

## **Research directions of contemporary transport psychology in Bulgaria**

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**Abstract.** Transport psychology plays a pivotal role in explaining, understanding and predicting human behaviour within the complex dynamics of the human-vehicle-environment system. Outlining contemporary research directions in the field is therefore essential. The article presents the state-of-art of the field of transport psychology and introduces two contemporary studies on driving behaviour in Bulgaria. These comprehensive studies reveal the intricate interplay between personality factors and driving styles among Bulgarian drivers. On the one hand, the studies unveil the effect of anxiety, sensation seeking, driving anger, aggressive driving behaviour, and risky driving behaviour on negative driving outcomes, such as registered traffic violations and accident involvement. On the other hand, they explore the concept of driving styles, identifying eight distinct patterns and their association with road safety incidents. By presenting the field of transport psychology and the results of these studies, the article highlights the significance of the discipline in solving road safety problems.

**Keywords:** transport psychology, personality, driving styles, driving behaviour

### **Introduction**

Psychology has played a pivotal role in advancing transport science through its unique models and theories, providing a disciplinary approach that offers deep insights into the complexities of the transport system. By its very nature, psychology can identify constraints within the transport system, predict their effects, and understand how this influence human behaviour, including the consequences of such behaviour. Transport psychology, the sole discipline dedicated to studying human behaviour within various transport systems, delves into the psychological processes underlying these behaviours. The discipline strives to analyse, explain and predict all phenomena related to the movement of people and goods (Michon 1985; Michon 1989). By examining human factors, ergonomics, environment, and the interaction between these components, transport psychology seeks to develop reliable methods to better understand and predict human behaviour and its variability in response to the human-vehicle-environ-

ment system. Given that road transport is the most widespread and utilized mode of transport, it is not surprising that transport psychology heavily focuses on human behaviour in relation to road incidents and accidents. In the West, the field of transport psychology is referred to as traffic psychology and the discipline is frequently referred to as traffic and transport psychology, largely due to the fact that the majority of studies in this field address fundamental issues of road safety. In Bulgaria, no such distinction is available. It should be noted that research on driving behaviour, studies of various personal, social, technological and demographic factors in relation to the behaviour of different road users, and analyses of the influence of these factors on involvement in road accidents will be regarded as problems of transport psychology.

Establishing a clear research direction in transport psychology is challenging due to its extensive overlap with various areas of general and applied psychology as well as due to intersection of the discipline with fields such as ergonomics, engineering, economics, and medicine. This psychological approach is thus an integral and indispensable part of road transport science research and objectives aimed at optimizing and minimizing the negative impact on both the environment and people. The human being as a traffic participant constitutes the core of a highly complex and interactive system, influencing both positive and negative aspects of mobility by their behaviour. This implies that the impact of such behaviour can be predicted and altered, which is a primary focus of traffic and transport psychology. Understanding, predicting, and modifying driving behaviour in different circumstances require a robust theoretical framework. A valid theory or model of human behaviour not only facilitates a deeper understanding of the causes behind drivers' actions on the road but also aids in predicting their responses to various safety measures and in developing improved training programs, vehicles, infrastructure, etc. (Shinar 2007).

*Models and theories in transportation psychology*

The most popular two-way simplified classification distinguishes, on one hand, between input-output models (behavioural oriented) and internal models (motivational oriented). On the other hand, models are categorized as either taxonomic or functional (Michon 1985; Blumenthal 1968; Wickens, Hollands 2000; Shinar 1978; Shinar 2007; Näätänen, Summala 1976) (Table 1).

**Table 1.** Classification of driving behaviour research models (Michon 1989)

<b>Driving behaviour models</b>	<b>Taxonomic</b>	<b>Functional</b>
<b>Input-output (behavioural)</b>	Task analyses	Mechanistic models Adaptive control models
<b>Internal state (psychological)</b>	Trait models	Motivational models Cognitive models

Taxonomic input-output models provide a thorough analysis of various activities undertaken by road users, encompassing both routine and exceptional situations. Task analyses have been conducted for a diverse range of road users, including vehicle drivers, pedestrians, cyclists, and motorcyclists. These tasks can become extensive and detailed, making the analysis comprehensive. Task analysis approaches are beneficial for formulating educational objectives and developing dynamic models. However, they offer limited insight into the actual task performance of individual road users due to the broad scope of the approach (Rothengatter 1997). Functional input-output models primarily focus on vehicle control tasks. The main limitations of these models stem from their narrow scope, largely due to the lack of consideration of mental processes and the absence of direct evidence linking operational performance to involvement in road accidents. Additionally, these models are challenging to integrate with higher-level models. Taxonomic internal models include trait models that explain individual differences primarily in terms of involvement in road accidents. A key concept in this context is accident propensity, a central focus of research on driving behaviour (Shaw, Sichel 1971). Functional internal models encompass cognitive models that focus on driver cognitive functions crucial to the driving process and motivational models that examine how drivers perceive and cope with risk on the road (Michon 1989). These models have been extensively employed in studies investigating driver behaviour. The theories within these models generally suggest that road users modify their behaviour in response to perceived or anticipated risk, comparing it to their acceptable risk or a situation that is not inherently risky. This broad classification of models encompasses a multitude of theories and methodologies employed in the study of driving behaviour. The literature contains both classical and contemporary theories, some of which complement each other, while others differ radically. Despite the shortcomings of particular models, their diversity and focus allow researchers to identify unsafe and dangerous behaviours on the road and determine the causes of road accidents due to human factors. This enables researchers to concentrate on the necessity to alter dangerous driving behaviour to minimize negative consequences.

