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FACULTY OF SOCIOLOGY AND PSYCHOLOGY
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DOCTORAL THESIS

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INTERVENTIONS REGARDING DRIVING BEHAVIOR. EXPLORING IMPLEMENTATION INTENTIONS IN THE CONTEXT OF SPEEDING

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Content

1. Introduction

Human behavior is the main factor in road accidents, and one of the primary driving behaviors that increases the severity of road accidents is speeding (Aarts & van Schagen, 2006; Garvill et al., 2003).

A range of factors underlie the behavior of excessive or inappropriate speed. One theoretical model that explains speeding behavior is the Theory of Planned Behavior (TPB; Ajzen, 1991). Research on the application of the Theory of Planned Behavior (TPB) in explaining speeding behavior shows varied conclusions. Some studies emphasize the importance of intention as an intermediary factor, while others highlight the direct influence of attitudes, subjective norms, and perceived behavioral control. On the other hand, certain research suggests that some variables have no direct effect on either behavior or intention. The diversity of these results, along with the limited number of studies based on objective measurements of behavior, indicates the need for further investigation into the relevance of TPB in this context.

Beyond understanding the factors that explain speeding behavior, it is also necessary to implement interventions aimed at reducing this risky behavior. The literature proposes various interventions to reduce speeding. Educational or awareness-raising interventions have proven to be ineffective (e.g., Carcary, 2000), while those involving feedback or training (e.g., Molloy et al., 2018a, b) require high costs and resource consumption. Implementation intention-based interventions are emerging as a promising option (e.g., Brewster, 2016), but the limited number of studies on this specific behavior, along with the absence of objective evaluations, highlights the need for further research to determine their effectiveness in reducing speeding. In addition to the lack of studies testing such interventions in real traffic environments using objective measurements, previous studies also present other limitations, such as short behavior monitoring periods, failure to consider variables like participants' gender and age, or the use of identical scenarios in simulator-based studies.

When it comes to evaluating speeding behavior, both subjective and objective measurements present a series of advantages as well as limitations. Self-reported questionnaires allow data collection from a larger number of participants, but there is a risk of bias due to social desirability or possible omissions or inaccurate perceptions of behavior by participants (Greaves & Ellison, 2011; Kaye et al., 2018). In contrast, objective measurements offer greater accuracy.

The use of internally valid tools, such as driving simulators, allows for fast and efficient data collection in a controlled environment (Singh & Kathuria, 2021). However, even in these cases, disadvantages such as unfamiliarity or inaccurate behavior perception may occur (de Winter et al., 2012). On the other hand, objective measurements with high external validity, such as GPS tracking, allow for the collection of large volumes of data over extended periods (Beusen et al., 2009), reduce participant reporting errors (Grengs et al., 2008), facilitate real-time speed analysis (Gonçalves et al., 2014), and can also be used on mobile phones (Bar-Gera, 2007). Therefore, subjective and objective measurements are complementary, and their combined use is recommended for a comprehensive understanding of behavior.

The objectives of this thesis focused primarily on testing the effectiveness of interventions on driving behavior to gain a clear understanding of what types of interventions work for specific behaviors. Furthermore, we focused on evaluating the effectiveness of implementation intention-based interventions in reducing speeding, using both objective and subjective measurements. Lastly, we analyzed the explanatory potential of the Theory of Planned Behavior (TPB) in predicting speeding behavior, using objective and subjective measurements.

The first study involved a systematic review and meta-analysis to assess the effectiveness of interventions on driving behavior. The next two studies focused on reducing speeding, a major cause of accidents (Fondzenyuy et al., 2024). Study 2 tested an intervention based on implementation intentions, awareness, and mental contrasting, using self-reported and GPS measurements for external validity. Study 3 tested a similar intervention using a driving simulator to increase internal validity. Study 4 focused on testing the classical mediation model of TPB using objective speed measurements collected through a driving simulator.

2. Study 1: Assessing the Effectiveness of Psychoeducational Interventions on Driving Behavior: A Systematic Review and Meta-analysis

The first study consisted of a systematic review and meta-analysis on the effectiveness of psycho-educational interventions on driving behavior, with the aim of investigating what types of interventions are effective for which types of behaviors.

