2
- • Section 4

***Figure 4***

*Mean standard deviation of lateral position in meters across different podcast conditions and driving sections*

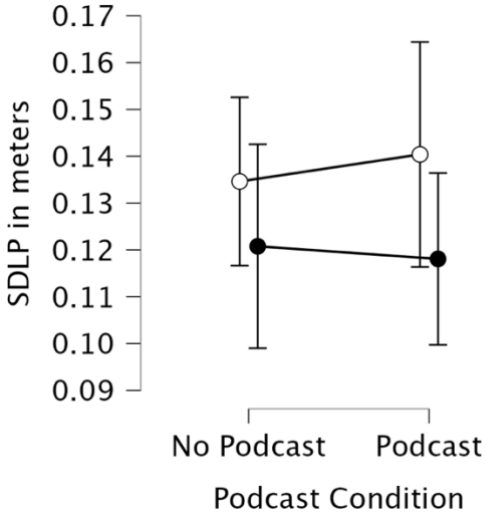
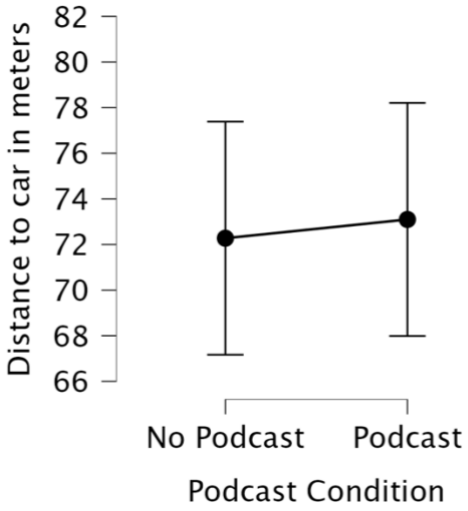



***Figure 3***

*Mean distance to the approaching car in meters during the gap acceptance task across different podcast conditions*




*Note:*

- Section 2
- Section 4

**Table 1**

*Mean Differences Between Podcast Conditions and Repeated Measures ANOVA Results for Measures of Driving Performance*

| Variable | $M_{dif}$ | | *F* | *p* |
|---|---|---|---|---|
| | Section 2 | Section 4 | | |
| SD speed (km/h) | 0.065 | 0.297 | <1 | 0.781 |
| SDLP (meters) | -0.006 | 0.003 | <1 | 0.875 |
| Accepted gap time (seconds) | 0.000 | - | <1 | 0.817 |
| Distance to approaching car (meters) | -0.822 | - | <1 | 1.000 |

*Note: Mdif* = mean difference between no-podcast and podcast conditions.
*SDLP* = standard deviation of lateral position.
*SD* speed = standard deviation of speed

## Effects of Susceptibility to Peer Pressure

To investigate the effect of self-reported susceptibility to peer pressure on driving performance, descriptive statistics and correlation coefficients were calculated between the subscales of peer pressure and the five dependent variables. The Peer Pressure and Risky Driving Scale included three subscales that had acceptable to good internal consistency: direct risk-encouraging ($\alpha = .637$), direct risk-discouraging ($\alpha = .907$), and indirect peer pressure ($\alpha = .795$). Additionally, a moderator analysis was conducted to investigate whether the susceptibility to peer pressure moderates the effect of listening to podcasts on driving performance.

### *Risk-Encouraging Direct Peer Pressure*

Overall, participants reported relatively low levels of susceptibility to direct risk-encouraging direct peer pressure, with $M = 1.40$ and $SD = 0.42$ on a 5-point Likert scale. Correlation analysis revealed no significant relation between self-reported scores on the Risk-Encouraging Direct Peer Pressure scale and driving performance outcomes. After running a moderator analysis, it was found that risk-encouraging direct peer pressure does not moderate the relationship between podcast condition and driving outcomes.

