

HOW THE INTERACTION BETWEEN DRIVER AND PASSENGER IS
RELATED TO DRIVER BEHAVIORS? A STUDY BASED ON THE NEWLY
DEVELOPED DRIVER-PASSENGER INTERACTION QUESTIONNAIRE

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RELATED TO DRIVER BEHAVIORS? A STUDY BASED ON THE NEWLY
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ABSTRACT

HOW THE INTERACTION BETWEEN DRIVER AND PASSENGER IS RELATED TO DRIVER BEHAVIORS? A STUDY BASED ON THE NEWLY DEVELOPED DRIVER-PASSENGER INTERACTION QUESTIONNAIRE

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The current study aims to investigate the details of driver-passenger interaction, determine and define its various sub-concepts, and examine the relationship between its factors and aberrant and positive driver behaviors by controlling the effects of basic related demographics variables, types of passengers, and driving skills. The present study also aimed to provide the literature with a quantitative measurement tool, the Driver-Passenger Interaction Questionnaire having five different factors; Distraction and Mental Overload, Sense of Responsibility, Proactive Contribution of Passenger, Fear of Being Criticized, and Passenger Assistance with Non-Driving Tasks. In addition to the Driver-Passenger Interaction Questionnaire, a Demographic Information Form, Passenger Information Form, the Driver Behavior Questionnaire, and the Driver Skill Inventory were filled out by a total of 317 drivers (163 females, 154 males). Bivariate Correlations, Hierarchical Regression Analyses, and MANCOVAs were performed to investigate the relationships between study variables. Results showed that the Fear of Being Criticized was positively related to Errors and negatively related to Positive Driver Behaviors. Also, the Sense of Responsibility

factor was positively associated with Slips and Lapses and Positive Driver Behaviors. Moreover, Distraction and Mental Overload and Passenger's Assistance with Non-Driving Tasks factors were positively related to Slips and Lapses. The results showed in general that, driver-passenger interactions and driver behaviors were related to each other. It was also found that at different levels of driver-passenger interaction factors, differences in driver behavior frequencies are observed. Evaluation of results, implications, critical remarks, and recommendations for future studies were discussed in light of related literature.

Keywords: Driver-Passenger Interaction, Driver Behaviors, Driver Skills, Types of Passenger, Passenger Presence

ÖZ

SÜRÜCÜ VE YOLCU ARASINDAKİ ETKİLEŞİMİN SÜRÜCÜ DAVRANIŞLARIYLA NASIL BİR İLİŞKİSİ VARDIR? YENİ GELİŞTİRİLEN SÜRÜCÜ-YOLCU ETKİLEŞİMİ ANKETİNE DAYALI BİR ÇALIŞMA

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Mevcut çalışma, sürücü-yolcu etkileşiminin ayrıntılarını araştırmayı, çeşitli alt kavramlarını belirlemeyi ve tanımlamayı ve temel ilgili demografik değişkenlerin, yolcu türlerinin ve sürüş becerilerinin etkilerini kontrol ederek sürücü-yolcu etkileşimi faktörleri ile anormal ve olumlu sürücü davranışları arasındaki ilişkiyi incelemeyi amaçlamaktadır. Bu çalışma aynı zamanda literatüre nicel bir ölçüm aracı olan Sürücü-Yolcu Etkileşimi Anketi'nin kazandırmayı amaçlamıştır. Sürücü-Yolcu Etkileşimi anketi beş faktörden oluşmaktadır; Dikkat Dağıtma ve Zihinsel Yüklenme, Sorumluluk Duygusu, Yolcunun Proaktif Katkısı, Eleştirilme Korkusu ve Sürüş Dışı Görevlerde Yolcu Yardımı. Sürücü-Yolcu Etkileşimi Anketi'ne ek olarak, Demografik Bilgi Formu, Yolcu Bilgi Formu, Sürücü Davranışları Anketi ve Sürücü Beceri Envanteri toplam 317 sürücü (163 kadın, 154 erkek) tarafından dolduruldu. Çalışma değişkenleri arasındaki ilişkileri araştırmak için İki Değişkenli Korelasyonlar, Hiyerarşik Regresyon Analizleri ve MANCOVA'lar yapıldı. Sonuçlar, Eleştirilme Korkusunun Hatalar ile pozitif, Olumlu Sürücü Davranışları ile negatif ilişkili

olduğunu göstermiştir. Ayrıca, Sorumluluk Duygusu faktörü, Kasıtsız Sapmalar ve Yanılgılar ve Olumlu Sürücü Davranışları ile pozitif ilişkili bulunmuştur. Buna ek olarak, Dikkat Dağınıklığı ve Zihinsel Aşırı Yükleme ile Yolcunun Sürüş Dışı Görevlerde Yardımcı olma değişkenlerinin Kasıtsız Sapmalar ve Yanılgılar değişkeni ile pozitif yönde ilişkili olduğu gösterilmiştir. Sonuçlar genel olarak sürücü-yolcu etkileşimi ve sürücü davranışlarının birbiriyle ilişkili olduğunu göstermiştir. Sürücü-yolcu etkileşim faktörlerinin farklı düzeylerinde, sürücü davranış frekanslarında da farklılıklar gözlenmektedir. Sonuçların değerlendirilmesi, çıkarımlar, eleştirel yorumlar ve gelecek çalışmalar için öneriler ilgili literatür ışığında tartışılmıştır.

Anahtar Kelimeler: Sürücü-Yolcu Etkileşimi, Sürücü Davranışları, Sürücü Becerileri, Yolcu Tipleri, Yolcunun Varlığı



To Mert

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CHAPTER I

INTRODUCTION

1.1. General Introduction

Road traffic accidents have been reported as one of the major global problems. Approximately 1.35 million people worldwide lose their lives, and 20-50 million are injured due to road traffic accidents every year (World Health Organization [WHO], 2018). Although low- and middle-income countries have almost 60% of the world's vehicles, 93% of road deaths occur in these countries (WHO, 2018). The consequences of traffic accidents are similar in Türkiye as in the rest of the world. According to data from the Turkish Statistical Institute, over 5,600 people died, and approximately 275,000 were injured in traffic accidents in 2021. Even worse, compared to the previous year, the number of people who lost their lives in traffic accidents increased by 10.2%. Considering the increase in the world population and mobility, traffic accidents are inevitably increasing daily and becoming a more severe problem.

Many traffic safety programs and countermeasures are implemented in many countries to minimize the costs of traffic accidents and maximize traffic safety. For example, the "Time for Action" Moscow Declaration was published at the First Global Road Safety Ministerial Conference 2009. Considering the first significant attempt to reduce traffic fatalities, the document highlighted the importance of protecting vulnerable road users, particularly pedestrians, cyclists, and motorcyclists. Secondly, the United National General Assembly has declared the Decade of Action for Road Safety 2021-2030 to reduce by 50% of deaths and injuries due to road traffic accidents by 2030. This action plan aimed at increasing road safety by including many components such as safe road infrastructure, safe vehicles, speed management, and financing. Moreover, the report prepared jointly by the World Health Organization (WHO) and the World Bank in 2004 emphasized that traffic safety had been a significant public health problem and

that increasing traffic safety with the cooperation of different sectors is possible. Effective intervention strategies such as minimizing exposure to high-risk scenarios, improving the visibility of vehicles, and setting and enforcing speed limits were mentioned.

In addition to the studies carried out worldwide, one of the studies to improve traffic safety in Türkiye is the Traffic Safety Action Plan (2012) prepared by the General Directorate of Security of the Ministry of Interior. Within the scope of this action plan, it is the reduction of deaths caused by traffic accidents through implementation such as education, countermeasures, infrastructure, health services, accident analysis, and traffic safety campaigns. In the continuation of this action plan in 2012, the 2021-2030 Highway Traffic Safety Strategy Document and Action Plan have been published as a new period. This official document aimed to develop a system that will compensate for possible human errors in traffic. While performing these studies in many areas, the support of the relevant stakeholders was also obtained. Therefore, scientists and practitioners working in traffic safety should also perceive the environment as an ecosystem and examine many factors to increase traffic safety. Examining these factors affecting traffic safety is critical for traffic studies.

1.2. Factors Related to Traffic Safety

In order to ensure the safe mobility of individuals within traffic environments, it is necessary to examine the elements that constitute these environments and enable people to reach their destinations securely. Rather than separately analyzing the potential effects of various causes on traffic safety, the focus is on understanding their interactions. Haddon (1972) introduced a matrix that categorizes human, environmental, and vehicular factors as three critical factors for road safety. Within this matrix, these three fundamental elements were further classified as a pre-accident, moment of accident, and post-accident. Although additional elements have been identified over the years, these three primary categories have continued to be studied under the same names and in the same order of importance for many years. In studies conducted worldwide, the causes of traffic accidents were described in terms of these three elements (Evans, 1991; Oppenheim & Shinar, 2011).

Human factors, the first factor, were defined as road users' characteristics like age, sex, education, medical conditions, fatigue, impulsiveness, drunk driving, speeding, aggressiveness, anxiousness, motivations, attitudes, values, beliefs, and cognitive skills. The second factor, environmental factors, consists of the elements related to road design, land use, weather condition, roadside object, travel time, lighting, road conditions, obstacles on the road, traffic flow or density, and social environment such as passengers. The last factor focuses on vehicle-related aspects, including features such as braking system, weightiness, handling, a segment of the vehicle, and vehicle in-equipment. These three fundamental elements of traffic accidents and their detailed examples can be seen in Figure 1.

Human factors were among the leading causes of traffic accidents (Shinar, 1978; Rumar, 1985). Similarly, the findings of studies conducted in Türkiye on the causes of road traffic accidents have consistent with other studies' findings (Selimoğlu, 2014). According to Traffic Statistics Bulletin, published annually by the General Directorate Security, the most frequent causes of traffic accidents in Türkiye were drivers, pedestrians, vehicle faults, passenger, and road defects, respectively, in 2022. In the studies on traffic safety, the emphasis is placed only on human and human error; from the point of view of current studies, it may be insufficient to focus on a single area. For this reason, human factors in driving should be evaluated together with other factors with which they interact (Öz & Demirutku, 2018).

The environmental factor has three components: physical, social, and cultural. Factors such as road design, speed limit adjustment, road surface, road width, and weather conditions can be listed with the physical environment (Brown et al., 2017). On the other hand, cultural environment in the context of traffic culture can be defined as the reactions and behaviors of road users in the traffic environment that is formed by the combination of a country's national, economic, and individual characteristics and practices, such as education and countermeasures for safe transportation (Öz, 2011). Finally, the social environment includes all the factors related to how road users' emotions, thoughts, and behaviors are affected by those of other road users (Öz & Demirutku, 2018).

The current study examined the relationship between two essential elements of road safety; human and environmental factors. That is, it is aimed to investigate how driver-passenger interaction, as a social environment-related factor, is related to driver behaviors, which is an aspect of human factors in driving.

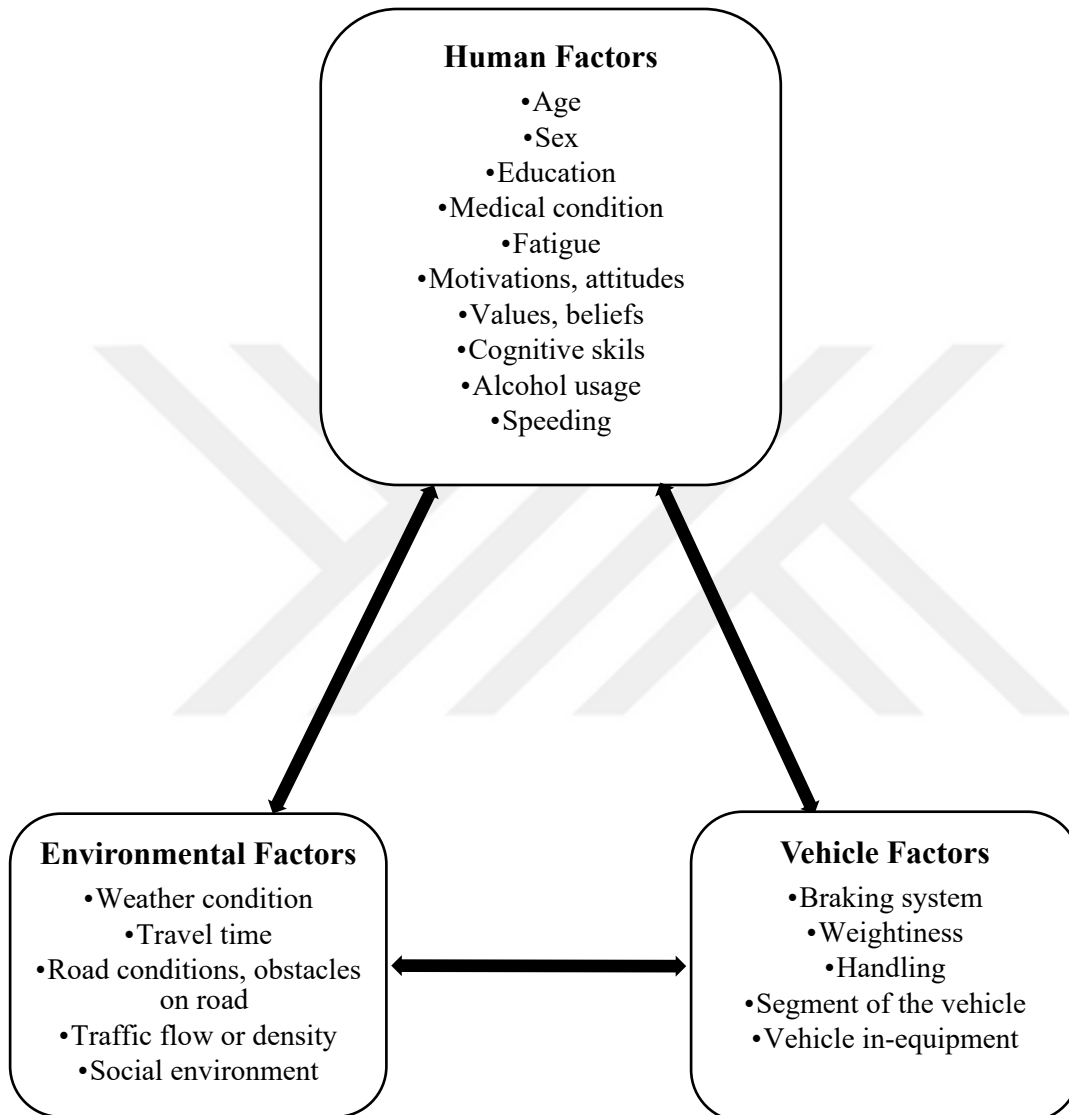


Figure 1. The causes of road traffic accidents. *Adapted from Öz, & Demirutku, 2018.*

1.2.1. Human Factors in Driving

In traffic safety research, human factors were used as a popular area because of considering one of the leading causes underlying traffic accidents. Moreover, considering the expectation that the interventions in this area provide the most

effective results, it has been inevitable for the studies to focus on human factors and their effects. For example, a study investigating human factors in driving revealed that more than half of accidents occurred due to road users, 57% in the U.S.A. and 65% in the U.K. (Oppenheim & Shinar, 2011). In addition, when examining the combination of road users and the other factors that affect them, the rate of road users causing traffic accidents reaches 95% (Oppenheim & Shinar, 2011). Furthermore, in Türkiye, it was stated that 203,923 of the 234,814 accidents in 2022 were due to drivers (General Directorate of Security, 2022). In other words, 87% of accidents are due to driver failure. Examples of these driver failures are; not being able to adapt the speed of the vehicle to the conditions required by the road, weather, and traffic, not complying with the transition priority in places where intersections, crossings, and sidewalks are narrow, failing to comply with lane watching and changing rules, hitting a car from behind.

Traffic research in human factors has been focused on two main components: driver behaviors/styles and driving skills/performance. Basically, driver behaviors/styles can be considered as “what the driver usually does,” whereas driving skills/performance is “what the driver can do”. In the following sections, detailed information on these two components of human factors is presented.

1.2.1.1. Driver Behaviors

Driver behaviors were clarified as how drivers prefer to drive; in other words, it concerned drivers' driving habits (Elander et al., 1993). The importance of examining driver behaviors is not only about how drivers behave on the road but also about predicting how drivers react to potential hazards and safety precautions (Donges, 1978). One of the most accessible methods to measure driver behavior is to ask how the driver behaves, namely the self-report method. Many measurements have been developed to examine driver behavior over time; the Attention-Related Driving Error Scale (Ledesma et al., 2010), the Aggressive Driving Behavior Scale (Houston & Harris, 2003), the Safe Driving Behavior Measure (Classen et al., 2013), Driving History Scale (Barkley et al., 2002). Many of these were used only within the scope of a specific study or were not very popular because only a few research groups used them. Besides many theories and models developed on behaviors, the most popular

model for driver behaviors was made by Reason et al. (1990). According to him, aberrant driver behaviors were divided into errors and violations, and he assumed that there were two types of errors based on different psychological bases. Violations are counted as deliberately aberrant driver behaviors, while errors coincide with driver distraction or inattention (Precht, Keinath, & Krems, 2017b).