A review of numerous models shows that human behaviour, especially driving behaviour cannot be adequately represented by a mathematical model with a high degree of predictive value (Shinar 2007). This is primarily due to the influence of multiple factors, many of which operate at an unconscious level. Consequently, predicting driving behaviour from a theoretical model, regardless of its complexity and comprehensiveness, is almost impossible (Shinar 2007). Existing models and theories are insufficient in explaining driving behaviour for two reasons. First, the generality of a theory often leaves specific aspects of vehicle control unaddressed. Second, the specificity of some theories means only certain elements of driver behaviour are covered. These conflicts contribute to the lack of consensus among researchers on a single dominant theory or model in the study of driving behaviour. This fragmented approach can impede further research and lead to conflicting messages being conveyed to the public and policymakers. Another reason for the lack of consensus is the absence of experimental testing to support the models (Michon 1989; Rothengatter 1997). Analy-

ses suggest older models of driving behaviour are inadequate for understanding this process in the modern world. Additionally, many existing models lack specificity, making it challenging to formulate testable hypotheses. Nevertheless, the direction of research is clear: identify behaviours that threaten safety, define measures to change them, and develop and implement effective programmes to support the change process.

### *Driving behaviour as a main construct in transport psychology*

In transport psychology, driving behaviour is a fundamental construct defined as the ability to operate a motor vehicle in a controlled manner. This involves a range of cognitive processes, including perception, attention, learning, memory, decision-making, and action control (Groeger 2000). Driving is a multi-component and complex action, partly due to the time required to detect, perceive, and process information before making decisions and reacting to road situations. It involves multiple tasks, often conceptualized as a hierarchical structure comprising three levels: strategic, tactical, and operational (Van Der Molen, Böttcher 1988; Michon 1989). Driving behaviour encompasses more than the skills required to operate a vehicle. Avoiding errors requires cognitive processes that extend beyond compliance with traffic rules, including maintaining attention, making decisions, employing advanced manoeuvring techniques, and having positive attitudes toward traffic regulations. The intentions and decisions drivers make while driving are crucial to their behaviour, with the driver solely responsible for their actions and reactions to potential incidents, which depend entirely on their ability to manage such situations. Thus, driving behaviour is influenced by a range of factors, including individual and demographic characteristics, culture, knowledge, driving skills and habits, and functional, cognitive, and mental states. As primary users of road infrastructure, drivers significantly impact safety and traffic efficiency. Although road crashes result from the interaction of three main factors - human, environment, and vehicle - in over 90% of cases, human behaviour is the primary cause. Most accidents are attributed to driver error and inattention. Given these statistics, a clear and comprehensive understanding of driver behaviour and the tasks performed while driving is of paramount importance to researchers. The main reason of studying driving behaviour is to ascertain the factors that influence it and to identify those that transform it into a dangerous activity. This knowledge can then be used to modify and change driving behaviour in order to make the road safer. This enables researchers to concentrate on the necessity to alter dangerous driving behaviour to minimize negative consequences. Efforts have focused on developing measures to counteract such behaviour and change it through different approaches.

The multiplicity of approaches to the study of driving behaviour logically is followed from a diversity of methods aimed at changing it. The existing literature indicates that attempts to modify driver behaviour are typically based on one of four main approaches (Rothengatter 1997). The first approach seeks to alter the physical driving environment to reduce deviations in driving behaviour. The second approach involves implementing strategies that severely punish deviant behaviour. The third approach aims to increase road users' per-

ception and awareness of risk, reducing their willingness to take risks. Finally, the fourth approach identifies unsafe drivers and corrects their behaviour or removes them from the traffic environment. These approaches are all designed to achieve their objectives through the implementation of different programmes for the purposes of prevention and intervention. For these programmes to be effective, it is essential that they are developed on the basis of scientific knowledge and evidence. That is why it is of a great importance to correctly identify the factors which influence driving behaviour. Understanding the myriad factors that influence driving allows not only to develop effective preventions and interventions, but also to enhance theoretical models, support policymaking, and ultimately, create a safer road environment. Contemporary studies offer valuable insights into the various factors influencing driver actions, allowing for better prediction and modification of behaviour to enhance road safety.