### *Risk-Discouraging Direct Peer Pressure*

Average scores on the Risk-Discouraging Direct Peer Pressure subscale were slightly higher, with $M = 2.75$ and $SD = 1.05$. From the driving performance measures, only the accepted gap time in the no-podcast condition had a significant correlation with susceptibility to risk-discouraging direct peer pressure, $r(24) = 0.41$, $p = 0.038$. Furthermore, higher scores on the scale were correlated with lower self-reported scores on how activated participants were during the podcast condition of the task, $r(24) = -0.492$, $p = 0.011$. The moderator analysis revealed that risk-discouraging direct peer pressure moderates the effect of podcast listening on speed variability, $\beta = .404$, $t(24) = 2.16$, $p = .041$, $R^2 = .163$. Individuals with

higher peer discouragement scores had greater increases in speed variability when listening to a podcast compared to when driving without auditory input.

***Indirect Peer Pressure***

Similarly to the first subscale, scores on the indirect peer pressure scale were low, with $M = 2.10$ and SD = 0.45, and there was no significant correlation with any driving outcome measures. However, indirect peer pressure was correlated with how often people listen to podcasts ($r(24) = -0.485$, $p = 0.012$), how activated they were during the no-podcast condition ($r(24) = -0.417$, $p = 0.034$), and how effortful they perceived that drive ($r(24) = -0.513$, $p = 0.007$). There were no significant moderation effects of indirect peer pressure on the relationship between listening to podcasts and driving outcomes.

**Exploratory Analysis**

To further explore individual differences in participants between the two podcast conditions, several exploratory analyses were conducted. These mainly included self-reported measures, such as how distracting, pleasant, annoying, and effortful the task and the podcast were, but also typical podcast listening behaviour. Participants reported an average effort of 5.00 ($SD = 2.366$) for the no-podcast condition and 6.23 ($SD = 1.840$) for the podcast condition on a 10-point Likert scale, $F(1,25) = 11.111$, $p = 0.003$. For the six questions about the content of the podcasts, participants had an average of 4.58 correct multiple-choice questions ($SD = 0.95$, *Range:* 3-6). Interestingly, the more frequently people listened to podcasts in their daily life, the more distracting ($r(24) = 0.642$, $p < 0.001$) and annoying ($r(24) = 0.465$, $p = 0.017$) and the less pleasant ($r(24) = 0.469$, $p = 0.016$) they rated listening to one during the drive. In both conditions, the faster participants drove, the better they evaluated their driving performance afterwards, with $r(24) = 0.421$ ($p = 0.032$) for the podcast condition and $r(24) = 0.389$ ($p = 0.05$) for the control condition. Furthermore, participants who reported exerting more effort during the podcast condition also rated the

podcast as more distracting ($r(24) = 0.53$, $p = 0.006$) and more mentally activating ($r(24) = 0.40$, $p = 0.044$).

## Discussion

This study aimed to investigate the effects of listening to a podcast on driving performance measures. Specifically, it was hypothesised that listening to a podcast while driving would lead to greater speed, speed variability and lane swerving (H1). It was also expected that in the podcast condition, participants would wait for larger gaps in the gap acceptance task and engage in more critical gap acceptance decisions by crossing the other lane with a shorter distance to the approaching car (H1). Furthermore, this study hypothesised that high direct and indirect susceptibility to risk-encouraging peer pressure would be associated with worse driving performance as defined by the driving performance indicators (H2). Lastly, it was hypothesised that these forms of peer pressure susceptibility would moderate the effects of listening to podcasts on driving performance (H3).

Contrary to the initial hypotheses, results revealed that listening to a podcast while driving in a driving simulator does not significantly impact driving performance in terms of speed, speed variability, lane swerving, accepted gap time and distance to the approaching car when crossing traffic in complex driving situations. However, participants who scored higher on the risk-discouraging peer pressure questionnaire showed an increased speed variability when listening to podcasts while driving. Furthermore, frequent podcast listeners were more distracted and annoyed and found the podcast to be less pleasant.

### Driving Performance

Generally, the null effects observed in the average speed, speed variability, lane swerving, and gap acceptance behaviour are not in line with the first hypothesis, which posits that listening to a podcast while driving might adversely affect driving parameters (H1). The obtained data contradicts the assumption that an auditory secondary task might interfere with

driving performance in complex situations (Brookhuis et al., 1991; Nowosielski et al., 2018; Strayer et al., 2015; Ünal et al., 2012). Other studies, however, have also found no effect or even performance-enhancing effects of listening to audio while driving for single measures of performance (Brookhuis et al., 1991; Hermannstadter & Yang, 2013; Nowosielski et al., 2018). Thus, the newly acquired data might simply add to the pool of evidence that suggests that engaging in auditory secondary tasks does not necessarily affect driving performance under certain circumstances.