The distinction between errors and violations emerged from developing the Manchester Driver Behavior Questionnaire (DBQ). The DBQ was developed to measure five different aberrant driver behaviors; slips, lapses, mistakes, unintended violations, and deliberate violations (Reason et al., 1990). Thereafter, Parker, Reason, Manstead, and Stradling (1995) obtained results consistent with the previous study by reusing the questionnaire and verifying the three-factor structure, such as lapses, errors, and violations. After the questionnaire was developed, many researchers in many countries conducted studies. For example, three factors were found in the research for replication study in the Western Australian population: errors, dangerous errors, and dangerous violations (Blockey & Hartley, 1995). Furthermore, in a study conducted in Sweden, results consistent with previous studies were obtained when the questionnaire was used. In contrast, the four-factor structure, such as violations, mistakes, inattention, and inexperience errors, was used in the questionnaire for young drivers (Rimmö & Åberg, 1999). Another example, as the result of a three-year follow-up study conducted by Özkan, Lajunen, and Summala (2006) in Finland, showed that two-factor structure, violations, and errors were the most applicable. Moreover, only violations items were included for German drivers, and violations were found to be valid and reliable (Haustein et al., 2022). Also, a three-factor structure, lapses, violations, and errors, were applied in the sample of Hungary, Türkiye, Pakistan, and China (Farooq et al., 2020). In addition to examining driver behaviors in different cultures, it has also been examined in terms of different road users, such as professional drivers (Sullman et al., 2002; af Wåhlberg, Dorn, & Kline, 2011; Öz, 2011); young drivers (Mattsson et al., 2015; Freydier et al., 2012); elderly drivers (Rimmö, & Hakamies-Blomqvist, 2002; Koppel et al., 2018); novice drivers (Roman et al., 2015; Rowe et al., 2015); disabled (Bakır, 2016); parent drivers (Bianchi, & Summala, 2004); a driver who has attention deficit hyperactivity disorder (Reimer et al., 2005; Biederman et al., 2012).

The DBQ was introduced as an original factor structure such as errors, lapses, ordinary violations and aggressive violations, and the factor structure and validation analysis for the Turkish version was done by Lajunen, and Özkan (2004). The DBQ is focused on aberrant driver behaviors due to the relation with traffic safety. However, because of multi-dimensional on driver behaviors, there was a need to examine driver behaviors with patient and careful driving style (Taubman-Ben-Ari, Mikulincer, & Gillath, 2003). Therefore, "Positive Driver Behaviors Scale", developed by Özkan and Lajunen in 2005 to measure the positive behaviors of drivers, is also used with the DBQ. In the current study, errors, slips and lapses, violations and positive driver behaviors were used. In the following sections, these factors are explained in more detail.

1.2.1.1.1. Errors

Reason and his colleagues (1990) have studied violations and errors separately due to the conceptual difference because errors involve an individual cognitive process while violations are related to the social context. Errors were identified as “the failure of planned actions to achieve their intended consequences” (Reason et al., 1990). For example, while waiting in the queue to turn left from the main road, avoiding the direct road traffic and almost colliding with the vehicle in front, estimating the speed of the oncoming vehicle slower than when overtaking, or missing the “give way” sign and colliding with right-of-way vehicles is accounted as errors.

Based on the algorithm (see Figure 2), Reason and his colleagues (1990) divided the errors into three categories; slips (attentional failures such as intrusion, omission, reversal, misordering, or mistiming), lapses (memory failure such as omitting planned items, place-losing, forgetting intentions), and mistakes (rule-based mistakes such as misapplications of a good rule or application of a lousy rule; and knowledge-based mistakes such as intended action, but do not achieve due to knowledge deficiencies). In addition, Wierwille et al. (2002) noted three different sub-categories based on the Indiana Tri-Level Study (1977). These three sub-categories are recognition errors (such as failure to observe, inattention, internal/external distraction), decision errors (such as misjudgment, false assumption, excessive speed, tailgating, improper maneuver), and performance errors (panic or freezing, inadequate directional control).

Then, in a recent study on the classification of errors, the kind of perception errors was counted in the classification, as mentioned earlier (Khattak et al., 2021).

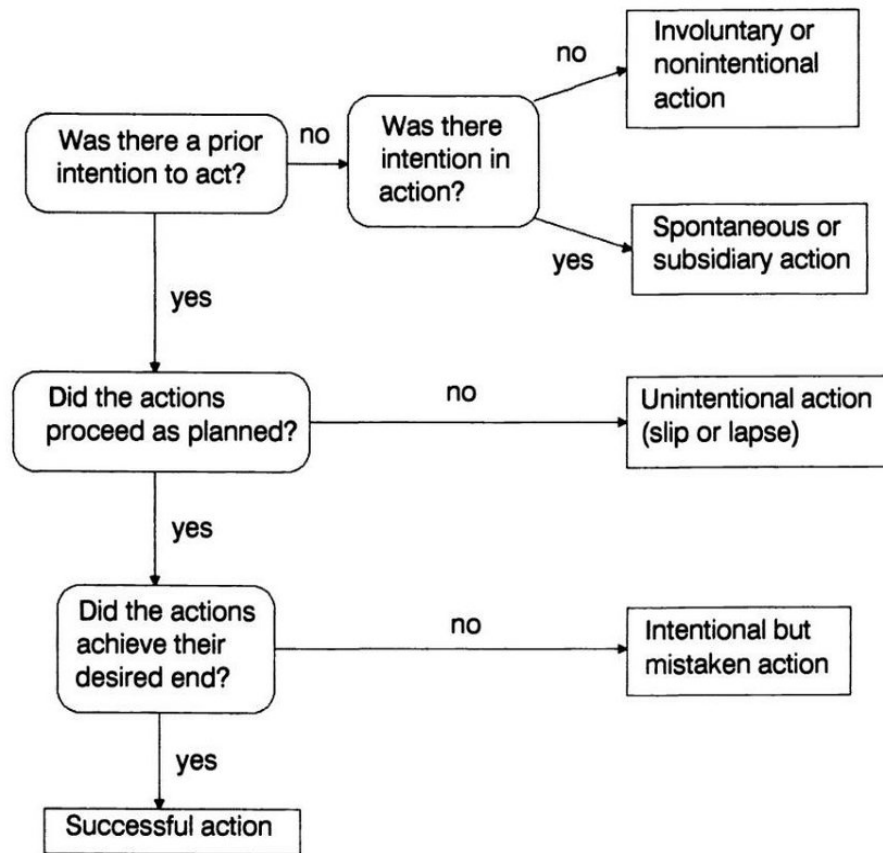


Figure 2. The Human Error Algorithm (Reason, 1990).

Studies have shown that there is a primary distinction between violations and errors (Parker et al., 1995; Lawton, Parker, & Stradling, 1997; Blockley & Hartley, 1995; Lajunen, Parker, & Summala, 2004; Åberg, & Rimmö, 1998; Lajunen, & Özkan, 2004). Comparable results in many studies have shown that errors have related to accidents. For example, it was found that recognition errors such as distraction or recognition failure were responsible for 34% of near-crashes and responsible for 38% of accidents (Khattak et al., 2021). In addition, it was determined that it was responsible for 34% of the accidents in decision errors such as speed-related, avoiding conflict, aggressive driving (drifting), stopping or decelerating (sudden or improper braking), and improper maneuvers.

There are also relationships between errors and some features of drivers. For example, a positive correlation was found between hostility (such as offensive hand gestures, honking the horn) and errors (Lucidi et al., 2019). The reason for this is that aggressive behaviors towards other road users cause the person to be distracted from driving and increase the frequency of errors (Zhang, Chan, & Zhang, 2015). In addition, studies have shown a positive relationship between the frequency of errors and anxiety (Clapp et al., 2011). As the mental and psychological functions of the drivers are affected by anxiety, their performance decreases while the frequency of errors increases (Pourabdian, & Azmoon, 2013).

Errors are associated with driver distraction and inattention (Precht, Keinath, & Krems, 2017b). Driver distraction can be identified as "occurring when a driver's attention is, voluntarily or involuntarily, diverted away from the driving task by an event or object to the extent that the driver is no longer able to perform the driving task adequately or safely" (Young, Regan, & Hammer, 2007). For example, talking or communicating with passengers (McEvoy, Stevenson, & Woodward, 2006; Zhang, Mehrotra, & Roberts, 2019), listening to the radio (Nowosielski, Trick, & Toxopeus, 2018; Young, Regan, & Hammer, 2007), lack of concentration such as daydreaming (Mafeni Mase et al., 2020; Regan, Hallett, & Gordon, 2011), and using cell phones such as texting or reading e-mails (Klauer et al., 2014; Engelberg et al., 2015) can be considered as types of distractions. Driver errors made due to the driver's distraction or inattention affect many accidents (Staubach, 2009; Klauer et al., 2014).

1.2.1.1.1. Slips and Lapses

Slips and lapses were defined as sub-factors of errors when first described. Slips and lapses were defined as "errors which result from some failure in the execution and/or storage stage of an action sequence" even though the action is well organized (Reason et al., 1990). Moreover, there is a difference in meaning between these two terms. Slips were identified as "potentially observable as externalized actions-not-as-planned," whereas lapses were defined as "a more covert error, largely involving failures of memory." (Wierwille et al., 2002). To illustrate, operating the wipers while intending to use the signal is accounted as a slip while forgetting where the car left in the parking lot is accounted as a lapse. In addition, there are also points where slips and lapses

diverge while they are close concepts. For example, although the situation assessment and planning are done well for slips, the action does not go as desired. On the other hand, the memory aspects are poor for lapses, although the situational assessment is good and the action is desirable (Wickens, 1992).

Reason et al. (1990) stated that slips/lapses involve less risk than other aberrant driver behaviors. However, the results of the studies have shown a positive relationship between slips and lapses and accident involvement (Tavakoli Kashani, Sokouni Ravasani, & Ayazi, 2016). So, slips and lapses are behaviors that need to be carefully studied in the traffic environment. On the other hand, slips and lapses are not used in some studies because they are more applicable to special driver groups, such as elderly drivers and drivers with autism spectrum disorders (Parker et al., 2000; Daly et al., 2014).

1.2.1.1.2. Violations

Violations were defined as “deliberate deviations from those practices believed necessary maintain the safe operation of potentially hazardous system” (Reason et al., 1990). Then, Lawton, Parker, Manstead and Stradling (1997) extended the DBQ and divided the violations factor into two sub-factors such as aggressive violations and ordinary violations. Aggressive violations were identified as behaving hostile against other road users and driving aggressively (Sullman, Meadows, & Pajo, 2002). To illustrate, sounding the horn to show anger at another driver or being angry with some types of drivers and showing this anger to them in some way is accounted as an aggressive violation. On the other hand, violations made deliberately without an aggressive purpose are named as ordinary violations (Dimmer, & Parker, 1999). For example, driving a vehicle even if it is considered to be above the legal alcohol limit, following the vehicle in front too closely unable to stop in an emergency, or crossing a red light at intersections even though the traffic lights turn red in your direction can be considered as an ordinary violation.

There are various types of violations; speeding, distracted driving related violations such as using cell-phones or passenger communication, drunk driving, overtaking, violations of red light, prohibited parking, violations of seat belt, not keeping enough following distance with the vehicle in front, turning or changing lanes without

signaling, not obeying traffic signs, etc. Studies conducted over the years between driver behaviors and accident involvement have shown that there is a positive relationship between violations and road traffic accidents (Wählberg, Dorn, & Kline, 2011; Iversen, & Rundmo, 2004; Yang, Du, Qu, Gong, & Sun, 2013; Khattak, Ahmad, Wali, & Dumbaugh, 2021). For example, speeding is one of the most common violations that are difficult to find a solution (Elvik, 2010). In addition, the study conducted by Mesken, Lajunen, and Summala in 2002 for Finland drivers showed that there was a positive relationship between interpersonal violations, especially speeding and number accidents.

Crossing a red light, which is another type of violations, is also a common violation. For example, in a study conducted by Porter and England in 2000, they observed 5112 drivers' light violations behaviors at intersections and the results showed that 35% of drivers passed a red light at least once. Another study conducted in the United States found that approximately 40% of near-misses and accidents were caused by light violations at intersections (Abdel-Aty, Kerr, Haleem, & Huang, 2009). On the other hand, although seat belt violations are not counted among the violations that cause traffic accidents, it is one of the most important factors affecting the severity of the consequences of traffic accidents. For example, there is a negative relationship between using seat-belt and injuries and fatal accidents (National Highway Traffic Safety Administration, NHTSA, 2014). Despite the fact that seat belts reduce the risk of death and injury in traffic accidents, seat belt violations are 57% in middle-income countries, while this rate reaches 92% in low-income countries (World Health Organization, WHO, 2015).

Another violation that poses a risk to traffic safety is distracted driving related violations. One of the most common distractions is using a cell-phone such as sending and reading text messages and e-mails or talking on cell-phones or using a smartphone app while driving (NHTSA, 2011). Another of the most common distraction in driving is passenger and interaction with them (Johnson, et al., 2004). It can even be said that the distraction effect of the passengers is more common than the mobile phone. For example, in a research, 35% of the drivers stated that they were in constant interaction with the passengers while driving, while only 10% stated that they answered calls while driving (Schroeder, Wilbur, & Peña, 2018). In fact, this rate is even lower in

sending and reading to messages, and approximately 1-2% of drivers stated that they used a phone while driving (Schroeder, Wilbur, & Peña, 2018). So, interaction with a passenger while driving can be as distracting as using a mobile phone. However, talking or interacting with the passenger is not considered a violation of traffic rules.

1.2.1.1.3. Positive Driver Behaviors

When it comes to human factors in driving, the first thing that comes to mind is usually aberrant behaviors such as violations, errors, and lapses. In other words, errors and violations that usually endanger traffic were the more frequently investigated behaviors because considering that these aberrant behaviors pose a threat to traffic safety (Gras, et al., 2006; Winter, & Dodou, 2010; Mallia, Lazuras, Violani, & Lucidi, 2015). Since these behaviors are associated with traffic accidents, it is thought that reducing these behaviors contributes to increasing traffic safety (Warner, Özkan, Lajunen, & Tzamalouka, 2011). However, the positive effects of drivers' positive behaviors on traffic safety and traffic environments have been overlooked until some time ago.

The DBQ has taken into account aberrant behaviors in all its versions. However, the type of driver behaviors defined as "a patient and careful driving style" by Taubman-Ben-Ari, Mikulincer, and Gillath (2003) has also entered the literature. It has been claimed that driver behaviors do not only consist of negative styles such as aggressive driving style and careless driving style. Moreover, Özkan and Lajunen developed the concept of positive driver behaviors in 2005 to examine positive behaviors in traffic and to close the gap in this field. The researchers were defined positive driver behaviors as behaviors that increase the safety of traffic environment, protect other road users or approach them in a kind and helpful way (Özkan, & Lajunen, 2005a). Based on these assumptions, developed the "Positive Driver Behaviors Scale" have good factor structure, high item loading, strong internal consistency, and a reliable measurement to measure positive driver behaviors.

There is a positive relationship between positive driver behaviors and age (Özkan & Lajunen, 2005a) and exposure (Öz, Özkan, & Lajunen, 2014). In other words, it can be said that positive driver behaviors increase with age and exposure, such as annual mileage, lifetime mileage, and experience. This positive relationship may be because

novice drivers cannot focus on polite driver behaviors. After all, novice drivers often focus on driving-related tasks (Özkan & Lajunen, 2005a). In addition, the research results showed that positive driver behaviors were negatively related to errors, violations, and hostile aggression (Özkan & Lajunen, 2005a). Similarly, consistent with previous studies in the literature, the study conducted by Chu and his colleagues (2019) indicated that positive driver behaviors had a negative relationship with violations, errors, and lapses. The reason for this relationship may be that being a polite driver has some characteristics that require avoiding disturbing behaviors of other drivers and paying attention to the traffic environment. In addition, it has also been determined that drivers with positive driver behaviors tend to drive more safely and are involved in fewer accidents (Poó, Taubman-Ben-Ari, Ledesma, & Díaz-Lázaro, 2013). Both aberrant and positive driver behaviors can be monitored simultaneously in traffic circumstances (Shen, Qu, Ge, Sun, & Zhang, 2018). In order to construct a safer traffic ecosystem, it is essential to comprehend driver behaviors (Kaçan et al., 2019).