### *Transport psychology in Bulgaria*

The evolution of transport psychology has paved the way for a more clear understanding of how human behaviour impacts road safety and efficiency, highlighting the importance of integrating psychological insights with practical applications, ensuring that theoretical models and empirical evidences are not only academically robust but also relevant to real-world scenarios. That is why transport psychology is a well-established and important field worldwide today. It plays a key role in addressing many issues, represents an integrated field of psychology, and serves as a well-developed and respected area of expertise. Transport psychologists are frequently sought after and called upon to contribute their insights to addressing a wide range of significant problems in the area of road safety. It is unfortunate that this is not the case in Bulgaria. Over the past few decades, the development of this field of psychology has stalled, and the traditions of research have been broken. As a result, the discipline is relatively unknown even among psychologists and experts working in the field of road safety. Furthermore, the need for knowledge in this area is largely unrecognized.

The main field of application of transport psychology in Bulgaria is related to the implementation of psychological assessment, which aims to evaluate the psychological qualities and personality characteristics necessary for successful and effective professional activity and ensuring safety in the various transport systems in our country - aviation, maritime, railway and road. In order to achieve this, the specific professional qualities that candidates should possess in order to fulfil the requirements of a particular position are clearly defined. The rules governing the assessment of the psychological fitness of professionals working in the various transport systems nowadays were regulated at the beginning of the 21st century. However, such assessment was applied long before that, and its conclusions are of the utmost importance for candidates for a particular position. The first psychological tools for revealing the abilities of candidates in order to improve the selection and training of pilots were introduced in 1926 and the regulation specifying the requirements for their health and mental state were developed in 1928 (Pencheva, Tsvetkova-Georgieva 2008). With

regard to the assessment of drivers of motor vehicles, the first methodologies for the assessment of psychological fitness were developed in the 1970s, when the Institute of Psychology at the Bulgarian Academy of Sciences began close cooperation with the Transport Medical Institute, and later with the Scientific and Applied Centre of Transport Psychology at the Ministry of Transport. It can be stated that there is no lack of traditions in the field of transport psychology in our country, but unfortunately the development of the discipline has ended with the establishment of requirements and the imposition of research only on the assessment of psychological fitness. The main problems in this respect are related to the lack of professional training in transport psychology and the insufficient current research in the field.

The need for the development of transport psychology in our country has grown significantly in recent years. This is due, on the one hand, to the alarming statistics concerning the number of fatalities and injuries in Bulgaria, which are far from the targeted values for achieving higher levels of road safety, and, on the other hand, to the commitments that our country is making in terms of implementing strategies and measures in the field. It is evident that contemporary research in this field, particularly research on driving behaviour and the psychological aspects underlying it, is severely lacking in Bulgaria. Given that driving behaviour is largely culturally determined, it is evident that up-to-date information on driving behaviour in Bulgaria is required not only to facilitate the identification of dangerous drivers, but also to facilitate the development of effective measures to correct dangerous driving behaviour. The absence of contemporary data precludes a comprehensive understanding of driving behaviour among Bulgarian drivers, thereby impeding the development and implementation of effective strategies, campaigns and measures to modify this behaviour. The objective of research in this field is to generate information that can be used as a basis for developing effective practices and policies in the field of road safety. The knowledge thus gained can be applied at the level of prevention in the form of information campaigns, training modules and rehabilitation programmes.

#### *Aim of the paper*

The objective of the current article is to present two latest studies, which identify personality and behavioural factors related to dangerous driving behaviour in Bulgaria. Furthermore, the article introduces results regarding the effect of some personality factors and driving style (habits) on negative driving outcomes.

### **Research and discussion**

Building on the research direction outlined in the preceding paragraph, recent studies in Bulgaria focus on identifying personality factors (Study 1) and driving styles (Study 2) associated with unsafe and dangerous driving practices (Totkova 2023). Both studies include only participants with a driving licence

and are active drivers. In order to encompass a range of actual driving behaviours, different groups of drivers are included based on the investigated negative driving outcomes. This involves drivers with registered traffic rules violations, drivers whose driving licences were suspended according to the Bulgarian legislation and drivers who were involved in road accidents. The studies also include individuals with no such negative driving outcomes. The driving background of the participants is studied through self-report registration of violations within the past three years, as well as the suspension of the driver's licence, and the participation in road accidents due to the driver's fault.

In both studies, informed consent was obtained from all participants. They were informed that the studies were part of scientific research projects and that the collected data was anonymous. Both studies have been approved by the Ethical Committee of the Institute for Population and Human Studies.