The findings have several theoretical implications that simultaneously provide evidence for and against existing theories and which, in turn, provide a more refined interpretation of the results. The null results align with the assumption of the Multiple Resource Theory by Wickens (2008), since the secondary task in this study uses a different modality and code of processing (auditory-verbal) than the primary task of driving (visual-spatial). Following this line of argument, one possible reason for the finding that the podcast did not interfere with the driving task is that different cognitive systems are responsible for handling the two different tasks, allowing for simultaneous performance in both (Wickens, 2008). Thus, the participants' ability to keep a steady pace, appropriate speed, lane position and accept a safe enough gap while listening to a podcast suggests that separate resource channels were used, which minimised the dual-task conflict.

Following the optimal workload models, this would, however, require that the threshold of central cognitive resources, such as the overall mental demand required by the two tasks, was not exceeded (de Waard, 1996; Young & Stanton, 2002). Thus, the cumulative effort of the tasks was in an optimal window for performance during both driving conditions. There are multiple possible explanations for that. Firstly, the driving environment in this study was not complex enough to detect an effect. Evidence for this comes from the self-reported effort scale that participants had to fill out after each drive. The ratings indicate that

the overall effort was not very high. This suggests that in both conditions, participants might not have pushed to the edge of their overall cognitive abilities, leading to no effect on driving performance. In more complex environments, the secondary task may interfere more with driving performance. This is something that should be tested in future simulator studies. Secondly, the secondary task was not complex enough to cause an increase in required effort and interference with the drive. Although most participants did not score perfectly on the podcast questions, listening to the podcast significantly increased the required effort to complete the drive, which makes this assumption plausible, but unlikely.

A third possible explanation is that participants did not pay attention to the podcast. The questionnaire on podcast retention indicates that this was most likely not the case, as the average for the quiz score was relatively high. However, a few individual scores were notably low despite its multiple-choice format. After conducting post-hoc, unstructured inquiries, in the form of talking to individual participants about how they perceived the task, the podcast and the questions, only a small fraction of participants attributed problems with the podcast retention to general inattentiveness. Hence, it is reasonable to assume that most participants tried to focus on both the podcast and the driving task at hand. It could be, however, that attention to the podcast was minimised during specific parts of the drive that required more attention, such as the gap acceptance task. Additionally, the podcast in this study was not chosen by the participants themselves. In everyday situations, people typically select podcast content that they find personally interesting or engaging, which might increase engagement with the secondary task. This could lead to greater competition for attentional resources than observed in this study, and especially in complex driving situations, to decreased performance.

Although this study has partially treated the five independent variables as one single concept of driving performance, it is important to mention important differences. The effect

of podcasts on average speed throughout a driving section can be interpreted in different ways and does not necessarily indicate better or worse performance. Higher speed, for example, could mean that the driver was either more confident or efficient, but it may also reflect reduced caution or increased risk-taking. Similarly, a lower average speed could be interpreted as carefulness and deliberate driving, or it could be a sign of impaired decision-making or mental overload. For that, the surrounding environment and the driver's goals are important and need to be taken into consideration. One important factor for that is the difference between the actual speed and the speed limit. Although no significant difference between the two podcast conditions was found, on average, participants drove slower than the suggested speed limit. To conclude, there is no specific effect of podcast listening on the strategic decision of average driving speed, which is in line with previous findings Nowosielski et al., (2018).

Similarly, listening to podcasts does not have a specific main effect on speed variability and lane swerving, which reflect longitudinal and lateral control on the operational level. In both conditions, participants maintained a similar lateral position and speed variability. This is in line with findings of Brookhuis et al. (1991), who found that listening to an audiobook or having a simple phone conversation does not influence lane swerving. In this study, and in line with de Waard (1996) and Wang et al. (2015), it was expected that listening to podcasts would have a greater influence on lane keeping and speed variability, due to a greater complexity of both the driving environment and the secondary task. These assumptions were not supported by the data. Next to the possibility that the podcast did not exert enough mental overload to observe an effect on performance, it is likely that listening to a podcast simply does not influence speed variability and lane-keeping ability.