1.2.1.2. Driver Skills

Along with driver behaviors, one of the other components of human factors in driving is driver skills. Driving skills consist of information processing, motor, and safety skills, which can be improved with practice and training (Elander, West, & French, 1993). Moreover, Spolander (1983) split driving skills into two; technical driving skills, defined as quick and fluent vehicle control and management of traffic environments, and defensive driving skills, defined as predictive accident skills. Spolander (1983) used a self-assessment instrument to measure these skills and found that driving skills increased with experience.

On the other hand, Näätänen and Summala (1976) did not yield results consistent with Spolander (1983). In the study of Näätänen and Summala (1976), unlike the previous study, it was found that driving skills improved with the increase in practice and exposure. However, the importance given to safety and safety skills decreased. One of the reasons for this can be interpreted as the intertwining of technical and defensive skills. On top of that, further clarification of the structure of driving skills has been made. Spolander (1983) asked the drivers to answer by comparing themselves with an average driver. On the contrary, Hatakka, Keskinen, Laapotti, Katila, and Kiiski

(1992) took a different approach by asking them to evaluate their own skills rather than the average driver. Afterward, Lajunen and Summala (1995) extended the driving skills classification by developing the Driver Skill Inventory (DSI). The DSI has been validated in many different countries, containing Germany (Ostapczuk et al., 2017), Sweden (Öztürk, Warner, & Özkan, 2022); Finland (Warner et al., 2013); China (Xu et al., 2018); Türkiye (Sümer, Özkan, & Lajunen, 2006).

The DSI is composed of two factors; perceptual-motor skills and safety skills. While measuring driver skills by drivers' self-assessment, studies have found that drivers overestimate their driving skills compared to average drivers (McKenna, Stainer, & Lewis, 1991). It is said that overconfidence in driving skills is also associated with taking more risks in traffic environments, and therefore the risk of being in a traffic accident increases (Näätänen & Summala, 1976).

1.2.1.2.1. Perceptual-Motor Skills

Perceptual-motor skills, such as information processing and motor skills, are components of driver skills (Lajunen & Summala, 1995). Evaluating one's own skills for situations such as lifting the vehicle on a slope without skipping backward, using a serial vehicle, and overtaking can be considered examples of perceptual-motor skills. Studies showed driver skills are related to accident involvement (Gregersen, 1996; Sümer, Özkan, & Lajunen, 2006). For example, perceptual-motor skills positively correlate with accident involvement risk (Lajunen, Parker, & Stradling, 1998). Afterward, in a cross-country study with a comparison of six countries, these results were proven to be perceptual-motor were positively associated with the number of penalties in Finland, Greece, and the Netherlands (Özkan, Lajunen, Chliaoutakis, Parker, & Summala, 2006). Also, in another study, in line with previous studies, for Turkish drivers, perceptual-motor skills were positively related to both active and passive accidents (Özkan, & Lajunen, 2006). The study results mean that as drivers' evaluation of their perceptual-motor skills as solid increases, the rate of drivers both actively crashing into something and passively crashing their vehicle by hitting another person increases.

Perceptual-motor skills are also related to some personality characteristics. For example, a positive correlation was found between driving aggression and perceptual-

motor skills (Lajunen & Summala, 1995). In other words, people whose perceptual-motor skills are evaluated as higher may get angry more quickly and use more aggressively in traffic environments. In addition, perceptual-motor skills were positively related to the sense of self-esteem (Lajunen & Summala, 1995). As a result of this research, drivers who believe that their perceptual-motor skills are strong and have high self-esteem may not think that they are at risk in traffic environments. Moreover, conscientiousness (order, competence, dutifulness, achievement striving, self-discipline) and openness to experience (fantasy, aesthetics, feelings, actions, values) are good predictors of perceptual-motor skills (Xu et al., 2018). For example, lower conscientiousness was associated with more accident involvement and perceptual-motor skills (Guo et al., 2016).

1.2.1.2.2. Safety Skills

Safety skills have been defined as motives consisting of both temporary motivational and more permanent personality traits and attitudes towards safety (Lajunen & Summala, 1995). Driving behind a slow vehicle without getting impatient, keeping sufficient following distance, and carefully obeying traffic lights can be counted as examples of safety skills. Like perceptual-motor skills, drivers have a tendency to overestimate their safety skills, compared to average drive (Walton, & Bathurst, 1998).

Earlier studies showed that safety skills were also associated with accident involvement (Lajunen, & Summala, 1995; Özkan, & Lajunen, 2006; Warner et al., 2013). Compared to perceptual-motor skills, safety skills are a stronger predictor of accident involvement (Lajunen, & Summala, 1995; Liu et al., 2021). In addition, while both active and passive accidents were associated with perceptual-motor skills, only active accidents were related for safety skills. There is a negative relationship between safety skills and active accidents (Özkan, & Lajunen, 2006). Furthermore, the study conducted by Sümer, Lajunen, and Özkan (2006) with Turkish drivers to compare perceptual-motor skills and safety skills showed that drivers with low level of safety skills and high level of perceptual-motor skills were the group with the highest accident and traffic fines rate. In other words, it can be said that the group with the highest risk of being in an accident in the traffic environment is the drivers with low safety skills and high perceptual-motor skills.

While perceptual-motor skills can be improved with practice and experience, no such improvement was seen for safety skills (Xu et al., 2018). Also, safety skills related to some personality characteristics. For example, agreeableness (trust, straightforwardness, altruism, compliance, modesty) and conscientiousness had been found to be a good predictor for safety skills (Xu et al., 2018). The result of the study conducted by Lou and Dai (2015) revealed that high agreeableness drivers and high conscientiousness drivers have a tendency to safe driving because they maintain positive relation to others (altruism), and obey traffic rules (compliance) due to agreeableness and they perceive the rules (dutifulness), think twice before doing (deliberation), behave ethically (have self-discipline).

1.2.1.3. The Relationship between Driver Behaviors and Skills

As mentioned in the previous parts of the current study, driver behaviors and driver skills are two crucial elements for studies on the effects of human factors on traffic safety in traffic literature. Extensive research has been conducted in the literary field to explore the interconnections between these two fundamental concepts. For example, the study conducted by Martinussen, Møller, and Prato (2014) indicated that violations were positively related to perceptual-motor skills and negatively related to safety skills. Under the literature, similar results were obtained in the study conducted by Özbay in 2017, and a stronger correlation was found, especially when the relationship between speeding behavior and driver skills was examined. Furthermore, errors and lapses were negatively associated with perceptual-motor and safety skills (Martinussen, Møller, & Prato, 2014). Moreover, in the same study, they classified drivers by examining both driver skills and driver behaviors. High levels of driver skills and, at the same time, drivers with a low frequency of aberrant driver behaviors have been determined as the safest driver group. These findings, in line with other studies, showed that drivers with high perceptual-motor skills were at the same time the riskiest driver group when they had low safety skills (Lajunen, Parker, & Stradling, 1998; Sümer, Özkan, & Lajunen, 2006).

When the relationship between driver skills and positive driver behaviors is examined, positive driver behaviors were positively associated with perceptual-motor and safety skills (Xu et al., 2018). The reason for this relationship can be explained as follows,

drivers with high perceptual-motor skills pay more attention to the behaviors of other drivers, and drivers with high safety skills can demonstrate positive driver behaviors more politely to other road users, as they prioritize the safety of others during travel.

When examining human factors in driving, it was stated that the two most fundamental variables are driver behaviors and driver skills. The studies mentioned earlier and many others (such as Yang, Li, Guan, & Jiang, 2022; Üzümcüoğlu, Özkan, Wu, & Zhang, 2020; Lajunen, Sullman, & Gaygısız, 2022; Azık Özkan, 2022) have shown the relationship between driver behaviors and driver skills. In order to gain a deeper understanding of driver behavior, this study considered the driver's skills to mitigate any potential impact on the results. In this way, by controlling the effect of driver skills on driver behaviors, more accurate results can be obtained, which is the primary purpose of the research, the effect of the driver-passenger interaction on the driver's behaviors. In other words, it aims to increase the accuracy of the relationship between the dependent variable (driver behaviors) and the independent variable (driver-passenger interaction) by controlling a decisive variable associated with dependent variables.

1.2.2. Individual Related Factors in Driving

Human factors in driving, driver behaviors, and driver skills, frequently used in the traffic literature, have also been examined in terms of some individual-related factors in driving with many studies. Extensive research has thoroughly examined various factors on the correlation between driving skills and behaviors. For example, driver behaviors and skills were examined concerning age (Yang, Li, Guan, & Jiang, 2022; Shinar, Schechtman, & Compton, 2001; Martinussen et al., 2013); sex (Özkan & Azık, 2022; Bener & Crundall, 2008); exposure (Harrison, 2019; Winter, & Dodou, 2010); sensation seeking (Cestac, Paran, & Delhomme, 2011; Li, Zhou, Ge, & Qu, 2022); aggression (Yang, Li, Guan, & Jiang, 2022; Sümer, Özkan, & Lajunen, 2006); inattention (Staubach, 2009; Klauer et al., 2014; Precht, Keinath, & Krems, 2017b); and attitudes (Mohamed, & Bromfield, 2017; Sheykhfard et al., 2023).

As previously stated, there are numerous variables associated with human factors. The current study considered three crucial variables related to human factors that could impact the results. The most prominent are observed as age, sex, and exposure in the

literature. For example, many studies have included the mentioned variables in their research as independent variables (Özkan & Azık, 2022; Struckman-Johnson et al., 2015; Navas et al., 2019), dependent variables (Yadav, Khanuja, & Velaga, 2020), mediation or moderation variable (Rhodes, & Pivik, 2011; Song et al., 2021), and control variable (González-Iglesias et al., 2012; Öz, Özkan, & Lajunen, 2013; Özbay, 2017). The driving-related situations can vary based on the individual's risky driving factors and relationships. The present study investigates human factors in traffic settings by considering age, sex, and exposure.

1.2.2.1. Age

Driver's age is one of the significant predictor variables of driver behaviors and driving skills. Especially since young drivers are the riskiest group in terms of the risk of being involved in traffic accidents, importance is given in the literature (Elvik, 2010; Martinussen, Møller, & Prato, 2014; Omran et al., 2023). For example, according to Elvik's study (2010), the injury rate of the youngest drivers aged 18-19 years is 5-10 times higher than other drivers. Moreover, the ratio of accidents for young drivers tends to increase rather than decrease over time (Luburić et al., 2023). Moreover, age was negatively related to violations, errors, lapses, and reckless driving (Martinussen, Møller, & Prato, 2014; An, Sun, & Wei, 2023), meaning that aberrant driver behaviors decrease with age. Other studies showed that young drivers tend to speed behavior more; on the contrary, drivers over 55 years old have less tendency (Fildes, Rumbold, & Leening, 1991; Kim et al., 2022). Moreover, young drivers showed a higher frequency of violations; on the other hand, elderly drivers showed more inattention errors (Özkan et al., 2006). In addition, young drivers had the highest risk of accident involvement due to in-vehicle distractions such as turning on the radio, passengers, or smoking (Lam, 2002; Ebel, Lingenfelder, & Vogelsang, 2023).

Age was positively related to both perceptual-motor and safety skills (Özkan et al., 2006; Özbay, 2017). In other words, drivers reported that perceptual-motor skills increase with age. Considering that driving skills increase with practice, this is an expected relationship. Moreover, another study examining the relationship between driver skills and age indicated that older drivers in different countries have more social tolerance and adherence to rules than younger drivers (Özkan et al., 2006). Also,

another problem with young drivers' driving skills is that 40% of young drivers rate themselves better than their driver's trainers do for them (Mynttinen et al., 2009). This situation, in turn, increases the risks of being involved in an accident by not noticing risk situations in traffic due to overconfidence in their skills.

1.2.2.2. Sex

Many studies conducted up to now have researched sex differences in driver behaviors (Parker et al., 1992; Lawton et al., 1997; Åberg & Rimmö, 1998; Özkan & Lajunen, 2005b; Granié et al., 2021). For example, Granié et al. (2021) conducted a study investigating the effect of gender differences on risky driver behaviors, including 32 countries. Actions that can significantly endanger one's safety while driving include driving while intoxicated, speeding, not wearing a seat belt, and using mobile devices while driving. These behaviors are defined as high-risk activities. The study results demonstrated that in almost all cultures, males are more likely to engage in risky behaviors than females. In addition, 32 different countries and eight different cultural classes were included in the same study. According to the study results, the differences between risky driver behaviors were not only related to biological sex differences but also determined by the expectations of cultures from gender roles (Granié et al., 2021). Another study conducted by Özkan and Lajunen (2005) for Turkish drivers indicated that being male was associated with more the number of accidents and penalties, aggressive and ordinary violations, and errors. In addition, it was noted that female drivers were generally affected by turning to the passenger and other internal distractions. In contrast, male drivers were found to increase the risk of accidents with external and internal distractions (Buckley, Chapman, & Sheehan, 2014).

In order to analyze the discrepancies in driving skills based on gender, it was found that males tend to have better perceptual-motor skills but lower safety skills (Martinussen, Møller, & Parto, 2014). In addition, Özbay (2017) found that while there is a relationship between being male and high perceptual motor skills and a relationship between being female and high safety skills, incompatible with the literature. Studies exploring the differences between male and female driving skills across various cultures have backed up these claims, particularly regarding perceptual-motor abilities (Özkan, Lajunen, Chliaoutakis, Parker, & Summala, 2006).

1.2.2.3. Exposure

Traffic exposure, which defines how long, how often, what amount, and in what situations of physical or social interaction the driver is in traffic environments, is an essential key variable associated with traffic safety and accidents. In other words, exposure can be used in different metrics such as the frequency of driving (Sayed, Abdelgawad, & Said, 2020), the time elapsed since the license was obtained, daily driving time (Tao, Zhang, & Qu, 2017), the number of years the vehicle was driven (Mohammed, Abdullahi, & Barakat, 2023), experience (Young, Regan, & Hammer, 2007), annual mileage (Özbay, 2017), and lifetime mileage (Lajunen, Sullman, & Gaygısız, 2022). Exposure was positively associated with the number of traffic accidents (Mohammed, Abdullahi, & Barakat, 2023). For example, daily driving time was negatively related to ordinary violations, the number of accidents, and the number of tickets (Tao, Zhang, & Qu, 2017). This finding means that as the driver's daily use of the vehicles increases, that is, the exposure to traffic increases, the number of ordinary violations, accidents, and traffic tickets increases. In addition, daily driving time was also a good predictor of accident risk (Tao, Zhang, & Qu, 2017). In addition, when the driving experience increases with the increases in exposure, the risk perception of the driver changes. More experienced drivers perceive risky behaviors as less dangerous and do more those (Machado-León et al., 2016). In addition, experienced drivers are more tolerant of distracted factors, as their driving behavior is more automatic than inexperienced drivers. Conversely, for novice drivers, the risk of an accident is higher in distracted driving situations (Young, Regan, & Hammer, 2007).

In addition to driver behaviors, driver skills, and exposure are related to a traffic environment. For example, annual mileage was positively associated with safety skills (Öz, Özkan, & Lajunen, 2013). Moreover, the results of the study conducted by Özbay (2017) indicated that annual mileage was negatively correlated with perceptual motor skills. In light of this information, it can be said that with increasing exposure, safety and perceptual-motor skills increase. Furthermore, in line with the zero-risk model (Näätänen & Summala, 1976), with increasing driving experience and exposures, the risk perception decreases, and this can affect decreased concern for safety. The results of Lajunen, Sullman, and Gaygısız (2022) study also prove this. Their study showed

that experience drivers stated higher perceptual-motor skills and lower safety skills than inexperienced drivers.

1.2.3. Environmental Factors in Driving: Social Interaction between Drivers and Passengers

Humans are social beings. Therefore, they cannot be expected to live in isolation from their social environment. In this case, they inevitably are affected by their social environment. Attitudes, beliefs, and norms are essential factors determining people's behavior (Ajzen, 1985; Ajzen, 2011; Zhang, Cowling, & Tang, 2010). The results of many studies carried out to date have proven this and have shown that people can change their behaviors by being affected by environmental factors, subjective norms, and other people's views/beliefs (Ajzen, 1985; Ajzen, 1991; Manning, 2009). Driving, similarly, cannot be an isolated activity because it is inevitable to interact with the social environment and other road users while driving and in traffic environments. Traffic safety culture also affects the behavior and reactions of road users in traffic environments such as the road or inside the vehicle. Özkan and Lajunen (2011) defined safety culture in traffic as "... the set of formal and informal rules, norms, basic assumptions, attitudes, values, habits, and perceptions concerning safety and/or conditions considered risky, dangerous or injuries" at different levels (i.e., micro, meso, macro, and magna).