The meta-analysis and systematic review were conducted in accordance with the PRISMA guidelines (Page et al., 2021), using the PICOS approach for study selection. Only studies that met

the following criteria were included: (P) the participants were drivers; (I) the study tested a psycho-educational intervention aimed at reducing negative driving behaviors/ road anger, or enhancing positive behaviors; (C) the presence of a control group; (O) outcomes focused on driving behavior; and (S) an experimental or quasi-experimental design was used.

The search was conducted in the PsychINFO, Scopus, Web of Science, and ProQuest Dissertations & Theses databases. Following the selection and coding process, 138 studies were included in the meta-analysis.

The impact was assessed both immediately after the intervention and in the long term. The strongest effects were observed in the reduction of distracted driving behavior immediately following the intervention. In contrast, interventions did not have a significant long-term impact on reducing driving errors or on reducing driving under the influence over short monitoring periods.

Interventions based on feedback, training, and motivational components were generally the most effective. In contrast, educational interventions had modest effects, and awareness campaigns did not produce significant changes. However, the effectiveness varied depending on the targeted behavior, which highlights the importance of tailoring interventions to specific contexts.

In terms of speeding, interventions showed moderate effectiveness. The most effective interventions for this behavior were those based on feedback and training. Interventions based on implementation intentions were analyzed in only a small number of studies, which prevented their inclusion in moderation analyses, but their results appeared promising.

Additionally, the review highlighted the need to integrate objective measurements when evaluating speeding behavior, as well as the importance of assessing the intervention's impact in relation to active control groups. Interventions that involve the practical application of learned strategies and actively engage drivers tend to be the most effective.

This meta-analysis contributes to the existing literature by offering a comprehensive perspective on effective interventions for reducing negative driving behaviors and enhancing positive ones.

3. Study 2: Predicting Subjective vs. Objective Speeding: Insights based on the Theory of Planned Behavior and an Implementation Intention Intervention

Given the need to implement effective yet low-cost interventions, Study 2 aimed to test the effectiveness of an implementation intention-based intervention in reducing speeding. The intervention was enhanced by incorporating additional strategies based on mental contrasting and awareness, using repeated sessions.

The study included 66 drivers, randomly assigned to two groups (32 in the experimental group vs. 34 in the control group). The experimental group received an awareness and implementation intention intervention, while the control group received only the awareness component. Measurements included self-reported questionnaires assessing speeding behavior, intentions, attitudes, subjective norms, perceived behavioral control, and self-efficacy, as well as objective GPS-based speed measurements.

We expected the intervention to be effective in reducing speeding, as measured both subjectively and objectively. Furthermore, we hypothesized that the TPB variables would predict both self-reported and objectively measured speeding, and that intention would mediate the relationship between TPB variables and speeding behavior (both self-reported and objective).

Multilevel analyses revealed that the intervention was not effective. Intention and perceived behavioral control emerged as significant predictors of self-reported speeding behavior. In contrast, subjective norms, attitudes, and self-efficacy did not show a direct significant impact. However, attitudes and self-efficacy indirectly influenced self-reported speeding through intention. For objectively measured speeding, the only significant predictor was age.

There are several possible reasons why the intervention may not have been effective. First, the experimental group clearly formulated the goal of respecting speed limits, while the control group did not receive such an explicit request. Additionally, participant engagement and commitment could not be controlled, nor could the opportunities participants had to apply the strategies developed during the intervention in real traffic conditions. Other individual factors may also need to be considered and addressed in future interventions.

Regarding the role of the TPB, the discrepancy between subjective and objective measurements suggests that both methods should be used when evaluating speeding behavior. TPB variables could also be measured by considering their specific subcomponents and assessing them

daily in the context of real traffic situations.

This study presents a comprehensive approach to speeding behavior, by using both subjective and objective measurements simultaneously. To the best of our knowledge, it is the first study to test a multi-session implementation intention intervention combined with awareness and mental contrasting in real traffic conditions, thus providing a foundation for future research.