### *Study 1 - Personality factors and negative driving outcomes*

In the realm of transport psychology, a significant focus revolves around delineating how personality variations influence driving behaviour and its outcomes. Since drivers directly control vehicles, a comprehensive analysis of their behaviours and consequences necessitates accounting for their unique personalities. Personality encompasses the dynamic organization of psychophysical systems that shape an individual's distinctive adaptation to their environment. Due to the inherent complexity and uniqueness of each personality, developing a standardized method for comprehensive driver personality assessment remains a huge challenge. As a result, research predominantly aims to identify specific personality factors that either enhance or diminish driving performance as it is clear that driving behaviour is notably shaped by a driver's temperament and personality traits. So, it can be expected that certain personality traits are inherently more dangerous than others and that a driver who exhibits a greater number of these traits is at a greater risk to themselves and other road users. Those who exhibit "dangerous" personality traits and characteristics to a significant degree represent the most problematic element in road safety. These dangerous aspects of personality are based on the results of multiple studies and are intended to assist researchers in identifying those personality factors that are hazardous to on-road behaviour so that when a driver needs to be tested, these are the factors that can be examined.

Numerous studies in transport psychology have consistently demonstrated a strong association between specific personality traits and driving behaviour, particularly risky driving (Šucha, Seidl 2011; Totkova, Racheva 2018). With regard to personality traits, egocentrism, the need for self-affirmation, emotional stability (neuroticism), hyper-sensitivity, anxiety, self-esteem, self-confidence, self-control, discipline, and rule-following, as well as benevolence and psychological resilience, are highlighted as connected to risky driving behaviour (Šucha, Seidl 2011). Extensive analysis of these studies identifies emotional stability, anxiety, aggression, anger, sensation seeking, and risk-taking as the most prevalent personality traits linked to dangerous driving behaviour (Totkova, Racheva 2018). These traits correlate significantly with increased likelihoods of engaging

in risky driving behaviours and higher probabilities of being involved in road accidents. That is the reason to explore namely these personality factors and their impact on negative driving outcomes in a Bulgarian context.

The focus of the research is on the study of anxiety, sensation seeking, driving anger, aggressive driving behaviour, risky driving behaviour and their relationship with recorded traffic offences and licence suspensions on the one hand, and involvement in road traffic accidents on the other. In addition, differences in negative driving outcomes are tracked in terms of sex, age and driving experience. The sample consisted of 1,440 participants (1,264 men and 178 women) between 18 and 76 years of age ( $M = 45.5$ ). Drivers who self-reported registered violations and driving licence suspension were 578, and participants involved in road accident were 686. A questionnaire was constructed for the purpose of the study, which included the assessment of these personality aspects through separate scales. The conducted Cronbach's alpha coefficient analyses and the factor analyses demonstrated very good results, indicating excellent psychometric properties of each of the scales and high degree of construct validity for the sample (Totkova 2023).

The study yielded several noteworthy findings pertaining to the relationship between personality traits and negative driving outcomes:

- ✓ Drivers with recorded violations and revoked licenses exhibited significantly higher levels of driving anger ( $t = 3.19$ ;  $p < 0.01$ ) and risky driving behaviour ( $t = 2.32$ ;  $p < 0.05$ ), as well as significantly lower levels of anxiety ( $t = -3.69$ ;  $p < 0.001$ ). No significant difference was observed in terms of sensation seeking and aggressive driving behaviour between the two groups of drivers.

- ✓ Drivers involved in a traffic accident showed significantly higher levels of anxiety ( $t = 3.33$ ;  $p < 0.001$ ), sensation seeking ( $t = 5.67$ ;  $p < 0.001$ ), risky driving behaviour ( $t = 2.52$ ;  $p < 0.05$ ), and aggressive driving behaviour ( $t = 8.46$ ;  $p < 0.001$ ), but significantly lower levels of driving anger ( $t = 4.82$ ;  $p < 0.001$ ).

- ✓ Anxiety, risky driving behaviour, and driving anger significantly influenced the prediction of having registered violations and license revocation. The results indicate that the probability of drivers committing violations and having their driving licenses suspended increases with increasing risky driving behaviour and driving anger, and decreases with increasing anxiety ( $\chi^2 = 29.49$ ;  $df = 3$ ;  $p < 0.01$ ).

- ✓ The effect of personality factors on crash involvement was significant for anxiety, aggressive driving behaviour, and driving anger. The odds of this negative driving outcome to increase increases with higher levels anxiety and aggressive driving behaviour and decreases with increasing driving anger ( $\chi^2 = 83.78$ ;  $df = 3$ ;  $p < 0.01$ ).