The audience effect is identified as the change in the performance or behavior of people due to being observed by someone or thinking that is being observed by others (Hamilton & Lind, 2016). The term was first used by Triplett (1898), who observed cyclist behavior. The study found that cyclists competing with each other were faster than cycling alone. Then, many studies began investigating changes in the behavior and performance of people being watched or observed. For example, Dashiell (1935) indicated that the presence of an audience improved people's performance compared to when they were alone. However, Pessin (1933) revealed the opposite effect that the presence of an audience was more arduous than being alone in memorizing nonsense words. The reason for this difference depends on the effect of the presence of others, the interaction between the task and the person. While such an audience effect is

defined as social facilitation in the psychology literature, the same term is used in the context of driving.

Social facilitation, the audience effect, is a subject that has been studied for many years in social psychology. In the context of driving, examining the impact of the presence of others on performance is similar to examining the impact of passengers on drivers (Baxter et al., 1990). Most studies on social facilitation have indicated that the presence of others improves performance on simple tasks while decreasing accuracy in complex tasks (Bond & Titus, 1983; Cottrell, 1968; Geen & Gange, 1977; Landers & McCullagh, 1976; Zajonc, 1980). Based on this information, the impact of the presence of others on driving, whether the presence of passengers facilitates or decreases the driver's behavior, is worth investigating.

Zajonc (1965) conducted a study to examine social facilitation and find an answer to the conflicting effect of the presence of others on performance in earlier studies. Social facilitation can be identified as the enhanced effect of the presence of others on an individual's performance compared to being alone (Zajonc, 1965). The theory suggests that when people are encountered familiar or well-learned tasks, the presence of others facilitates their performance. With this theory, which Zajonc (1965) found, studies in this area have continued and progressed. For example, Cottrell (1968) stated that if observers or audiences judge a person's behavior or performance, this judgment will affect the person. Also, some studies have argued that the audience has a distracting effect, as it has been noted to impair performance due to the division of attention between the audience and the task (Sanders & Baron, 1975).

The influencing factors of driver behaviors can be divided into internal and external factors. The former consists of factors related to drivers like age, gender, and exposure (Jing, Shan, & Zhang, 2023). The latter includes external factors such as other road users, passengers, environment, or road conditions that are not directly related to the drivers and are at least partially beyond their control (Weng & Meng, 2012). The presence of others in the car, the primary variable of the present study, is one of those variables. Even if the presence of the passenger is not a driver-related factor, according to some studies, it increases the risk of being involved in an accident by affecting the driver's behaviors (Lee & Abdel-Aty, 2008; Rosenbloom & Perlman, 2016; Simons-

Morton et al., 2011). Some other studies, on the contrary, stated that the presence of the passenger affects the driver's behaviors positively and prevents the accident (Rueda-Domingo et al., 2004; Vollrath, Meilinger, & Krüger, 2002; Nakagawa & Park, 2014a). When the literature on passengers is examined, it is seen that there are conflicting results. The reason for these contradictory results is that the driver-passenger interaction varies depending on some characteristics such as age, gender, and the number of passengers, types of passengers. Therefore, the effects of the driver-passenger interaction on road traffic safety change as positive or negative, and understanding the nature of this interaction requires more research effort.

Another factor associated with the impact of passenger presence on driver behavior and road traffic safety is experience. Driving a car is a complex task requiring the simultaneous use of several subtasks (Aasman & Michon, 1992). On the other hand, driving is a well-learned task for experienced drivers. For experienced drivers, driving may have become automatic behavior that does not require much attention. For example, the study conducted by Cantin, Lavallière, Simoneau, and Teasdale (2009) found that younger drivers have longer reaction times than older drivers in complex driving conditions. Based on these findings and the social facilitation theory, it can be said that the presence of others distracts younger drivers and inexperienced drivers. In comparison, it is a facilitator for older drivers and experienced drivers. According to some studies, there seems to be a correlation between driving with a passenger and an increased likelihood of accidents among young drivers. The data suggests that 43% of these drivers had been involved in an accident under these circumstances. In comparison, 28% of adult or older drivers reported having had a similar experience. (Orsi, Marchetti, Montmoli, & Morandi, 2013). There are also studies investigating whether it facilitates the effect of passengers on driver behavior (Engström, Gregersen, Granström, & Nyberg, 2008; Fleiter, Lennon, & Watson, 2010; Geyer & Ragland, 2004; Hu, Xie, Han and Ma, 2020; Lee and Abdel-Aty, 2008).

In the following sections, the issue was investigated in more detail, and both positive and negative effects of the presence of passengers were mentioned. Then, some related factors of passengers, such as passenger's age, sex, and the number of passengers, were presented because when these factors change, the effects of the passenger's presence

might also change (Braitman, Chaudhary, & McCartt, 2014). Finally, it was introduced how different types of passengers can impact drivers' behavior.

1.2.3.1. The Negative Effects of Passenger Presence

The passenger's presence has several adverse effects on road traffic safety (Chung et al., 2014), accidents (Behnood & Mannering, 2017), and driver behavior (Ross et al., 2016). Distracted driving stands out as one of the significant negative consequences. Distracted driving is defined as engaging in any secondary activity other than driving, which may cause the driver to divert from driving (Stutts et al., 2005). In addition, driver distraction is acknowledged as one of the crucial factors that cause road traffic accidents (McEvoy, Stevenson, & Woodward, 2007). It was also reported that 8% of fatal crashes, 15% of injuries, and 14% of all police-reported crashes in the U.S.A. in 2018 were caused by distracted drivers (National Center for Statistics and Analysis, 2020). In addition to this significant effect of distracted driving on the probability of an accident, it should also be considered that accidents are rare events. Therefore, the number of near-misses due to distracted driving should be much greater than the number of accidents due to distracted driving (Ranney, Garrott, & Goodman, 2001).

The most common distractions while driving are in-vehicle equipment, passengers, adjusting external objects, people or events, lack of concentration such as daydreaming, using a cell phone, and so on (Johnson et al., 2004; McEvoy, Stevenson, & Woodward, 2006; Stutts et al., 2001; Stutts et al., 2005; Sullman, 2012; Young, & Lenné, 2010). The study conducted by Stutts et al. (2001) indicated that when the factors that cause distraction of drivers are examined, 29.4% of the participants stated outside people, objects, and events, while 11.4% said adjusting the radio. In the third place, 10.9% of the participants stated that other occupants in a vehicle are the most distracting factor.

Passengers can also distract drivers by talking or interacting in other different ways. For example, the driver may turn towards the passenger to communicate or may argue with him/her, and the driver cannot focus on the road due to mental overload (Lee, 2014; Schaap, Horst, Arem, & Brookhuis, 2013). Sullman (2012) conducted a study on drivers' distraction with 7,168 drivers. In line with earlier studies, the passenger's presence was considered a distraction for drivers. The study analyzed the age and

gender of drivers and revealed that both males and females across all age groups reported passengers as the most common distraction while driving. In addition, in another study conducted in this area, it was determined by a self-report questionnaire that talking to a passenger is one of the five most frequent distracting activities (McEvoy, Stevenson, & Woodward, 2006).

There are many factors behind the passenger's presence causing the accident. One of the most prominent and notable of these is the driver's age (McEvoy, Stevenson, & Woodward, 2006; Young & Lenné, 2010). For example, the risk of accidents and injury for young drivers under 25 can increase when passengers are in their cars (Orsi, Marchetti, Montomoli, & Morandi, 2013). Similarly, another study showed that young drivers are more distracted because they interact verbally with passengers (Toxopeus, Ramkhakawabsingh, & Trick, 2011). In addition, the impact of passenger presence on driver distraction is significantly higher among drivers under 30 years old, followed by older drivers (50 years or older) and middle-aged drivers. (Sullman, 2012).

Despite the information about the adverse effects of distracted driving, it is noteworthy that there is little information about the prevalence of distractions other than mobile phone use (Rakauskas, Gugerty, & Ward, 2004; Strayer & Drew, 2004). In addition, the paucity of research on personal factors and self-regulated behaviors that motivate drivers to include or avoid distraction is remarkable (Young & Lenné, 2010). Therefore, there is a need to explain which characteristics of drivers encourage distraction or under which conditions drivers are more prone to distraction activities like driver-passenger interaction.

Similar to distraction, the mental overload of drivers by passengers also increases the risk of accidents. For example, it has been observed that the presence of the passenger has a negative effect on traffic safety in complex and more attention-seeking situations. Passengers increase the risk of accidents in situations where the driver needs to pay more attention than in normal conditions, such as when passing a car (overtaking) or at intersections, especially with less experienced drivers (Vollrath, Meilinger, & Krüger, 2002).

It would be an understatement to say that the passenger's presence has only a negative effect as a distraction or mental overload. The presence of the passenger can have

effects on driver behaviors. The lack of an apparent effect of passenger presence in investigating the effect of passenger presence on speed choice in Goralzik and Vollrath (2017) study suggests that the effects of passenger presence reported in previous studies (e.g., Regan and Mitsopoulos, 2001) are due to the driver-passenger interaction rather than just the presence of the passenger.

Passengers can distract drivers and may even cause them to commit more violations. Additionally, passengers may criticize the driver's behavior or driving skills, which can cause the driver to become more nervous or aggressive while driving. (Simons-Morton et al., 2005). This situation may cause drivers to show riskier driver behaviors due to the fear of being criticized by passengers (Gheorghiu, Delhomme, & Felonneau, 2015). For example, since peer pressure is generally adequate on young drivers, studies show that young drivers drive riskier due to peer passenger pressure (Bingham et al., 2016; Shepherd, Lane, Tapscott, & Gentile, 2011). Based on the fear of being criticized, it can be said that young drivers exhibit riskier driver behaviors due to being bullied or ostracized as bad or novice drivers, especially when they are with their peers (Weston & Hellier, 2018). However, the study's findings by Horvath, Lewi, and Watson (2012) indicated that attitudes and self-efficacy are good predictors of driver behaviors. In other words, attitudes and self-efficacy can predict speed behaviors and intentions by reducing the influence of peer pressure.

In some circumstances, the existence of a passenger in the vehicle may negatively impact the driver's behaviors and raise the probability of accidents. Maintaining focus on the road while driving is of utmost importance. However, the presence of passengers can often present a challenge, similar to juggling multiple balls simultaneously. It is essential to be aware that there may be adverse effects, such as the distraction effect of the presence of the passengers on the drivers (Zhang, Mehrotra, & Roberts, 2019) and the driver's mental overload due to interaction or conflict with the passenger causes him or her to be unable to pay attention to the traffic environment (Precht, Keinath, & Krems, 2017a). In addition, research has shown that when drivers feel criticized or unaccepted, they tend to exhibit riskier behaviors and their overall driving performance is negatively impacted. (Shepherd, Lane, Tapscott, & Gentile, 2011).

1.2.3.2. The Positive Effects of Passenger Presence

Studies conducted in this field suggest that the presence of passengers in a vehicle can potentially reduce the probability of accidents occurring and promote better driving habits in the driver (Lee & Abdel-Aty, 2008; Rueda-Domingo et al., 2004; Vollrath, Meilinger, & Krüger, 2002). On the other hand, research shows that passengers can have an adverse impact on driving, particularly young drivers between the ages of 16 and 17, who are at a higher risk of accidents. (Presusser, Ferguson, & Williams, 1998; Chen, Baker, Braver, & Li, 2000). However, most of these studies are in countries such as the U.S.A. and Canada, where the driving age starts at 16. Therefore, when we exclude this age group, it can be said that the passenger's presence generally has a positive effect rather than a negative one. The reason for these conflicting results depends on the driver's and passenger's demographic characteristics and the interaction between them. For example, the study conducted by Rueda-Domingo et al. (2004) revealed that the presence of the passenger has a protective effect on older drivers compared to younger drivers.

There are various ways in which the mere presence of a passenger can positively impact the driver. As a passenger, it is possible to improve the safety of the driver and other road users by notifying them of any potential hazards in the vicinity. This proactive behavior can help to prevent accidents and promote safe driving practices. Vollrath, Meilinger, and Krüger (2002) indicated that the presence of a passenger in the vehicle reduces the risk of an accident when the traffic flows slowly and it is dark. This finding may be because the passenger can make the driver more patient when traffic congestion and help the driver's visibility in the evening when it gets dark. In another study, it was determined that the presence of a passenger in adverse weather conditions reduces the risk of accidents (Hing, Stamatiadis, & Aultman-Hall, 2003). In another study, warnings to passengers about a police car, cyclist, pedestrian, or an animal on the road were considered very helpful by the drivers (Charlton & Starkey, 2020). In addition, it is said that the passenger's presence contributes to safe driving, such as warning potholes on the road, warning against traffic errors made by other road user, and encouraging them to obey the speed limits. In addition, the results of mentioned studies are consistent with the results of the study by Lee and Abdel-Aty (2008), that drivers showed a lower likelihood of alcohol usage and lower speed.

Therefore, when passengers are present in a vehicle, the probability of accidents occurring and the likelihood of drivers sustaining fatal or severe injuries is significantly reduced. (Lee & Abdel-Aty, 2008).

Another positive effect of the passenger's presence on the driver's behaviors is that the drivers feel the responsibility of the passenger's life to drive more safely. For example, the results of the study conducted by Rosenbloom and Perlman (2016) indicated that it had been seen that if there are passengers in the vehicle, the tendency of drivers to commit traffic violations is less. It has been determined that drivers are more likely to wear seat belts, signal, not use mobile phones, leave sufficient follow-up distance, stop at intersections, and wait at yellow lights when passengers are in the vehicle. Especially for child passengers, regardless of the age and gender of the driver, drivers commit fewer violations and drive safer (Taubman-Ben-Ari, & Noy, 2011). This is because the driver feels the responsibility for the passenger's life. Similarly, the Fleiter, Lennon, and Watson (2010) study showed that if a passenger was familiar, drivers decreased their speeding. The drivers in the study stated that they drive more slowly because they consider passengers' safety their responsibility.

Another contribution of the presence of the passenger to driving safety is the passenger's assistance with non-driving tasks for the driver, in addition to the positive effect of the passenger's presence on the driver's behaviors, such as the passenger as mentioned earlier, warns the driver of dangerous situations that driver is not aware of or cannot see, and the driver feels the passenger's vital responsibility. For example, Stutts and colleagues (2001) reported that adjusting equipment in the vehicle is one of the most common distractions for drivers. In light of similar findings, assisting the driver with non-driving tasks such as adjusting the radio or air conditioning or answering mobile phone calls has a positive and protective effect on safe driving. In another study, the results showed that passengers could directly contribute to safe driving for drivers by adjusting the radio or air conditioning, preparing snacks, or adjusting non-critical dashboard control (Geyer & Ragland, 2004). In addition to things that can be very helpful, such as looking at the map or navigating, passengers can assist with more superficial things, such as showing an empty parking space (Charlton & Starkey, 2020).

In light of this information, the passenger's presence contributes to road safety, such as warning the driver against sudden dangers, encouraging them to follow the rules, and supporting non-driving tasks using in-vehicle equipment. In addition, the presence of passengers positively impacts driver behaviors because drivers feel the responsibility of the passengers' life on themselves.

1.2.3.3. Passenger Related Factors in Driver-Passenger Interaction

The passenger's demographics influence the relationship between the driver and the passenger. The three most popular variables in the literature used in research are the age and gender of the passenger and the number of passengers in the vehicle (Aldrige et al., 1999; Doherty, Andrey, & MacGregor, 1998). In addition, the driver's age and gender play a critical role. In particular, there appears to be variation in the impact of passenger presence on accident risk, depending on the combination between driver gender and age and passenger gender and age.

First of all, the variable related to passenger age and the studies on it are mentioned. Young drivers show riskier behaviors when they drive with their peers, while they are safe when traveling with an adult or child (Aldridge et al., 1999). In another study, consistent with the literature, the accident risk decreases when young drivers travel with adult passengers aged 21 years or older (Fu & Wilmot, 2008). In addition, the same study revealed that young drivers with young passengers aged 15 to 17 years old have the highest accident risk. For adult drivers, although traveling with passengers of the same age carries a higher risk of accidents than other age groups, traveling with passengers has a protective effect on traffic safety (Braitman, Chaudhary, & McCartt, 2014).

Secondly, the gender factor also differentiates the effect of the passenger's presence on the accident risk. For example, it can be said that females are more likely to cause an accident with a child or adult in the vehicle (Aldrige et al., 1999). This may be because mothers are responsible for their children or young females are responsible for siblings or other children. Because females, regardless of age, are more likely to be responsible for caring for younger family members than males, they may be traveling in the same vehicle more frequently. In another study for young drivers, the risk of an accident increases when drivers often travel as passengers of the same sex.

However, the male driver-male passenger match has a higher accident rate compared to the female driver-female passenger match (Fu, & Wilmot, 2008). On the contrary, there is a strong protective effect of presence of passenger when the male driver travel with female passenger (Rueda-Domingoa et al, 2004). For adult drivers, similar results can be provided that male drivers have the higher risk when traveling with male passenger (Braitman, Chaudhary, & McCartt, 2014).