4. Study 3: The Effectiveness of Implementation Intentions Interventions on Speeding Using a Driving Simulator

The objective of Study 3 was to test the effectiveness of an intervention similar to the one used in Study 2, this time employing a driving simulator. The study followed a 2 x 2 factorial design (experimental vs. control and pre-test vs. post-test). The participants were 78 drivers (38 in the experimental group and 40 in the control group) who completed a simulated driving test both before and after the intervention.

We expected that, as a result of the intervention, the experimental group would exceed speed limits less frequently compared to the control group, which only read a short text about the consequences of speeding. ANCOVA analyses revealed no significant differences between the groups.

The lack of significant results may be explained by the participants' unfamiliarity with the simulator and the different perception of speed in a simulated environment. Additionally, personal or cultural factors might have influenced the outcomes, as well as the single-session design of the intervention.

The study has several strengths, including high internal validity and an evaluation of an improved intervention compared to those described in previous research. Moreover, familiarity effects with the driving scenarios were minimized by using different scenarios for the pre-test and post-test.

5. Study 4: The Theory of Planned Behavior and Speeding: Perspectives from a Driving Simulator Study

The objective of Study 4 was to investigate the predictive role of the Theory of Planned Behavior (TPB) in speeding behavior using a driving simulator.

Participants (198 drivers) completed self-reported measures of TPB variables, and speeding behavior was assessed through the driving simulator. The mediating role of intention in the relationship between TPB variables and speeding behavior was tested.

We expected that attitudes, subjective norms, perceived behavioral control, and self-efficacy would have a direct effect on intention. Furthermore, we hypothesized that intention and perceived behavioral control would directly affect speeding behavior, while attitudes, subjective norms, perceived behavioral control, and self-efficacy would have an indirect effect on speeding, mediated by intention.

The results partially supported the classic TPB model, showing that attitudes, perceived behavioral control, and self-efficacy had a direct effect on intention, which was the only direct predictor of speeding behavior. The lack of effect of subjective norms on intention may be explained by the "speeding culture" in Romania, where sanctions are perceived as weak or rarely enforced. Perceived behavioral control did not have a direct effect on speeding, possibly due to environmental factors that influence drivers' perception of their ability to comply with speed limits.

Intention was the only significant predictor of objectively measured speeding, suggesting that TPB variables might be influenced by less conscious factors, making the theory more suitable for self-reported behavior than for objective measurements.

This study presents a considerable advantage, being, to our knowledge, the first to test the full relationship between TPB variables and speeding behavior, considering intention as a mediator, in a simulated driving environment.

6. Theoretical and practical implications

The study showed that the Theory of Planned Behavior (TPB) partially explains self-reported driving behavior but has limited predictive power for objectively measured behavior, suggesting the need to integrate other theories and cultural or personal variables. TPB measurements should be more detailed to allow for more precise conclusions.

Objective methods, such as GPS measurements, provide more accurate results than self-reports, and their concurrent use is encouraged.

Speeding appears to be a conscious choice, under the driver's control. Implementation intention-based interventions did not yield significant results in this study, although other research highlights their potential. Larger sample sizes and improved interventions are needed, potentially incorporating strategies such as feedback or even emotional regulation techniques, considering the stress factors present in real-world driving environments that may influence driver behavior.

7. Limitations and Future Research Directions

This research also has several important limitations. The meta-analysis did not include interventions from the fields of law enforcement and road engineering, which could be considered in future studies to provide a more comprehensive analysis.

Study 2 used intention measures with low internal consistency. Future research should employ more accurate methods and incorporate strategies to increase participant engagement.

Moreover, the driving simulator experience could be enhanced, for example, through the use of virtual reality. Additionally, the inclusion of supplementary variables could provide a broader and more nuanced perspective.

8. Conclusions

This research initially provides a comprehensive analysis of psycho-educational interventions targeting driving behavior, highlighting which strategies are most effective. Subsequently, the focus was directed toward speeding behavior, a primary risk factor in road

accidents, by testing an implementation intention-based intervention, enhanced with awareness and mental contrasting components. Driving behavior was assessed using both self-reported questionnaires and objective measurements.

The results indicate that the intervention did not reduce speeding, and that the Theory of Planned Behavior explains subjective perceptions of speed more effectively than actual driving behavior.

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