It can be reasonably stated that drivers who exhibit a proclivity for undertaking risky manoeuvres while driving, disregard various prohibitions and warnings on the road and underestimate the risk of their actions, as well as drivers who are prone to verbal and physical aggression on the road and use the vehicle to harass or intimidate another road user, will be more likely to have recorded offences, licence revocations and involvement in road accidents. These findings are consistent with those of other research, which indicates that



drivers with high levels of risky driving behaviour are more likely to be involved in accidents with injuries and material damage (Iversen, Rundmo 2002), have higher rates of involvement in road crashes due to conscious decisions to take risks (Clarke, Ward, Truman 2005). Furthermore, drivers with high levels of aggressive driving behaviour were also more likely to be involved in road traffic incidents and to have a higher number of injury and fatal accidents (Jovanović et al. 2011). With regard to the effect of anxiety and driving anger, it is evident that both low and high levels of these factors have a significant effect on the likelihood of negative driving outcomes. Anxiety has a positive effect on the likelihood of involvement in road accidents and a negative effect on the likelihood of offending. In other words, medium levels of anxiety do not affect drivers' behaviour, while low or high levels do. This result corroborates the non-linear relationship between anxiety and driving, whereby unsafe driving behaviour occurs at both low and high levels of anxiety (Oltedal, Rundmo 2006). Conversely, the effect of anger is observed to be negative in relation to traffic accidents and positive in relation to offending. Despite the evidence from global research indicating that high levels of anger while driving are associated with negative driving outcomes, including violations (Lajunen et al. 1998), involvement in road accidents (Oltedal, Rundmo 2006), and involvement in more road crashes (Deffenbacher et al. 2000), this study demonstrates that this is also true for both low and high levels of driving anger. For this reason, the same interpretation is applied to the results, and a non-linear relationship between driving anger and negative driving outcomes is proposed. Both anxiety and anger, as personality traits and states, exert an influence on human behaviour. It can be posited that when the levels of these personality factors are within the average range, the driving behaviour is safer than when these rates are high or low. Sensation seeking did not emerge as a factor associated with negative driving outcomes in this study. Upon analysis of the results, no statistically significant differences were observed in levels of sensation seeking between drivers with traffic offences or involvement in road crashes and drivers without such on-road behaviours. Additionally, sensation seeking was not identified as a significant predictor of negative driving behaviour outcomes.

### *Study 2 - Driving style and negative driving outcomes*

The previous section introduced the concept of individual differences among drivers in terms of negative outcomes of the driving process along with attempts to explain these differences, dating back to accident proneness theory. This proneness is seen as a common characteristic that predisposes to involvement in accidents of all kinds and has been successfully applied in the field of road safety (Sagberg et al. 2015). Numerous studies in this field have demonstrated that drivers exhibit differences in their involvement in road accidents, with these differences showing relative stability over time (Häkkinen 1958). It has become evident that previous studies on individual differences in the propensity to be involved in road accidents concentrated on examining a multitude of personal, demographic and social factors, yet did not incorporate actual measures of driving behaviour. The results from some early studies generally indicate that

safe drivers drive more often in the same way when the same road situations occur and recur (Häkkinen 1958). Over time, and as a result of the accumulation of research and data, specific driving behaviours have been identified that are associated with involvement in road crashes and road incidents. Researchers have established a direct correlation between these behaviours and driving skill. However, they have also observed that having the requisite skill is not always a prerequisite for drivers to avoid behaviours that are potentially dangerous. This necessitates the differentiation between driver performance and the manner in which a driver chooses to drive, or, alternatively, between driving skills and driving styles, which are regarded as two distinct components of driving (Elander, West, French 1993). The term “driving skills” is used to describe the limits of performance in executing driving tasks and encompasses information processing processes. The capacity to process information exerts a significant influence on driving skills, particularly in instances where this capacity is either temporarily (driving after consuming alcohol) or permanently (presence of various diseases) constrained. The development of driving skills is most often initiated during a driving licence course, and is subject to change. With practice and training, these skills can improve, particularly with the accumulation of experience. While there has been some consensus among researchers on the definition of driving skills and the elements that should be included in their assessment, there has been less agreement on the definition of driving styles. A considerable body of research exists on the subject, with numerous definitions and models proposed, created depending on the direction of the research and the constructs covered. Furthermore, there is a divergence of opinion among researchers regarding the relationship between skills and driving styles. Some authors posit that driving skills and driving styles are mutually exclusive (Elander, West, French 1993), while others argue that these two constructs represent two distinct, yet simultaneously independent possibilities for the occurrence of an accident on the road (Lajunen, Özkan 2011). Still others propose that driving style is partly a consequence of driving skills, as well as the conscious choices the driver makes while driving (Sagberg et al. 2015). Nevertheless, comparable parameters are also observed, most frequently involving driving habits that have been developed over an extended period of time. The authors derive three states that most often determine driving style based on these definitions. Firstly, it can be observed that driving style varies across individuals or groups of individuals. Secondly, driving style may be defined as the habitual manner in which an individual or group of individuals drives, which is a relatively stable element of road behaviour. Thirdly, the majority of definitions posit that driving style is reflective of the conscious choices made by the driver (Sagberg et al. 2015).