Finally, the number of passengers is an important predictor for accident risk and driver behaviors. Traveling with more than one passenger carries a greater risk of accident than driving alone or traveling with a single passenger (Keall, Firth, & Patterson, 2004). Moreover, Doherty, Andrey, and MacGregor (1998) argued that the number of passengers of young or inexperienced drivers should be limited in order to prevent or reduce the distraction effect of passengers. Similarly to previous studies, Hing, Stamatiadis, and Aultman-Hall (2003) revealed that elderly drivers who aged 75 or older have a more tendency to be accident involvement when they drive with two or more passengers. The reason for this is that more passengers increase the possibility of distraction. On the contrary, the results of the study examining the relationship between the number of passengers and the driver's violations showed that the higher the number of passengers, the less likely they were to commit violations (Rosenbloom, & Perlman, 2016). In addition, proving the above mentioned, the protective effect of passengers may include performing well, for example the "audience effect" in social psychology (Zajonc, 1965). In this case, good performance will lead to safe driving. Increased passenger numbers can have an additional effect in terms of larger audience, better performance – the more passengers, the safer driving (Engström, Gregersen, Granström, & Nyberg, 2008).

1.2.3.3.1. The Type of Passenger

Whether different passenger types cause different driver behaviors is a matter of curiosity. When the literature is examined, studies have generally looked at one or most two passenger types and their effects on accidents or driver behaviors (Simons-Morton, & Ouimet, 2004; Maasalo, Lehtonen, & Summala, 2019). It stands as a gap in the literature since several passenger types are examined together, and how driver-passenger interaction changes according to different passenger types has yet to be

investigated much as far as is known. Studies conducted with different passenger types are given below in the current study.

A study by Rosenbloom and Perlman (2016) revealed that having at least one child passenger in the vehicle ensures a low percentage of violations. The same results were obtained for both male and female drivers and both young and other drivers driving with at least one child passenger. In addition, as evidence of the results of the study as mentioned earlier, the study conducted by Taubman-Ben-Ari and Noy (2011) examined how parenthood changed driver behaviors and found that there was an increase in negative behaviors such as a decrease in speeding and an increase in positive ones. Unlike these findings, studies also state that child passenger has adverse effects (Aldrige et al., 1999; Maasalo, Lehtonen, Pekkanen, & Summala, 2016). For example, in one study, female drivers tend to have accident involvement over male drivers when driving with small children, especially 0-4 years. This may be because mothers may be more sensitive to their children due to hormonal changes or lack of sleep (Henry & Sherwin, 2012) and may be more prone to distraction (Koppel et al., 2011; Stutts et al., 2005). In another study, drivers traveling with children reported more distraction; on the other hand, it has been observed that the risky behaviors they show in the traffic environment are less compared to the drivers without children (Maasalo, Lehtonen, & Summala, 2019).

In light of these findings, child passengers have both positive and negative effects. In other words, it has been determined that child passengers reduce the risk of accidents by reducing aberrant driver behaviors and increase the risk of accidents by causing distraction. This is because drivers with child passengers, regardless of whether they are their own children or another child, can be deduced that they use less risk because they feel the responsibility for the children's lives.

There are also studies on drivers driving with their parents. For example, when the speed behaviors of the drivers with a parent as a passenger and a friend as a passenger and those without passengers are compared, it is seen that the drivers who drive with their parents show less speed limit exceeding behavior than the drivers who drive with a friend or alone (Arnett, Offer, & Fine, 1997). In addition, a parent's presence prevents adolescents from reckless driving (Arnett, Offer, & Fine, 1997). In addition, graduated

driver licensing (GDL) is enacted as law in many countries, such as the U.S.A., Canada, Australia, New Zealand, and some European countries. With the GDL, novice and young drivers often drive with their parents rather than driving alone. The findings of the study conducted by Hartos, Eitel, Haynie, and Simons-Morton (2000) indicated that driving with a parent reduces the risk of accidents and violations. In addition, while novice drivers perform riskier behaviors in the first months of their license, these behaviors decrease slightly over time (Simons-Morton, & Ouimet, 2006). The classical learning curves can elucidate the phenomenon typically observed in complex behaviors. At the outset, the error detection rate is notably high, though it tends to decrease over time. However, since the consequences of a mistake made in traffic can be more severe than any learning behavior, novice drivers should be on the road with their parents (Goodwin, Waller, Foss, & Margolis, 2006). To our knowledge, very few studies are in the literature on driver behaviors when parents are passengers. However, studies generally focus on parents' role in young drivers' driving education. (Simons-Morton, 2007; Simons-Morton, Ouimet, & Catalano, 2008; Mirman, & Kay, 2012).

As another operational definition, it can be assumed that young drivers are usually the parents when driving with an adult passenger. Young drivers are less likely to have accidents and near misses and to display less risky driver behaviors with adult passengers than when they drive alone or when their peers accompany them as passengers. Based on this assumption, it can be said that young drivers show safer driver behaviors with a parent as a passenger (Simons-Morton et al., 2011; Ouimet et al., 2010). One reason could be that parents or adult passengers can encourage young drivers to practice safer driving habits, limit distraction by handling in-car technology, and offer helpful tips for safer driving.

Another passenger type mentioned in the current study is the spouse/lover/partner. As far as we know, the number of studies on this passenger type is minimal. For example, Dillon and Dunn (2005) conducted a study with fifty-seven couples. Participants consisted of male drivers and female passengers, and most stated that they had been together for more than five years and had a driver's license for more than ten years. It was discovered in this study that the more reckless the drivers were, the more their significant others (spouses) grumbled about their driving habits. However, passengers and drivers agreed that the more the passenger complains, the more negatively the

driver is affected. Eagly and Steffen (1986) revealed that male drivers predict risky situations in traffic less accurately than female drivers. Therefore, while male drivers do not think there is a problem, their driving is negatively affected when criticized (Dillon & Dunn, 2005). In other words, the fear of being criticized negatively affected drivers. In addition, while the passengers stated that they do not perceive drivers' driving skills as bad even if the driver displays risky behaviors, they also stated that they feel less safe. Moreover, it has been found that whether the passenger has had a traffic accident before is a good predictor of the complaint level.

Nakawaga and Park (2014b) conducted another study to create a measurement scale for married couples. A scale with twenty-six items and five factors with high internal consistency was developed. The presence of passengers was found to correlate with higher accident risk, specifically concerning psychological factors such as "Pique," "Flattery, vanity, overdependence," and "Annoyance." On the other hand, two other psychological factors, like "Relief (the driver was more calm, relaxed, and alert with the passenger)" and "Responsibility (the driver feels a sense of responsibility for passengers' lives)," comprised the relationship between reckless driving and the presence of a passenger. Although this study does not find how often the five psychological factors occur in drivers, there are no results on their effects on traffic safety.

In addition to passenger types such as spouse, child/baby, and parent, there are some studies on how drivers behave when they travel with their friends as passengers. Simons-Morton et al. (2011) found that teenage drivers tend to have accident involvement when driving with risky friends as a passenger. The observed behavior may be attributed to indirect peer pressure, stemming from a desire to gain acceptance within a given social environment and impress one's peers. (Scott-Parker et al., 2009; Rimal & Real, 2005). In addition, young drivers aged 16-18 years old are more easily distracted than adult drivers aged 25-66 years old, and it has been found that their following distance and vehicle control skills are weaker than older drivers (Greenberg et al., 2003). Therefore, young drivers are at a higher risk of accidents than adult drivers when their friends are in the vehicle as passengers (Zhang, Mehrotra, & Roberts, 2019).

Finally, it is feasible to engage in a collaborative commute with colleagues and establish a driver-passenger dynamic that is work-related in nature. For example, Hu, Xie, Han, and Ma (2012) conducted a study to investigate the effect of passengers on aggressive driver behaviors. They compared the differences between driving with supervisors and friends. In that study, the operational definition of supervisor was "someone that has an officially higher rank than the person and usually takes direct or indirect supervising responsibility on the person, mostly in working settings" (Hu, Xie, Han, & Ma, 2012). The finding revealed that drivers show more aggressive driver behaviors when they travel with friends, whereas they drive less aggressively with a supervisor. Interestingly, the opposite results were obtained when the same study was repeated by manipulating the drivers. It was found that when the supervisory passenger encouraging aggressive behaviors and a friend prioritizing safe behaviors are identified for manipulation, drivers show less aggressive driver behaviors than when traveling with friends (Hu, Xie, Han, & Ma, 2012). In light of the findings of this study, it can be inferred that drivers' behaviors change according to how they perceive the presence of passengers rather than the actual presence of passengers. It is recommended to consider the influence of social factors on driver behavior in order to understand their impact better. The audience effect, which has been studied for years in social psychology, wants to say precisely this. According to the audience effect, their behaviors and performance change when people think they are being observed or watched (Hamilton & Lind, 2016). Considering the driving context, drivers may change driver behaviors by thinking they are being watched by passengers (Cantin, Lavallière, Simoneau, & Teasdale, 2009).

1.2.3.4. The Relationship between Driver Behaviors and Driver-Passenger Interaction

The presence of the passenger, in other words, the presence of an audience, must be taken into account, which can affect human factors in driving. People may show different social behaviors, especially when they think someone is watching them (Camilleri & Kozak, 2022). Considering that the driving environment is a social environment observed or watched by the passenger, the passenger affects the driver's behaviors. Based on this observation, the current study is aligned with its intended objectives.

Most studies are based on accident reports and datasets rather than variables such as driver behavior, road traffic safety, and driver skills (Doherty, Andrey, & MacGregor, 1998; Vollrath, Meilinger, & Krüger, 2002; Engström, Gregersen, Granström, Nyberg, 2008). For example, young drivers are likelier to engage in accidents when they have passengers in the car. On the other hand, older drivers may observe a decline in accident incidents when companions accompany them (Rueda-Domingo et al., 2004). In addition, according to studies conducted on road safety, drivers tend to exhibit a higher level of caution and adhere to traffic rules more strictly when passengers are on board (Rosenbloom & Perlman, 2016). Due to the lack of available information, it is currently impossible to obtain specific details regarding the potential impact of the passenger on the driver during the accident. Additionally, the extent to which the passenger may have contributed or the type of effect they had on the overall outcome remains unknown. It is of utmost importance to conduct a thorough analysis of the psychological impact that the presence of a passenger may have on the driver during travel or risky situations. Such an examination in the present study is essential in filling the gap in the existing literature.

In the present study, driver behaviors were investigated concerning driver-passenger interaction. Many studies demonstrated a relationship between driver behaviors and the presence of passengers (Lee & Abdel-Aty, 2008; Rosenbloom & Perlman, 2016; Vollrath, Meilinger, & Krüger, 2002). Moreover, it has been found by many studies in the literature that the presence of the passenger sometimes has a positive and sometimes a negative effect on driver behaviors and the risk of accident involvement (Rueda-Domingo et al., 2004; Simons-Morton et al., 2011). However, the underlying reason for these contradictory findings is that the psychological mechanism of the passenger's presence on drivers has not yet been fully resolved (Nakawaga & Park, 2014a). It seems that a passenger's presence could affect how the driver perceives them and the interactions between them (Hu, Xie, Han, & Ma, 2012). The present study aimed to determine the types of interaction between drivers and passengers, as there is limited information on this topic. Additionally, the study investigated how these interactions affect the driver's behavior.

1.3. The Aim of the Study

As mentioned in the previous sections, a review of the previous studies showed that the content and nature of driver-passenger interactions in a vehicular setting need a more detailed understanding; additional data and research are required to achieve a more comprehensive understanding of this subject. With the current study, this lack of focus in the literature was aimed to be completed with the investigation of driver-passenger interaction in terms of its content, factors, and in relation to the related concepts and variables. In light of this aim, one of the main goals of the study was to develop a valid and reliable measurement tool for driver-passenger interaction for the first time in the literature.

In addition to the aim of understanding the concept of driver-passenger interaction in detail with the newly developed questionnaire to measure it, the present study also aimed to test this concept's relationships with the driving-related basic variables and driver behaviors as one of the most critical factors in road safety. With its mentioned aims, the study would have the potential to contribute to the literature in understanding driver-passenger dynamics, the relationship between the driver-passenger interaction and driver behaviors, and help us develop more effective road safety strategies in the future.

CHAPTER II

STUDY 1:

DEVELOPMENT OF THE “THE DRIVER-PASSENGER INTERACTION QUESTIONNAIRE (DPIQ)”

2.1. Introduction

Most of the research that have delved into the dynamics of the relationship between the driver and passenger have relied heavily on accident reports as their primary source of information. (Vollrath, Meilinger, & Krüger, 2002; Rueda-Domingo et al., 2004; Preusser, Ferguson, & Williams, 1998; Braitman, Chaudhary, & McCartt, 2014; Doherty, Andrey, & MacGregor, 1998; Geyer, & Ragland, 2004). In the previous research, there was a primary emphasis on determining the correlation between passenger presence or absence during a trip and the likelihood of accident involvement. While there were mentions of both positive and negative effects, a thorough examination of these effects was not conducted. It is vital to fully comprehend the implications of these findings, as there was insufficient information available about the nature of the interaction between the driver and the passenger.

Results of the few previous studies focus on how the passengers' existence in the car affects the driver's behavior (e.g., Fleiter, Lennon, & Watson, 2010; Hu, Xie, Han, & Ma, 2012; McEvoy, Stevenson, & Woodward, 2007). For example, data was collected through focus groups and interviews in a study examining the social effects of driving speed decision-making (Fleiter, Lennon, & Watson, 2010). In another study, data were collected by interviewing the survivors hospitalized after the accident to examine the effect of using mobile phones while driving and carrying passengers on the risk of an accident (McEvoy, Stevenson, & Woodward, 2007). The previous studies primarily

rely on qualitative data, highlighting the necessity for a scale to measure the driver-passenger interaction and sub-concepts.

It is observed that studies on the effects of passenger presence generally focus on accident reports. In contrast, studies focusing on the impact of passenger presence on driver behavior or traffic safety typically use qualitative data methods and remain in a narrow perspective. In this context, it is seen as a need to develop a quantitative measurement to measure the effect of driver-passenger interaction on road safety and driver behavior from a general perspective. Therefore, the Driver-Passenger Interaction Questionnaire was developed within the scope of the current study, aiming to obtain more detailed information about the driver-passenger interaction in the vehicle. The aim of the current research was to conduct a series of semi-structured interviews with drivers while developing the scale to gain a deeper understanding of the dynamics involved in driver-passenger interaction. This approach was chosen to obtain rich and detailed data that can shed light on the various factors that impact the quality of the interaction between drivers and their passengers. This study aims to pinpoint crucial areas that require improvement, enhancing the overall experience for drivers and passengers.

2.2. Method

2.2.1. Participants

A comprehensive data set was collected through an interview involving 17 participants. Among these individuals, there were 10 females and 7 males who generously shared their valuable insights and perspectives. The range of ages among the individuals who participated in the study varied between 24 and 63 ($M = 35.88$, $SD = 11.54$). Based on the data gathered from the interviews, it was found that each participant was a frequent driver, engaging in driving activities daily or at least three to four times every week. The annual kilometres range changed between 1,000 and 12,000 ($M = 5,688.24$, $SD = 3,523.47$). In addition, the range of the number of years of having a driving license was between 5 and 42 ($M = 16.12$, $SD = 10.95$). The descriptive statistics of interview participants mentioned above in the current study could be seen in Table 1.

Table 1. Descriptive Statistics of Interview Participants (N = 17)

	Minimum	Maximum	Mean	SD
Age	24	63	35.88	11.54
Driving experience (years)	5	42	16.12	10.95
Annual mileage (km)	1000	12000	5,688.24	3,523.47

2.2.2. Procedures

Ethical permission was taken from the Middle East Technical University Human Subjects Ethics Committee (HSEC, see Appendix F) to conduct interviews. The collection of data took place in January in the year 2022. This information is precise and accurate, clearly understanding when the data was obtained for any further analysis or reference. For the study, individuals were chosen using the convenience sampling method, which selects people who are readily accessible and available. It is important to note that participation in the study was entirely voluntary, with no pressure or coercion exerted on potential participants to take part. As outlined in Appendix G, the semi-structured interviews were carried out over the phone with the utmost care and attention to detail. Before the interviews, all participants were fully informed of the study's purpose and objectives and were allowed to provide explicit consent. This approach ensured that all interviewees felt comfortable and confident sharing their valuable insights and perspectives throughout the study.