Lastly, listening to a podcast while driving does not influence the size of the accepted gap and the distance to the approaching car of the opposite lane in a gap acceptance task. This

means that decision-making during tactical manoeuvres is not impaired. This is not in line with the first hypothesis (H1) and suggests that making critical decisions while driving is not influenced by an auditory distraction. One mechanism for this could be that drivers naturally disengage from the podcast when facing a mentally taxing driving situation to compensate for the additional workload. From a traffic safety standpoint, these findings are reassuring, as they indicate that drivers do not make riskier or more critical decisions when listening to a podcast.

**Susceptibility to Peer Pressure**

Higher susceptibility to both encouraging and discouraging direct peer pressure is not directly connected to impaired driving performance. These findings are contrary to the second hypothesis (H2) and challenge previous findings by Li et al. (2025) and Trógolo et al. (2022). One likely explanation lies in the demographics of our sample. All participants were young, educated university students and acquainted with the researchers, resulting in a very homogeneous group. Hence, the means on the peer pressure subscales were all very low, which makes it difficult to detect an effect on driving performance measures.

Participants who were more sensitive to risk-discouraging peer influence showed increased speed variability when driving with the podcast, compared to without it. In practical terms, this means that these individuals' speed fluctuated more, so that they slowed down and sped up more inconsistently under the influence of podcasts. This is not in line with previous findings, which showed that while risk-encouraging peer pressure, as well as indirect peer pressure, predict riskier driving behaviour, risk-discouraging peer pressure does not make individuals drive more safely (Li et al., 2025; Trógolo et al., 2022). Since the present study found no reduction in speed variability in the control condition, it does not mean individuals generally drive more cautiously. Instead, only when a distractor (e.g. podcast) is introduced, they perform worse. One explanation for this could be that individuals

who are more receptive to safety-oriented driving feedback are more sensitive to social or spoken input in the car. This would mean that the podcast would have captured a bit more of their attention, and therefore, they had fewer cognitive resources to spend on keeping a steady pace. Evidence for this comes from studies that suggest that the presence of peers in the car can lead to higher driving behaviour variability and more risky driving (Aktaş & Öztürk, 2024; Ehsani et al., 2015; Guggenheim & Taubman – Ben-Ari, 2018; Sutherland et al., 2022). While no peers were present in this study, it is possible, though speculative, that individuals who are more sensitive to social cues or spoken input may have experienced the podcast as an artificial "social presence". This could have led to a similar effect in those participants, which might have caused them to react as if a peer were present. It is also possible that people sensitive to risk-discouraging peer pressure try to drive more conscientiously and divide their attention so that they repeatedly check their driving speed, slowing down to ensure they are not going too fast, which then produces a less consistent speed profile. Importantly, this finding was not part of the hypotheses and should therefore be interpreted with caution, as it could simply resemble a Type 1 error. However, these findings underscore that individual differences could be important in understanding how distractions influence driving behaviour.

**Exploratory Analysis**

Next to the main analysis, the exploratory analysis offered additional interesting insights into how participants experienced the tasks. Surprisingly, frequent podcast listeners found listening to the podcast while driving more distracting and annoying, and even less pleasant than the other participants. A possible reason for this contradiction is that they were not allowed to select the podcast content themselves. In real-life situations, people typically choose podcasts they find personally interesting. Without this autonomy, the content of the podcast may feel less engaging or even annoying, especially to frequent podcast listeners who

are used to a more tailored experience. Additionally, participants who rated the podcast as more distracting also reported higher effort, which might suggest that subjective cognitive load is higher when people have to split their attention to attend to two simultaneous tasks.

**Limitations and Strengths**

There are at least two potential limitations of this study. The first limitation concerns the nature of the sample. This study used a convenience sample, which led to a homogeneous group in terms of age and educational status. While this can introduce biases and limit the generalizability of results, it is worth noting that this specific age group is particularly susceptible to risky driving behaviour. Therefore, although limited, the sample may still represent the population that is especially relevant when studying driving and distractions.