It is considered that driving style should be viewed as a multifaceted construct that includes not only driving habits but also automated driver actions and represents the habitual way of driving characteristic of a given driver. Most of the specific factors of the driving process are integrated and grouped into four broad dimensions of driving style. The first dimension is defined as reckless and inattentive driving and is associated with deliberate breaking of traffic rules and sensation seeking while driving. The second dimension is anxious driving, which has been the subject of investigation in studies on driver stress. It reflects

feelings of alertness and tension, as well as the ineffective application of relaxing activities while driving. The third general dimension is angry and hostile driving, which is associated with irritation, anger, hostile attitudes and actions while driving, as well as aggressive displays towards other road users. The final dimension is that of patient and careful driving, which encompasses good planning, attention, patience, courtesy, and calmness while driving, as well as compliance with traffic rules. The main driving styles (Risky, Irrational, Anxious, High-velocity, Dissociative, Patient and careful, Angry and Distress-reduction styles) and their characteristics are located within these four dimensions (Taubman-Ben-Ari, Mikulincer, Gillath 2004). A number of driving style indicators have been demonstrated to be effective in predicting involvement in road accidents. The most evident conclusion is that drivers whose driving style is characterized by a tendency to exceed the speed limit and/or engage in sudden acceleration and braking are more likely to be involved in road traffic accidents. Drivers who adhere to speed limits and execute smooth acceleration and deceleration manoeuvres are less likely to be involved in road accidents (Sagberg et al. 2015). It is evident that a distinguish between unsafe and safe driving styles can be made. Nevertheless, it is not possible to rank the styles in ascending order, starting from the safest to the most dangerous, due to the lack of information on the strength of influence that each style has on road crash involvement.

The focus of Study 2 is on investigating the construct of driving style and its relationship with recorded traffic offences and licence revocation on the one hand, and involvement in road traffic accidents on the other. In addition, differences in negative driving outcomes are tracked in terms of sex, age and driving experience. The sample consisted of 456 participants (204 men and 252 women) between 19 and 72 years of age ( $M = 37$ ). Drivers who self-reported registered violations and driving licence suspension were 223, and participants involved in road accident were 190. Study 2 employs the Bulgarian version of the Multidimensional Driving Style Inventory (MDSI-BG) to assess the driving styles (Totkova, Racheva 2019). The MDSI-BG comprises a total of 57 items, exhibiting a high degree of consistency in the sums for the entire questionnaire ( $\alpha = 0.78$ ). The adapted version of the instrument reveals a factorial structure comparable to previous versions of the inventory, with eight factors measuring each driving style - Risky, Irrational, Anxious, High-velocity, Dissociative, Patient and careful, Angry, and Distress-reduction driving styles.

The study yielded several noteworthy findings pertaining to the relationship between driving styles and negative driving outcomes:

✓ Drivers with traffic offences and a suspended licence showed significantly higher levels of risky ( $t = 4.35$ ;  $p < 0.001$ ), irrational ( $t = 4.18$ ;  $p < 0.001$ ), anxious ( $t = -2.49$ ;  $p < 0.05$ ), high-velocity ( $t = 3.15$ ;  $p < 0.01$ ), dissociative ( $t = 2.18$ ;  $p < 0.05$ ), angry ( $t = 4.83$ ;  $p < 0.001$ ), and distress-reduction styles ( $t = 1.96$ ;  $p < 0.05$ ) compared to those with no suspended licence and no offences in the last three years. These drivers in turn showed significantly higher scores for patient and attentive driving styles ( $t = -2.13$ ;  $p < 0.05$ ).

✓ Drivers who were involved in a traffic accident showed significantly higher levels of risky ( $t = 2.98$ ;  $p < 0.005$ ), irrational ( $t = 2.30$ ;  $p < 0.05$ ), and high-velocity driving styles ( $t = 2.81$ ;  $p < 0.005$ ) compared to drivers who are

not involved in a traffic accident. They have significantly higher levels of a patient and careful driving style ( $t = -4.60$ ;  $p < 0.001$ ) compared to drivers who have caused a road accident.

✓ The effect of driving styles on registered traffic offences and driving licence suspensions was significant for angry and anxious driving styles. Increase in the angry driving style increases the chance of having violations and a suspension of the driving license, while increase in the anxious driving style decreases this chance ( $\chi^2 = 28.789$ ;  $df = 2$ ;  $p < 0.001$ ).