2.2.3. Measures

To ensure important information was captured, a semi-structured interview was conducted. The initial section of the interview form consisted of questions regarding the respondent's demographic information, such as gender, age, years of driving experience, and annual mileage. Additionally, ten open-ended questions were included to identify the different aspects of driver-passenger interaction. The questions cover topics like how passengers affect a driver's behavior and skills, the different types of interactions between drivers and passengers, and how passengers of different types

impact driver behavior and skills. For example, "When you consider your travels with a passenger in the vehicle, how do you believe the passenger typically impacts the driver's behaviors?" was asked. To better understand the different aspects of driver-passenger interaction, the goal is to gather specific details on how having a passenger can positively impact road safety and driving. These details include how a passenger can assist with non-driving tasks (such as operating in-vehicle equipment and answering calls for the driver), alerting the driver to potential dangers, and making the driver feel more responsible for safe driving. For example, "Did the passenger's presence in the vehicle alter your perception of potential risks and hazards? If yes, please explain how it affected your perception." was asked. The goal is to gather comprehensive details about the negative impacts that passengers may have on drivers, such as distractions, mental overload, or the fear of being judged for their driving style. For example, "Are you worried about facing criticism for driving when you have a passenger in your vehicle? If so, where do you anticipate this criticism coming from, and how does it impact your driving behavior?" was asked.

2.3. Results

In order to perform a thorough evaluation, qualitative research methods were employed to carry out a meticulous content analysis on every single response obtained. This approach allowed for a comprehensive examination of the data gathered, ensuring a comprehensive and insightful analysis. The following sections contain information on interview questions, participant answers, and the frequency of those answers.

Question 1: *"When you consider your travels with a passenger in the vehicle, how do you believe the passenger typically impacts the driver's behaviors?"*

The responses by the participants to the inquiry were categorized into four sections as 1) drive more carefully with a passenger in the vehicle ($N = 7$), 2) drive more comfortably alone ($N = 3$), 3) presence of the passenger has no effect unless the passenger interacts ($N = 2$), and 4) distracted if interacting with the passenger ($N = 5$).

Question 2: *"When considering your experiences driving with a passenger in the vehicle, how do you believe the presence of the passenger impacts your driving abilities?"*

The responses by the participants to the inquiry were categorized into three sections as 1) driving is adversely affected when the passenger interacts ($N=8$), 2) no effect ($N=2$), and 3) driving is positively affected when the passenger interacts ($N=7$).

Question 3: *"When accompanying a passenger during travel, what type of communication do you engage in with them?"*

The responses by the participants to the inquiry were categorized into three sections as 1) a conversation with the passenger ($N=12$), 2) listening to a piece of music with the passenger ($N=2$), and 3) physical interaction with the passenger ($N=3$).

Question 4: *"Can the presence of different passengers, such as friends or parents, impact your driving skills and abilities? If so, how?"*

The responses by the participants to the inquiry were categorized into three sections as 1) no effect ($N=2$), 2) driving more carefully if vulnerable passenger (such as unhealthy, disabled, elderly, or baby) ($N=8$), and 3) driving more carefully if a passenger is familiar ($N=7$).

Question 5: *"Can having a passenger in the car assist you with non-driving activities such as using vehicle equipment, snacking, or answering phone calls? If so, in what ways?"*

The responses by the participants to the inquiry were categorized into four sections as 1) assisting in finding an address or using navigation ($N=4$), 2) assisting with eating snacks and drinking, including tea and coffee ($N=2$), 3) Assisting with mobile phone use ($N=4$), 4) assisting in adjusting the radio's settings ($N=7$).

Question 6: *"Did the passenger's presence in the vehicle alter your perception of potential risks and hazards? If yes, please explain how it affected your perception."*

The responses by the participants to the inquiry were categorized into two sections as 1) the proactive contribution of the passenger in cases of sleeplessness or distraction ($N=11$), and 2) hindering the ability to identify and assess potential hazards due to interactions with a passenger ($N=6$).

Question 7: *“Do you feel a sense of responsibility for the safety of the passengers in your vehicle?”*

According to all the participants, ensuring the passenger's safety is their responsibility. This sense of responsibility has been found to impact three distinct ways; 1) driving more carefully ($N = 7$), 2) no difference ($N = 2$), and 3) anxious driving ($N = 8$).

Question 8: *“How does having a passenger in your vehicle affect your level of attention while driving?”*

The responses by the participants to the inquiry were categorized into three sections as 1) driving more carefully due to the proactive contribution of passengers and to provide their safety, or if there are vulnerable passengers in the vehicle ($N = 5$), 2) no effect ($N = 2$), and distracted driving due to the passenger's constant intervention in driving-related situations, or interaction with passenger such as chatting, or dispute ($N = 10$).

Question 9: *“Does traveling with a passenger impact your mental state? If so, how?”*

The responses by the participants to the inquiry were categorized into two sections as 1) no effect ($N = 7$), and 2) adverse effects of situations like passengers talking excessively or discussing important issues with the driver, as well as driver-passenger arguments ($N = 10$).

Question 10: *“Are you worried about facing criticism for driving when you have a passenger in your vehicle? If so, where do you anticipate this criticism coming from, and how does it impact your driving behavior?”*

The responses by the participants to the inquiry were categorized into two sections as 1) Yes, avoiding receiving negative criticism, such as a novice driver or not having good driving skills ($N = 10$), and 2) No, not afraid of being criticized because of trusting driver skills and driving carefully ($N = 7$).

2.3.1. Evaluation of Interview Results and Development of “Driver-Passenger Interaction Questionnaire (DPIQ)”

Based on semi-structured interviews, the DPIQ was developed to facilitate new studies and to gain deeper insights into the interaction between drivers and passengers. In the realm of traffic environments, the interaction between drivers and passengers has been a topic of interest for some time. However, until recently, there had been no existing scale available to measure this interaction accurately. As a result, this is the first attempt to gain a deeper understanding of the dynamics between drivers and passengers in such settings.

According to the findings of Study 1's interviews, drivers' perceptions of their passengers can vary depending on the level of interaction between them, sometimes resulting in a positive perception and other times in a negative one. Many of the interviewed individuals reported that a driver's behavior is not influenced by the presence or absence of a passenger unless the passenger engages with them. Nevertheless, it has been noted that passenger interaction can lead to adverse outcomes such as distraction or mental strain. On the contrary, most participants stated that with the proactive involvement of the passenger in driver-passenger interaction, driving becomes a positive experience. For example, passengers can also benefit from improved driving safety through assistance with non-driving tasks and alerts to potential dangers the driver may not have noticed. It is essential to recognize that how a driver interacts with their passenger can differ depending on the person they are traveling with. Interviews have shown that when driving with vulnerable passengers like the unwell, elderly, or baby, drivers tend to be more cautious and prioritize safety. Those who feel responsible for their passengers tend to exhibit safer driving habits and less risky behavior when carrying vulnerable or familiar passengers.

Before analyzing the interview results, in order to identify potential items for the DPIQ, a literature review was conducted to form the dynamics of traveling with passengers. The review focused on exploring the interactions between drivers and passengers and examining the tools available for measuring these interactions. A comprehensive literature analysis examined the relationship between the driver and the passenger. Qualitative data collection tools were also reviewed, and the items

related to driver-passenger in-vehicle interaction were adapted accordingly. Additionally, the outcomes of the interview were evaluated and analyzed in detail. In the final phase, theoretical dimensions for the newly developed questionnaire were determined with its six sub-dimensions and 49 items. The names of the dimensions were “Passenger’s Assistance with Non-Driving Tasks”, “Proactive Contribution of Passenger”, “The Sense of Responsibility”, “Distraction”, “Mental Overload”, and “The Fear of Being Criticized”.

2.4. Discussion

Various studies have investigated the influence of passengers on accident rates (Orsi, Marchetti, Montomoli, & Morandi, 2013; Rosenbloom, & Perlman, 2016) and the potential dangers that may arise when young and elderly drivers have passengers (Toxopeus, Ramkhakawabsingh, & Trick, 2011; Sullman, 2012). The aforementioned studies carry significant weight in terms of not solely emphasizing the driver towards road safety but also highlighting the passenger's impact in traffic settings. These research efforts explore the detail of the subject matter, shedding light on various factors that contribute to ensuring a safe and secure journey for all individuals on the road. Typically, the literature concentrated on accidents as the primary outcome of the studies. It is essential to consider the connection between driver behaviors, driver skills, positive driver behaviors, safe driving, and the presence of passengers (Goralzik, & Vollrath, 2017; Gheorghiu, Delhomme, & Felonneau, 2015; Zhang, Mehrotra, & Roberts, 2019; Charlton, & Starkey, 2020). The current study provides a valuable addition to the existing literature by investigating the correlation between passenger and driver behaviors.

It has been noted that most studies conducted in this area have solely concentrated on investigating the effects of the driver's presence or absence (Behnood, & Mannering, 2017; Braitman, Chaudhary, & McCartt, 2014; Lee, & Abdel-Aty, 2008). However, conducting more extensive research is vital to understand better the various factors that can impact driving behavior and safety. It is more significant for the driver to perceive the presence of their passenger and interact with them, rather than just their physical presence or absence. During interviews, drivers reported that they tend to drive more cautiously and attentively when the passenger is familiar with them.

According to a study in literature, the relationship of intimacy between a driver and passenger can improve driving safety (Fleiter, Lennon, & Watson, 2010). This implies that the connection between the driver and the passenger plays a significant role in ensuring road safety, regardless of whether the passenger is present. The current study highlights the importance of focusing on the interaction between the driver and passenger rather than just the passenger's presence. Furthermore, a measuring tool has been created to measure this interaction.

Upon examining the literature, it was evident that studies which explore the correlation between drivers and passengers predominantly employ qualitative research methods (e.g., McEvoy, Stevenson, & Wookward, 2007; Hu, Xie, Han, and Ma, 2012). The dynamics between drivers and passengers in a transportation setting is something critical and in order to fill the gap in the literature, a qualitative study must be conducted to explore how drivers and passengers interact and relate to each other. Developing a Driver-Passenger Interaction Questionnaire (DPIQ) represents a valuable contribution to the literature in this area.

The insights gathered from interviews and the development of the DPIQ tool will provide valuable information for future studies on driver-passenger interactions. The development of the DPIQ tool is an important step forward in studying driver-passenger interactions. The tool provides a way to measure the quality of driver-passenger interactions. This will allow researchers to understand better the factors that contribute to positive and negative interactions and develop interventions to improve the quality of interactions. As a result of these interviews, the DPIQ is developed, and the aforementioned goals are tried to be achieved. The current study's interviews and the DPIQ will offer initial information for future research, building on the discoveries and advancements made thus far. The statement suggests that exploring the aforementioned potential can lead to significant advancements in various fields of study from a theoretical and practical standpoint. The insights gained can be used to enhance existing knowledge and develop new approaches to ongoing challenges. This highlights the importance of continued research and exploration to further our understanding of complex topics.

CHAPTER III

MAIN STUDY:

DETERMINING THE FACTOR STRUCTURE OF THE DRIVER-PASSENGER INTERACTION QUESTIONNAIRE AND INVESTIGATING THE RELATION WITH DRIVER BEHAVIORS

3.1. Introduction

As stated in previous chapters, the driver-passenger interaction pertains to how the driver and passenger engage with each other while traveling together in a vehicle. This aspect of transportation can significantly impact the driver's behavior and the road users' safety. The presence of a passenger in a car can impact the driver's behavior. This is because the passenger can act as a form of social monitoring, influencing how the driver conforms to social norms and expectations (Camilleri & Kozak, 2022). In some cases, the passenger can distract the driver or criticize, increasing the risk of an accident (Hu, Xie, Han, & Ma, 2012). In some cases, a passenger's behavior can lead a driver to become more aggressive (Hu, Xie, Han, & Ma, 2012) or distracted (Sullman, 2012). Criticizing the driver excessively can also increase the risk of dangerous driving (Dillon & Dunn, 2005). Passengers have traditionally been thought to have a negative impact on drivers, but related studies have shown that driving with a passenger can actually reduce the risk of a crash (Rueda-Domingo et al., 2004). While passengers can sometimes be a distraction, research has shown that they can also help drivers stay focused and make better decisions (Charlton & Starkey, 2020). A passenger's presence can help reduce driver fatigue and stress, leading to safer driving (Geyer & Ragland, 2004). Passengers can also help to remind drivers to obey traffic laws and drive safely (Rosenbloom & Perlman, 2016). Basically, the driver-passenger interaction is heavily influenced by the drivers' perceptions of their passengers. These perceptions can result in a range of outcomes, either positive or

negative in nature. In the scope of the current study, a detailed examination of the concept of driver-passenger interaction will contribute to the literature.

The literature has previously examined the relationships between driver-passenger interaction and driver behavior. Additionally, no tool is currently available to measure driver-passenger interaction in this field. One of the objectives of this study is to form a questionnaire that evaluates driver-passenger interaction. This study thoroughly examines the concept of driver-passenger interaction and breaks it down into sub-concepts. Within this scope, one of the main objectives of this study is to examine the relationship between driver-passenger interaction and driver behaviors. Developing the driver-passenger interaction questionnaire and examining the relationship between driver behaviors contribute to the literature. This is because the concept of driver-passenger interaction is being studied for the first time. This will be a pioneering study for future studies.

To sum up, the importance of the driver-passenger interaction and the need to define and understand the concept has been discussed in the previous chapter. Study-I was conducted in order to develop a questionnaire to understand the nature of the concept, and a theoretical dimensionality was formed. The factor structure of the developed questionnaire and the relationships stated in the primary purpose should be tested in a main study.

3.2. Method

3.2.1. Participants

The current study consisted of 317 participants, 163 of whom were female (51.4%) and 154 of whom were male (48.6%). The age range of the participants changed between 19 and 70 ($M = 33.28$, $SD = 9.32$). Even though they had different education levels, two of them were in intermediate school (0.6%), 21 of them were in high school (6.6%), 17 of them were college graduates (5.4%), 176 of them were university graduate (55.5%), and 101 of them were postgraduate; master's degree or doctoral degree (31.9 %), all participants had a driving license for at least a year. The range of the number of years of having a driving license was between 1 and 50 ($M = 10.86$, $SD = 8.78$). The range of annual km/h was from 100 to 110,000 km/h ($M = 10,178.55$, $SD = 13,760.29$), while the range for lifetime kilometers was from 100 to

3,000,000 ($M = 133,294.80$, $SD = 307,447.77$). The descriptive statistics of the demographic characteristics of participants can be seen in Table 2.

Reports showed that 206 participants drive nearly every day (65%), 68 of them drove 1 or 2 times in a week (21.5%), 25 of them drove 1 or 2 times in a month (7.9%), 16 of them drove in few times in a year (5%), and 2 of them drove rarely or almost never (0.6%). Moreover, the majority of them actively drove almost every day ($M = 4.45$, $SD = .89$). In addition, only 4 out of 317 participants reported that they drove professionally. These usually include taxis or heavy vehicles such as trucks or pickup truck. Moreover, while 97 participants (30.6%) stated that they had an active accident, 87 (27.4%) stated that they had a passive accident at least once in the last three years. In addition, 55 of the 97 drivers (56.7%) who had an active accident stated that they were alone when they had an accident, while 42 of them (43.3%) stated that they were passengers in the car. On the other hand, 45 of the 87 participants (51.7%) who had passive accidents stated that they were alone when they had an accident, whereas 42 of them (48.3%) stated that they were passengers in the vehicle. The range of active accidents was between 1 and 10 ($M = 1.84$, $SD = 1.52$), while the range of passive accidents was between 1 and 5 ($M = 1.45$, $SD = .78$).

Table 2. The Descriptive Statistics of the Demographic Characteristics of Participants

	Minimum	Maximum	Mean	SD
Age	19	70	33.28	9.32
Driving experience (years)	1	50	10.86	8.78
Annual mileage (km)	100	110,000	10,178.55	13,760.29
Lifetime mileage (km)	100	3,000,000	133,294.80	307,447.77

Finally, 126 (39.7%) stated that they had received at least one type of ticket, such as drunk driving, red light violations, speeding, seat belt violations, and any other type. When examining the most common type of tickets, it was determined that 65.9% of those reported receiving traffic fines due to speeding ($N = 83$), 13.5% of participants

stated received red light violations ($N = 17$), 18.3% of participants ($N = 23$) reported they received any other type of tickets such as talking on the phone while driving, incorrect overtaking, wrong turn, lane violations, parking ticket, entering the opposite direction. In addition, among those who received a traffic ticket, 58 participants (46%) reported that they traveled with a passenger. In comparison, 68 participants (54%) reported traveling alone.

3.2.2. Procedures

Before data collection, ethical permission was taken from the Middle East Technical University Human Subjects Ethics Committee (HSEC, see Appendix C). Data were collected by using the convenience sampling method, often preferred because it is easy accessibility to the participants for the researcher. All questionnaires were prepared on an internet-based site, and online data was collected via Qualtrics online research software (www.qualtrics.com). With the link created through the online research platform, Qualtrics, the questionnaires were distributed to the participants via e-mail or social media such as Facebook, Twitter, and Instagram. In addition, the Sona System, a participant pool system used by the Middle East Technical University Department of Psychology Department, was also used for data collection.