A second limitation of this study is the artificial setting of the simulator and the associated lack of real-world stress and potential consequences, which limits ecological validity. The absence of real traffic, time pressure, and potential consequences of making a wrong decision or incorrectly allocating attention in a critical situation may influence how participants are affected by a secondary task. They might, for example, be willing to take more risks than they would in a real car and therefore not compensate on the primary driving task, despite focusing on the podcast. Importantly, the outcome of this study also questions the assumption that the driving environment used in this study can be classified as a complex environment. Additionally, many participants reported that driving in the simulator does not feel like driving in a normal car and that, especially, taking turns feels “weird” and “unfamiliar”.

Despite these limitations, this study had several strengths. First, the use of a counterbalanced within-subjects design allowed each participant to serve as their own control, which increased statistical power and reduced variability due to individual differences. Second, this study utilised a high-fidelity driving simulator that precisely

measured several outcome variables while at the same time allowing for a controlled and safe testing environment. Third, the recording of personality traits and subjective ratings, such as effort, allowed for a more nuanced understanding of the effect of podcasts on driving performance. Finally, unlike previous studies, this study tested podcast retention, which provided insights into the participants' engagement with the secondary task. Importantly, they were also informed about the podcast quiz beforehand, which likely increased their attention to the podcast.

**Practical Implications**

The results of this study have several practical implications. First, podcasts are relatively low-risk distractions while driving, which means that they can be used relatively safely in moderate driving conditions. However, since this study lacks the real-world stress associated with very complex driving situations, drivers should still monitor their attention and adjust, for example, by pausing the podcast in complex traffic to ensure additional safety. Unlike passengers, podcasts continue despite changing driving demands, which can pose a risk. The present findings could inform the development of interventions, such as in-car systems that automatically pause podcasts in cognitively demanding driving situations.

Additionally, it is important to reiterate that the null effects of listening to podcasts on driving performance are likely and at least in part due to the different modalities and codes of processing used for the two tasks. This means that listening alone might be unproblematic, but operating a cell phone or another device, to play, pause or skip back and forth in a podcast might conflict more with the resources required in operating a vehicle, due to similar modalities and codes of processing. This can help inform the design of adaptive systems that enable drivers to listen to podcasts while limiting the need for manual or visual interaction, or even manage the audio content dynamically based on driving demands.

Lastly, although this study has not found a direct impact of peer pressure sensitivity on driving outcomes, it highlights the importance of considering individual factors when trying to understand the impact of distractions on the driver. Differences in traits such as the sensitivity to a specific form of peer pressure might determine how much drivers are distracted by a secondary task, which could be accounted for by individual interventions.

### Suggestions for Future Research

This was one of the first studies that specifically looked at the effect of podcasts on driving behaviour. Thus, much work remains to be done to fully understand the relationship between listening to podcasts and driving. Although this study indicates that listening to podcasts while driving may be safe at certain times, the question of when it poses a risk remains unanswered. Hence, a more diverse array of environments needs to be tested. Future studies could also replicate this study with a more diverse sample or even real-road studies. These studies could also establish more rigorous standards for distinguishing a complex from a simple driving situation, as this seems to be one of the determining factors influencing the impact of auditory distractions on driving performance, and possibly one of the biggest limitations of this study. It would also be helpful to extend the current findings by exploring more individual differences, next to discouraging peer pressure, that will help understand the relationship between auditory distractions and driving performance in a more nuanced way.

## Conclusion

In conclusion, this study investigated whether listening to podcasts influences driving performance in a complex driving environment and whether susceptibility to peer pressure moderates this relationship. Overall, podcast listening did not negatively impact speed, speed variability, lane swerving and gap acceptance behaviour. Similarly, susceptibility to peer pressure was not correlated with driving performance. However, the relationship between podcast listening and lane swerving was moderated by risk-discouraging peer pressure

sensitivity. This result implies that although listening to podcasts while driving does not pose a general risk to driving safety, a higher susceptibility to risk-discouraging peer pressure could make drivers more vulnerable to distractions. This highlights the importance of considering individual differences when investigating the impact of secondary tasks on driving performance.

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