✓ The effect of driving styles on crash involvement was significant only for the patient and careful driving style. According to the results increasing in the levels of the patient and careful driving style decreases the chance of involvement in a traffic accident ( $\chi^2 = 20.634$ ;  $df = 1$ ;  $p < 0.001$ ).

These results are consistent with previous research findings that an angry driving style is significantly and positively associated with offending, while a patient and careful driving style is negatively associated with negative driving outcomes (Wang, Xi, Zhao 2018). These findings indicate that a driver's habitual driving style, characterized by varying degrees and frequencies of angry outbursts, displays of verbal or physical aggression, and relatively frequent actions such as yielding the right of way, tailgating, failing to keep distance, improper use of the horn, and others, may be a predictor of more frequent traffic violations. Conversely, the probability of committing traffic offences is reduced for drivers who experience feelings of anxiety and apprehension while driving and who habitually drive cautiously and carefully to avoid potential situations of additional anxiety. It is to be expected that drivers who habitually drive carefully and calmly, who do not distract themselves, who wait for the right of way and who tend to plan their route are less likely to be involved in an accident through no fault of their own, as a contributory cause or due to a technical fault in the vehicle.

## Conclusion

Summarizing the results of the two studies on the investigation of personality factors and driving style suggests an outline of their significant role in relation to negative driving outcomes. Anxiety, driving anger, aggressive driving behaviour, and risky driving behaviour have a significant effect on committing traffic offences, driving licence suspension and involvement in road accidents. In addition, anxious driving style, angry driving style and patient and careful driving style have an effect on these outcomes.

The article represents two studies with pioneering contribution to the field of transport psychology in Bulgaria. This article has outlined key findings regarding the roles of personality factors, driving styles, demonstrating that these constructs are significant predictors of negative driving outcomes. While these results largely align with findings from other studies, their significance within the Bulgarian context is notable, given the scarcity of contemporary research in the country. Driving behaviour is heavily influenced by cultural factors, underscoring the critical need for updated insights to facilitate easier identification of

risky drivers and the development of effective interventions to mitigate unsafe driving practices. While researchers worldwide are advancing knowledge in this field through robust research efforts, Bulgaria lags behind. Current research on driving behaviour and its psychological underpinnings in Bulgaria is deficient, with the development of transport psychology having stagnated in recent decades, disrupting established research traditions. Without contemporary data, a comprehensive understanding of driving behaviour among Bulgarian drivers is unattainable, hindering the development and implementation of targeted strategies, campaigns, and interventions to address unsafe driving practices effectively. Generating new research in this field is crucial for laying the groundwork for evidence-based practices and policies aimed at improving road safety. This knowledge can inform preventive measures such as informational campaigns, training modules, and rehabilitation programs aimed at promoting safe driving behaviours.

While the presented results in this article does not claim to encompass the entirety of transport psychology, it nonetheless charts a new trajectory for its development in Bulgaria. The studies provide a robust foundation for shaping a modern understanding of transport psychology and for establishing this discipline as a well-defined and respected area of expertise in Bulgaria. By applying scientific evidence, researchers and practitioners can collaborate effectively to develop comprehensive approaches to road safety issues and implement practical measures aimed at enhancing safety on the roads.

## References

- Blumenthal 1968:** M. Blumenthal. Dimensions of the traffic safety problem. - *Traffic Safety Research and Review*, 12, 1968, 1, 7-12.
- Clarke, Ward, Truman 2005:** D. Clarke, P. Ward, W. Truman. Voluntary risk taking and skill deficits in young driver accidents in the UK. - *Accident Analysis and Prevention*, 37, 2005, 523-529.
- Deffenbacher et al. 2000:** J. L. Deffenbacher, M. E. Huff, R. S. Lynch, E. R. Oetting, N. F. Salvatore. Characteristics and treatment of high-anger drivers. - *Journal of Counselling Psychology*, 47, 2000, 1, 5.
- Elander, West, French 1993:** J. Elander, R. West, D. French. Behavioral correlates of individual differences in road-traffic crash risk: An examination of methods and findings. - *Psychological Bulletin*, 113, 1993, 2, 279-294.
- Groeger 2000:** J. A. Groeger. *Understanding Driving: Applying Cognitive Psychology to a Complex Everyday Task*. London, 2000.
- Häkkinen 1958:** S. Häkkinen. *Traffic Accidents and Driver Characteristics: A Statistical and Psychological Study*. PhD thesis, Institute of Technology Otaniemi, Helsinki, 1958.
- Iversen, Rundmo 2002:** H. Iversen, T. Rundmo. Personality, risky driving and accident involvement among Norwegian drivers. - *Personality and Individual Differences*, 33, 2002, 8, 1251-1263.
- Jovanović et al. 2011:** D. Jovanović, K. Lipovac, P. Stanojević, D. Stanojević. The effects of personality traits on driving-related anger and aggressive behaviour in traffic