All participants were given informed consent (see Appendix D) and were informed about the purpose of the study and the people from whom they could obtain information about the survey. Participation in the study was entirely voluntary, and all participants were informed that they had the right to withdraw from the study whenever they wanted or felt uncomfortable. In addition, it was ensured that the information of the participants would be kept confidential and anonymous and that the data would only be used for scientific purposes.

3.2.3. Measures

In the present study, five instruments were used. These were the Demographic Information Form, the Passenger Information Form (PIF), the Driver-Passenger Interaction Questionnaire (DPIQ), the Driver Behavior Questionnaire (DBQ), and the Driver Skill Inventory (DSI).

3.2.3.1. The Demographic Information Form

Participants were asked to complete a demographic information form (see Appendix E). It consisted of questions about age, sex, level of education, the number of years having a driving license, the number of years the vehicle was used, annual km, and lifetime km. Moreover, the number of active accidents (e.g., hitting another road user), the number of passive accidents (e.g., being hit by another road user), and the number of tickets and the types of tickets in the last three years were inquired of participants. For these three questions, the participants were asked whether they were passenger/s in the vehicle at that time, if they had an active/passive accident, or received a penalty.

3.2.3.2. The Passenger Information Form (PIF)

The PIF was created to obtain information such as the presence or absence of the passenger in the vehicle and the demographic of the passenger (see Appendix F). This form included eight questions. First, a small matrix consisting of three items was asked to detect the passenger's presence in the vehicle. For the first question, the participants answered the phrase "Considering the last six months, please indicate how often you have experienced the following situations while driving." by using a 6-point Likert type (1 = Never, 2 = Once in six months, 3 = Once a month, 4 = Semimonthly, 5 = Once a week, 6 = Every day). The items of the question are as follows:

- I am alone in the car.
- I have a passenger with me.
- I have more than one passenger with me.

Those who marked "Every day" in the item "I am alone in the car" and/or those who marked "Never" in the item "I have one or more than one passenger with me" were considered a driver without a passenger.

Because the DPIQ only contains questions about drivers with passengers and the other questions in the PIF include details about passengers, drivers alone were directed to complete the DBQ instead. The drivers not carrying passengers were not required to answer questions about passengers. Instead, they were asked to complete questionnaires regarding their driving behaviors and skills. All drivers whom passengers accompanied have responded to all questions.

The second question asked the participants, "When you think about the last six months, list the following passenger types according to your frequency of traveling together." Participants are expected to rank the types of passengers based on their frequency of travel, from the most traveled to the least traveled (1 = most traveled, 11 = least traveled). Passenger types were friend, parent (mother/father), sibling, spouse/lover/partner, relative, boss, coworker, elderly, child/baby, disabled, and stranger (such as hitchhiking or ridesharing). The passenger's age group (baby, child, adolescent, adult, or elderly) and gender were requested to obtain details about the most frequent traveler. Over the past six months, they have been asked to indicate the number of passengers they typically travel within their vehicle by selecting either one, two, or three or more passengers.

In order to learn whether it is a necessity or preference for drivers to travel with passengers, "Would you prefer to travel alone or with a passenger in the vehicle if given the choice?" were asked. Then, a question was asked to find out how often the driver interacts with the passenger in the car, using a 5-point Likert scale. (1 = Never, 5 = Always). Moreover, to find out if the participants have ever had an accident or near-misses due to the distraction of the passenger, "Have you ever been in an accident or almost had one when driving due to distractions caused by passengers or any passenger-related reasons?" were asked to participants. Finally, for general information, "When reflecting on the collective travels you have had with the passenger, how do you believe their presence in the vehicle influences your driving behaviors?" were asked of participants in order to learn whether the presence of passenger affects the drivers' behaviors positively or negatively according to the drivers' perception.

3.2.3.3. The Driver-Passenger Interaction Questionnaire (DPIQ)

The DPIQ (see Appendix G for the version used in the data collection process) was developed to examine the driver-passenger interaction inside the vehicle within the scope of the current study. This questionnaire aimed to obtain more detailed information about the driver-passenger interaction in the vehicle. This questionnaire consisted of 49 questions, two main dimensions (positive and negative interaction), and six sub-dimensions. These five dimensions were Passenger Assistance with Non-

Driving Tasks, Proactive Contribution of Passengers, Sense of Responsibility, Distraction, Mental Overload, and Fear of Being Criticized.

The forty-nine items were presented to the participants using a 5-point Likert type (1 = Strongly Disagree, 5 = Strongly Agree). The passenger's assistance with non-driving tasks consisted of seven items ($\alpha = .73$); for example, "When I am behind the wheel, the passenger in the car provides directions through the map, thus enhancing the safety of my driving." or "I feel safer when my passenger deals with in-vehicle equipment like the radio and air conditioning while I focus on driving." Higher scores mean that the passenger's presence contributes positively to driving by assisting with non-driving tasks. The proactive contribution of passenger dimensions included eight items ($\alpha = .85$); such as "My driving becomes safer when passengers alert me to potential dangers in traffic, and it is helpful when passengers notice and communicate potential hazards." or "If my passenger alerts me of any possible obstacles on the road, like road work or potholes, it can greatly increase safety while driving." Higher scores mean that the proactive contribution of passengers to the driver contributes positively to driving. The sense of responsibility consisted of eleven items ($\alpha = .82$): "While driving, I take care to avoid sudden braking and accelerating in order to ensure a smooth and comfortable ride for the passenger." or "As the driver, I am responsible for ensuring the safety of my passengers while they are in the vehicle." Higher scores mean the driver's sense of responsibility towards the passenger contributes positively to driving.

The distraction dimension included ten items ($\alpha = .74$); for example, "I find that singing along with a passenger in the car can be distracting for me." or "It is not safe to turn back and talk to a passenger in the rear seat while driving." Higher scores mean that the presence of passengers distracts the drivers and negatively affects driving. The mental overload dimension consisted of nine items ($\alpha = .59$), such as "I am finding it hard to concentrate on driving because I keep replaying a memory in my head where I was unhappy while talking to a passenger." or "Having a passenger in the car during heavy traffic can help promote safe driving." High scores mean that the presence of the passenger increases the mental intensity of the driver and negatively affects the driving. The fear of being criticized dimension included four items ($\alpha = .71$): "I tend to get nervous while driving if I worry that my passenger may not approve of my

driving skills." High scores mean the driver's fear of being criticized by the passenger negatively affects driving.

According to the current study, Cronbach's alphas for all dimensions were measured separately. Except for the mental overload dimension, all other dimensions had high reliability. Factor structure analysis was performed, and the statistics and results of this analysis were explained in the next section, the results section.

3.2.3.4. The Driver Behavior Questionnaire (DBQ) and the Positive Driver Behavior Scale (PDBS)

The Driver Behavior Questionnaire (DBQ) was developed by Reason and his colleagues (1990) in order to measure aberrant driver behaviors. DBQ was used by being translated to Turkish, performed factor structure by Lajunen and Özkan (2004). DBQ is a self-report questionnaire consisting of violations (ordinary and aggressive violations), errors, slips, and lapses. In the current study, the Positive Driver Behaviors Scale (PDBS), developed by Özkan and Lajunen (2005), was also used with the DBQ. PDBS aims to measure drivers' behaviors to help, pay attention and be polite to other road users in the traffic environment, regardless of safety concerns. For example, "Taking care not to limit the mobility of other road users (such as pedestrians, cyclists) while parking your vehicle" or "Be careful not to splash water and similar substances accumulated on the side of the road on pedestrians while driving your vehicle." was sample item of PDBS.

The current research included the DBQ, which comprised 28 items and used a 6-point Likert scale (1 = Never, 6 = Always). The DBQ's violations factor is divided into two categories: aggressive violations (consisting of 3 items) and ordinary violations (consisting of 9 items). For example, "Following a driver with whom you are angry in traffic and attempting to assert your dominance." can be an example of aggressive violations items, and "Drive until the last moment in a lane that will be closed on the highway." can be a considered as ordinary violations items. Moreover, there were sixteen items, with eight errors (such as While waiting in the queue to turn left from the main road, avoiding the primary road traffic, and almost colliding with the vehicle in front) and the other eight slips and lapses such as Finding yourself driving in the more familiar direction B when you intended to go in direction A.). A higher score

indicates that drivers display a more significant number of aberrant driving behaviors, such as violations, errors, and lapses. In addition, PDBS comprises 14 items that use a 6-point Likert scale (1 = Never, 6 = Always).

The original factor structure of the DBQ with positive driver behaviors was used in the current study. Reliability analysis was done for each factor and overall questionnaire. The internal consistency value for the overall DBQ was .73. The violations factor of the DBQ was highly reliable (12 items; $\alpha = .84$). The internal consistency reliability values for aggressive violations and ordinary violations were .65 and .82, respectively. In addition, errors (8 items; $\alpha = .56$) and slips and lapses (8 items; $\alpha = .70$) were also reliable. Finally, Cronbach's alpha for the internal consistency value of the PDBS was .72.

3.2.3.5. The Driver Skill Inventory (DSI)

The Driver Skill Inventory (DSI) was developed by Lajunen and Summala (1995) to measure the participants' self-reported perceptual-motor and safety skills orientations. The DSI was used by being adapted to Turkish by Sümer and Özkan (2002). The short version used in the present study contains ten items; 5 are perceptual-motor skills (such as being able to park in a narrow space while reversing the car), and 5 are safety skills (such as maintaining patience while driving behind a slow vehicle).

In the current study, participants were asked to evaluate their perceptual-motor and safety skills using a 5-point Likert scale (1 = Definitely weak, 5 = Definitely strong). Higher scores mean drivers tend to have more perceptual-motor and safety skills orientations. Reliability analysis was performed to test internal consistency for both dimensions of the DSI. The internal consistency value for the overall DSI was .66. Also, for perceptual-motor and safety skills, Cronbach's alpha scores were .80 and .65, respectively.

3.3. Results

3.3.1. General Information

For the present study, the analyses were organized into five different sections. The first section presented the process of cleaning data and the computation of the subscales.

Next, the second part included statistical information regarding the factor structure analysis of the DPIQ that was developed in this study. The section includes information on discarded items and their reasons, the formation of factor structure, and reliability analysis based on the final version. The third section presented descriptive statistics for passenger information and the study variables in the current study. Next, the correlation analyses of interested variables were discussed. Finally, in the main analyses section, Hierarchical Regression Analyses were conducted and presented to investigate the correlation between driver-passenger interaction and driver behaviors. In addition, MANCOVAs were done to examine the differentiation of driver-passenger interaction at different levels on driver behaviors. The results of these analyses were shared in the last section.

3.3.2. Data Cleaning and Computing Subscales

In order to guarantee precise results, the data was thoroughly cleaned before commencing the analysis. Those who did not fully complete the questionnaire, did not accept informed consent, voluntarily participated, or indicated that they did not have a driver's license were excluded from the data set. A total of 716 individuals were surveyed to gather the data. However, the study sample was reduced due to various reasons. Three hundred forty individuals did not complete the questionnaire, 14 declined to participate voluntarily, 17 did not possess a valid driving license, and four revealed that they drove for professional purposes. The study observed extreme values, and as a result, data from five participants were excluded because of dishonest annual and lifetime mileage information. After completing the data-cleaning process, there are now 336 participants whose data can be utilized.

In order to ensure accurate data entry, all variables' minimum and maximum values were verified. Once the process was complete, the sub-factors and dimensions of each instrument were formed by calculating the average values of each item.

3.3.3. Factor Structure of the DPIQ

In order to establish a factor structure for the newly developed DPIQ, which contains 49 items, an Exploratory Factor Analysis was conducted. This approach was necessary as no pre-existing factor structure was available for reference. The factor structure was

analyzed using the principal component analysis as the extraction method. Factor analysis was conducted using Promax with Kaiser Normalization as the rotation method, as the expected relationship between the factors was present (Tabachnick & Fidell, 2012). The sampling adequacy measure according to Kaiser-Meyer-Olkin was .84, and Bartlett's sphericity test showed significance ($X^2 = 5,385.61$, $df = 780$, $p < .001$). It can be concluded that the DPIQ consisting of 49 items is appropriate for conducting factor analysis.

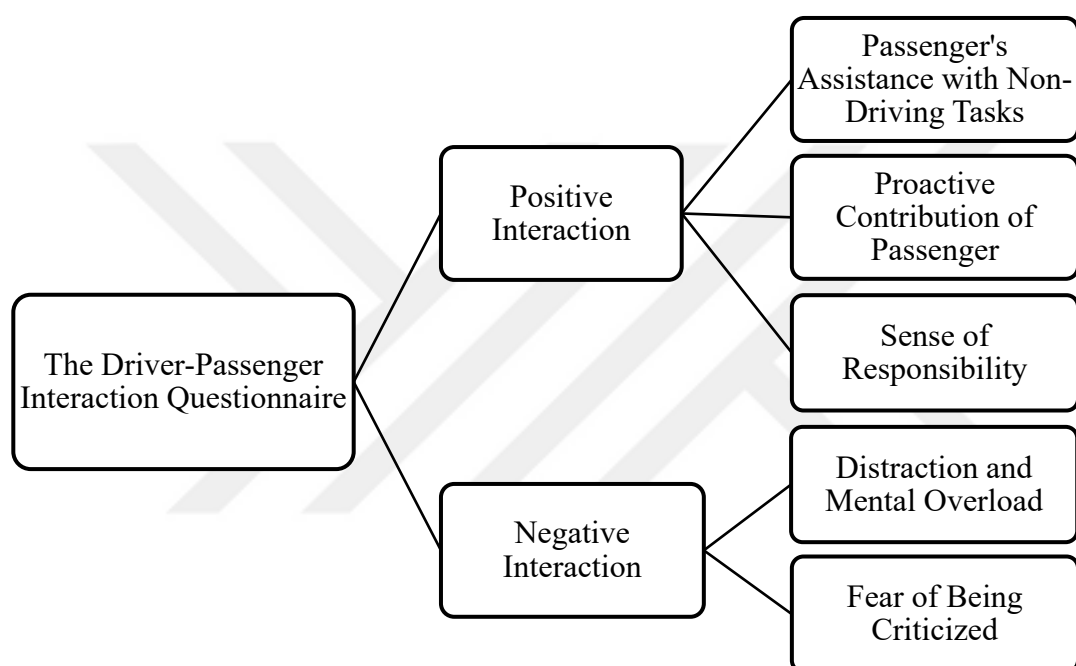


Figure 3. Dimensions of the DPIQ

The scree plot, Eigenvalues, and explained variances of the factors were first examined to determine the number of factors. It was suggested that a 12-factor structure be considered when examining the Eigenvalues. The factor analysis was repeated after discovering that some factors in the 12-factor structure model contained only one or two independent items. This time, six factors were fixed according to the conceptual framework. However, upon examining the six-factor structure, it was found that mental overload and distraction are closely related and cannot be distinguished from each other. In other words, the factor analysis merged Mental Overload and Distraction

into one factor. In this case, factor analysis indicated two items as the sixth factor; Item 12, “Traveling alone distracts me.” and Item 31, “I am a safer driver when I drive alone.” Therefore, mental overload and distraction were accepted as a single factor, and factor analysis was repeated by fixing five factors. In addition, factor loading under the cut-off of .30 was suppressed because of small coefficients to get clearer item loadings. In order to provide a visual representation of the DPIQ's factor structure, Figure 3 has been included for reference.

In total, nine items (item 9, item 10, item 12, item 13, item 28, item 31, item 33, item 39, item 46) were removed from the questionnaire (see Table 3). Two of them were excluded because they did not load any factors. In addition, four of them were eliminated because they were loaded on another factor instead of the relevant factor. In other words, they were loaded with factors that did not make sense semantically. Additionally, upon examination of the reliability analysis, it was observed that excluding these four items from the factors identified in the factor analysis resulted in a noticeable increase in the alpha coefficient values. Finally, the three items were eliminated from the questionnaire due to cross-loading. Each item in the questionnaire was reviewed separately to identify those that should be discarded and evaluate their loadings before removal.

After removing nine items with factor analysis, DPIQ comprised 40 items and five factors (see Appendix J for the DPIQ with 40 items after factor analysis). Since the items in the mental overload and distraction factors were not separated into factors, the questionnaire included five factors when these items were gathered under a single factor. Factors were named according to item loading scores and factor analysis as follows: Factor 1 was named as “Distraction and Mental Overload”; Factor 2 was named as “The Sense of Responsibility”; Factor 3 was named as “Proactive Contribution of Passenger”; Factor 4 named as “The Fear of Being Criticized”; Factor 5 named as “Passenger’s Assistance with Non-Driving Tasks.” In other words, the driver-passenger interaction was examined under three factors in the positive direction and under two factors in the negative direction. Table 4 displays the scores for the factor loading of the item.