- among Serbian drivers. - *Transportation Research Part F: Traffic Psychology and Behaviour*, 14, 2011, 1, 43-53.
- Lajunen, Özkan 2011:** T. Lajunen, T. Özkan. Self-report instruments and methods. - In: *Handbook of Traffic Psychology*. Amsterdam, 2011.
- Lajunen et al. 1998:** T. Lajunen, A. Corry, H. Summala, L. Hartley. Cross-cultural differences in drivers' self-assessments of their perceptual-motor and safety skills: Australians and Finns. - *Personality and Individual Differences*, 24, 1998, 4, 539-550.
- Michon 1985:** J. A. Michon. A critical view of driver behavior models: What do we know, what should we do?. - In: L. Evans, R. C. Schwing (eds). *Human Behavior and Traffic Safety*. Boston, 1985.
- Michon 1989:** J. A. Michon. Sociale verkeerskunde: Een plaatsbepaling. - In: C. W. F. Van Knippenberg, J. A. Rothengatter, J. A. Michon (eds.). *Handboek Sociale Verkeerskunde*. Assen, 1989.
- Näätänen, Summala 1976:** R. Näätänen, H. Summala. *Road-User Behaviour and Traffic Accidents*. Amsterdam, 1976.
- Oltedal, Rundmo 2006:** S. Oltedal, T. Rundmo. The effects of personality and gender on risky driving behaviour and accident involvement. - *Safety Science*, 44, 2006, 7, 621-628.
- Pencheva, Tsvetkova-Georgieva 2008:** E. Пенчева, Д. Цветкова-Георгиева. Психологическу подбор и успеваемост при летателно обучение. - *Machines, technologies, materials*, 2, 2008, 8-9, 71-74. (E. Pencheva, D. Tsvetkova-Georgieva. Psihologicheski podbor i uspevaemost pri letatelno obuchenie. - *Machines, technologies, materials*, 2, 2008, 8-9, 71-74.)
- Rothengatter 1997:** T. Rothengatter. Psychological aspects of road user behavior. - *Applied Psychology: An International Review*, 46, 1997, 3, 223-234.
- Sagberg et al. 2015:** F. Sagberg, Selpi, G. F. Bianchi Piccinini, J. Engström. A review of research on driving styles and road safety. - *Human Factors*, 57, 2015, 7, 1248-1275.
- Shaw, Sichel 1971:** L. Shaw, H. S. Sichel. *Accident Proneness: Research in the Occurrence, Causation and Prevention of Road Accidents*. New York, 1971.
- Shinar 1978:** D. Shinar. *Psychology on the Road: The Human Factor in Traffic Safety*. New York, 1978.
- Shinar 2007:** D. Shinar. *Traffic Safety and Human Behavior*. Leeds, 2007.
- Šucha, Seitzl 2011:** M. Šucha, M. Seitzl. The role of personality qualities in driving. - *Transactions on Transport Sciences*, 4, 2011, 4, 225-232.
- Taubman-Ben-Ari, Mikulincer, Gillath 2004:** O. Taubman-Ben-Ari, M. Mikulincer, O. Gillath. The multidimensional driving style inventory - scale construct and validation. - *Accident Analysis and Prevention*, 36, 2004, 3, 323-332.
- Totkova 2023:** З. Тоткова. Транспортна психология. Личност и поведение на шофиране. София, 2023 (Z. Totkova. *Transportna psihologiya. Lichnost i povedenie na shofirane*. Sofia, 2023.)
- Totkova, Racheva 2018:** З. Тоткова, Р. Рачева. Личностни характеристики, свързани с рисковото поведение на пътя. - *Психологични изследвания*, 21, 2018, 2, 171-193. (Z. Totkova, R. Racheva. *Lichnostni harakteristiki, svarzani s riskovoto povedenie na patya*. - *Psihologichni izsledvaniya*, 21, 2018, 2, 171-193.)
- Totkova, Racheva 2019:** Z. Totkova, R. Racheva. The Bulgarian version of the Multidimensional Driving Style Inventory: Psychometric properties. - *Behavioral Sciences*, 9, 12, 2019, 145.
- Van der Molen, Bötticher 1988:** H. H. Van der Molen, A. M. Bötticher. A hierarchical risk model for traffic participants. - *Ergonomics*, 31, 1988, 4, 537-555.

**Wang, Xi, Zhao 2018:** W. Wang, J. Xi, D. Zhao. Driving style analysis using primitive driving patterns with Bayesian nonparametric approaches. - IEEE Transactions on Intelligent Transportation Systems, 20, 2018, 8, 2986-2998.

**Wickens, Hollands 2000:** C. D. Wickens, J. G. Hollands. Engineering Psychology and Human Performance. 3rd ed. Upper Saddle River, 2000.

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