Table 3. Items Eliminated from the DPIQ

Deleted items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
<i>Item deleted because of not being loaded to any factors</i>					
Having a passenger assist me with snacks or drinks while driving can promote safer driving.					
When I am driving alone, I tend to be a safer driver.					
<i>Item deleted because of not suitable for the content</i>					
As the driver, it is my responsibility to ensure the safety of my passengers while in the vehicle.				-.42	
When I am tired, the passenger talking to me to stay awake helps me drive safer.					.45
Traveling alone distracts me.			-.31		
It is unsafe to turn back and talk to a passenger in the back seat while driving.				.49	
<i>Item deleted for cross-loading</i>					
As a driver, it's helpful when a passenger can hand me things that are out of reach in the car, contributing to overall safety on the road.		.34			.34
In heavy traffic, the presence of the passenger contributes to my safe driving.		-.34	-.33		
When driving, it's helpful for passengers to follow the signs that indicate the table and street names for easy navigation.			.42		.41

Note. Factor loadings <.30 were suppressed.

Factor Name: Factor 1 named as “Distraction and Mental Overload”; Factor 2 named as “The Sense of Responsibility”; Factor 3 named as “Proactive Contribution of Passenger”; Factor 4 named as “The Fear of Being Criticized”; Factor 5 named as “Passenger’s Assistance with Non-Driving Tasks”.

Table 4. The Items loading of the DPIQ Based on Principal Components Factor Analysis with Promax Rotation

Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Trying to remember a memory of being unhappy while chatting with the passenger prevents me from focusing on the road.	.75				
Interacting verbally with the passenger distracts me.	.75				
While chatting with the passenger, I could not perceive the potential dangers in the flowing traffic.	.74				
Physical interaction with the passenger in the vehicle distracts me.	.74			-.31	
Talking to the passenger can distract me.	.72				
Interacting with the passenger adversely affects safe driving when the weather conditions are bad.	.66				
Trying to remember a happy moment while chatting with passenger prevents me from focusing on the road.	.64				
Verbal interaction with the passenger does not affect my driving, even if the road conditions are bad.	-.64				
Singing with the passenger in the car can distract me.	.63				
Physical interaction with the passenger does not affect my driving, even in bad weather conditions.	.63			-.33	
While driving, I may miss the road signs/signs/traffic lights, etc., while talking to the passenger.	.58				
Traveling with a passenger distracts me.	.57				
It distracts me when the passenger shows things in the external environment (people, billboards, shops, etc.) to me or others in the vehicle while traveling.	.55				
I may forget to follow the traffic rules while communicating with the passenger.	.48				
Arguing with the passenger may cause me to exceed the speed limit.	.35				
I drive more carefully when there is a passenger in the vehicle for the passenger' comfort.		.71			
I pay more attention to traffic rules when passengers are in the vehicle.		.71			
I avoid sudden braking or accelerating to prevent passengers from being disturbed while driving.		.69			
I drive safer when there are passengers in the vehicle.		.67			
I ensure that the passenger travels comfortably while driving.		.64		-.31	
I avoid tension with other drivers in traffic when passengers are in the vehicle.		.64			
When there are passengers in the vehicle, I contribute to the safer journey of the passengers by compensating for the mistakes of other drivers.		.60			

Note. Factor loadings <.30 were suppressed.

Factor Name: Factor 1 named as “Distraction and Mental Overload”; Factor 2 named as “The Sense of Responsibility”; Factor 3 named as “Proactive Contribution of Passenger”; Factor 4 named as “The Fear of Being Criticized”; Factor 5 named as “Passenger’s Assistance with Non-Driving Tasks”.

Table 4. The Items loading of the DPIQ Based on Principal Components Factor Analysis with Promax Rotation (continued)

Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
I act calmly in annoying situations in traffic so that there is no tension when there are passengers in the vehicle.		.58			
When there is a passenger in the vehicle, I avoid taking unnecessary risks for their safety.		.54		-.39	
When there is a passenger in the vehicle, I can give up my right of way in situations such as intersections and turns so that the passenger can be comfortable.		.41			
It contributes to safe driving when the passenger warns me about obstacles (road works, potholes, etc.) that may suddenly appear on the road.			.84		
The fact that the passenger sees the dangers in the traffic and warns me contributes to safer driving.			.81		
I can drive more safely if the passenger warns me about road disturbances or disruptions.			.73		
The passengers warning me that when I exceed the speed limit contributes to safe driving.			.73		
It contributes to safe driving if the passenger warns me of the presence of any living creature (human, cat, dog, etc.).			.71		
Passengers' motivation to drive more carefully contributes to my safe driving.			.61		
I rearrange my driving behaviors and preferences according to the passenger's warnings.			.50		
I take more risks while driving because I don't want the passenger to consider me a novice.				.73	
I drive faster when there are passengers because I don't want to be considered a slow driver.				.72	
The thought that the passenger will not like my driving causes me to drive nervously.				.55	
When a passenger is in the vehicle, the thought that they are watching my behavior negatively affects my driving.				.48	
While I am driving, the passenger in the vehicle gives directions using navigation, contributing to my safe driving.					.81
While driving, the passenger gives directions using the map, contributing to safe driving.					.78
It provides a safer driving environment for the passenger to deal with the setting of in-vehicle equipment (such as radio, air conditioning) for me.					.59
If my phone rings while driving, the passenger answering my phone contributes to my safe driving.					.45
Reliability	.84	.82	.86	.71	.70

Note. Factor loadings <.30 are suppressed.

Factor Name: Factor 1 named as "Distraction and Mental Overload"; Factor 2 named as "The Sense of Responsibility"; Factor 3 named as "Proactive Contribution of Passenger"; Factor 4 named as "The Fear of Being Criticized"; Factor 5 named as "Passenger's Assistance with Non-Driving Tasks".

According to the change in the questionnaire after the factor analysis, the internal consistency reliability score for the overall DPIQ was .85. Moreover, Factor 1, Distraction and Mental Overload consisted of fifteen items, and the Cronbach's alphas was .84. Factor 2, the Sense of Responsibility, included ten items and the Cronbach's alphas was .82. In addition, factor 3, Proactive Contribution of Passenger consisted of seven items, and the Cronbach's alphas was .86. Factor 4, the Fear of Being Criticized, included four items and the Cronbach's alphas was .71. Finally, Factor 5, Passenger's Assistance with Non-Driving Task, consisted of four items, and the Cronbach's alphas was .70. Table 4 displays the distribution of items based on their respective factors and internal reliability scores.

The first factor, which explained 18% of the total variance, included fifteen items, eigenvalue was 7.10, and communalities ranged from .30 to .64. The second factor, which explained 14% of the total variance, included ten items, eigenvalue was 5.53, and communalities were ranged from .30 to .54. The third factor which explained 8% of the total variance included seven items, eigenvalue was 3.01, and communalities were ranged from .36 to .74. The fourth factor which explained 5% of the total variance included four items, eigenvalue was 2.17, and communalities were ranged from .46 to .56. Finally, the fifth factor which explained 4% of the total variance included four items, eigenvalue was 1.72, and communalities were ranged from .30 to .74. The sum of the five factors explained 49% of total variance (See Table 5).

Table 5. Explained Variance, Eigenvalues, and Reliability Scores of Factors

Factors	Eigenvalues	Variance	Item	α
Mental Overload and Distraction	7.10	18%	15	.84
Sense of Responsibility	5.53	14%	10	.82
Proactive Contribution of Passenger	3.01	8%	7	.86
Fear of Being Criticized	2.17	5%	4	.71
Passenger's Assistance with Non-Driving Tasks	1.72	4%	4	.70
Total (Overall scores)		49%	40	.85

3.3.4. Descriptive Statistics of Measurements

In this section, first of all, descriptive statistics of the data collected in the Passenger Information Form (PIF), such as the number of drivers without passengers, the number of drivers with different types of passengers, demographic information of passengers, and the frequency of interaction with a passenger were mentioned. Next, descriptive statistics were provided for the DPIQ, DBQ, and DSI subscales.

3.3.4.1. Descriptive Statistics for Passenger Information

In order to examine how the driver-passenger interaction, driver behaviors, and driver skills variables differ according to different passenger types, it is necessary to group the priority drivers according to the type of passenger they travel the most frequently. Participants were asked to rank 11 different types of passengers, including friends, parents, siblings, spouses/lovers/partners, relatives, bosses, coworkers, elderly individuals, children/babies, disabled individuals, and strangers (such as those found while hitchhiking or ridesharing). The purpose of this ranking was to determine which type of passenger travels the most frequently. Out of the 336 participants, 19 were found to be traveling without any passengers. The remaining 317 participants were then surveyed to determine which type of passenger they traveled with more or less frequently. Table 6 displays the categories of passengers that were most frequently and least frequently chosen by the driver's preferences. The results showed that 90 (28.4%) of the participants stated that they traveled most frequently with their spouses/lovers/partners, 56 (17.7%) of them with their parents, 54 (17%) of them with a child/baby, 54 (17%) of them with their friends, 30 (9.5%) of them with a coworker, 20 (6.3%) of them with their boss, 9 (2.8%) of them with their sibling, 2 (0.6%) of them with their relatives, and 2 (0.6%) of them with an older person. Out of the less frequent types of passengers, it was found that 227 individuals (71.6%) shared their travel experience with a stranger, 49 (15.5%) traveled with a disabled companion, 15 (4.7%) with their boss, 9 (2.8%) with their child or baby, 8 (2.5%) with their significant other, 3 (0.9%) with their parents, 3 (0.9%) with their siblings, 2 (0.6%) with a coworker, and 1 (0.3%) with their relatives.

In order to make analyzes according to different passenger types, the passenger type variable was created. Passenger types specified in Table 6 were re-coded to be used in the analysis. Fifty-four participants coded as "1.00" for the "Friend" passenger type. There were 56 participants in the "Parent" passenger category, assigned the code "2.00". Ninety participants were categorized as "Spouse/lover/partner" passengers with a code of "3.00". As the "Boss" and "Coworker" passenger types were both work-related, they were combined into a single passenger type. This new passenger type, referred to as "Boss and Coworker," was assigned a code of "4.00" and had 50 participants. Fifty-four participants were coded as "5.00" for the "Child/baby" passenger type. The study excluded nine participants who were traveling with their siblings, two who were traveling with their relatives, and two who were traveling with older individuals. This was because the number of groups was too small compared to the others, and there were not enough individuals for analysis. A total of 13 participants were excluded as they were unsuitable for passenger-type analyses. The analysis included a total of 304 participants, comprising five different passenger types: friend, parent, spouse/lover/partner, boss and coworker, and child/baby.

Table 6. The Most and Least Traveled Passenger Types

Type of passenger	The Most		The Least	
	Frequency	Percent	Frequency	Percent
Friend	54	17%	-	-
Parent	56	17.7%	3	0.9%
Sibling	9	2.8%	3	0.9%
Spouse/lover/partner	90	28.4%	8	2.5%
Relative	2	0.6%	1	0.3%
Boss	20	6.3%	15	4.7%
Coworker	30	9.5%	2	0.6%
Elderly	2	0.6%	-	-
Child/baby	54	17%	9	2.8%
Disabled	-	-	49	15.5%
Stranger	-	-	227	71.6%
Total	317	100%	317	100%

When the age distribution of the passengers was examined, 193 (60.9%) of the participants stated that they traveled mostly with an adult passenger (25-65 years old), 47 (14.8%) of them with a young passenger (18-25 years old), 35 (11%) of them with a child passenger (6-18 years old), 29 (9.1%) of them with a baby passenger (0-6 years old), and 13 (4.1%) of them with an elderly passenger (65 years old or more). The gender distribution among the 317 passengers was nearly balanced; 165 were female, and 152 were male. In addition, 135 participants (42.6%) reported that they were traveling with two passengers, while 124 (39.1%) stated that they were traveling with one passenger. Additionally, out of the total number of participants, 58 individuals (18.3%) reported that they typically drove with three or more passengers.

Most participants ($N = 180$, 56.8%) reported that they would prefer to travel with a passenger if they had a choice, whereas others ($N = 137$, 43.2%) stated they would not. Moreover, the findings showed that when driving with someone else in the car, the participants generally engage in conversation with their passenger ($M = 3.81$, $SD = .85$). Moreover, 27 participants (8.5%) reported that the passenger had an accident due to distraction of the passenger or another reason related to the passenger. Finally, out of all the trips taken with the passenger, 237 participants (74.8%) believed that the passenger's presence positively impacted the driver's behaviors. In comparison, 80 (25.2%) thought it had a negative effect.

3.3.4.2. Descriptive Statistics of the DPIQ, DBQ, and DSI

The first measurement used in the present study is the Driver-Passenger Interaction Questionnaire (DPIQ) developed within the scope of this study. The DPIQ comprises five sub-scales; Distraction and Mental Overload, the Sense of Responsibility, the Proactive Contribution of the Passenger, the Fear of Being Criticized, and the Passenger's Assistance with Non-Driving Tasks. The second instrument was the DBQ with Positive Driver Behavior Scale. This instrument consisted of five sub-scales: Aggressive Violations, Ordinary Violations, Errors, Slips and Lapses, and Positive Driver Behaviors. The last scale used in the current study was the DSI, which evaluated two sub-scales: Perceptual-Motor Skills and Safety Skills. All sub-scale scores were calculated and reported in Table 7. In addition, means, standard deviations, minimum and maximum values, the total number of participants, the number of items of sub-

scales, and Cronbach's alphas for internal consistency scores for the sub-scales can be seen in Table 7.

Table 7. Descriptive Statistics of Sub-Dimensions

Study Variables	<i>N</i>	Mean	<i>SD</i>	Minimum	Maximum	Item Number	α
DPIQ							
Distraction	304	2.81	.60	1.27	4.47	15	.84
Sense of Resp.	304	3.72	.60	1.80	5.00	10	.82
Proactive	304	3.41	.86	1.00	5.00	7	.86
Fear of Cri.	304	2.07	.74	1.00	4.25	4	.71
Assistance	304	3.73	.72	2.00	5.00	4	.70
DBQ							
Agg_vio	304	2.23	.87	1.00	5.00	3	.65
Ord_vio	304	1.89	.60	1.00	3.89	9	.82
Errors	304	1.64	.45	1.00	3.00	8	.56
Lapses	304	1.69	.41	1.00	3.00	8	.70
Pos. Dri. Beh.	304	4.43	.57	2.79	5.79	14	.72
DSI							
PMS	304	3.94	.68	2.40	5.00	5	.80
SS	304	3.99	.55	2.60	5.00	5	.65

Note: Distraction = distraction and mental overload, Sense of Resp. = the sense of responsibility, Proactive = proactive contribution of passenger, Fear of Cri. = the fear of being criticized, Assistance = passenger's assistance with non-driving tasks, Agg_vio = aggressive violations, Ord_vio = ordinary violations, Pos. Dri. Beh. = positive driver behaviors, PMS = perceptual-motor skills, SS = safety skills. Scale values: DPIQ; 1 = strongly disagree, 5 = strongly agree; DBQ; 1 = never, 6 = always; DSI; 1 = definitely weak, 5 = definitely strong.

The descriptive statistics for the factors of the DPIQ were calculated. The results showed that drivers rated the distraction effect of the presence of the passenger above average ($M = 2.81$, $SD = .60$). At the same time, they reported that the Fear of Being Criticized by the passenger was low level ($M = 2.07$, $SD = .74$). In addition, drivers stated that they felt the Sense of Responsibility of the passenger at a high level ($M = 3.72$, $SD = .60$). Moreover, the findings indicated that drivers reported that the

Proactive Contribution of Passenger had a high level ($M = 3.41$, $SD = .86$). Finally, drivers rated that Passenger's Assistance with Non-Driving Tasks was high ($M = 3.73$, $SD = .72$).

Concerning the DBQ factors, the findings showed that drivers rated more Aggressive Violations ($M = 2.23$, $SD = .87$) than Ordinary Violations ($M = 1.89$, $SD = .60$). In addition, the results indicated that drivers reported they had low frequency of Errors ($M = 1.64$, $SD = .45$) and Lapses ($M = 1.69$, $SD = .41$). On the other hand, drivers stated that they had Positive Driver Behaviors ($M = 4.43$, $SD = .57$) very often in traffic environments.

Concerning the sub-scales of the DSI, the results showed that drivers rated stronger Safety Skills ($M = 3.99$, $SD = .55$) as compared to their Perceptual-Motor Skills ($M = 3.94$, $SD = .68$). For both sub-factors of the DSI, self-ratings were above the average; this means, drivers thought that both their perceptual-motor skills and safety skills were strong.

3.3.5. Bivariate Correlation Analysis between the Variables of the Study

A Bivariate Correlation analysis was conducted to establish the relationship between all variables of interest in the study. The first section includes analyses that examine the relationship between demographic variables and scales. The second section examines the results of analyses to investigate the relationship between sub-scale instruments. In the third and last section of correlation analysis, there were analyses to explain the relationship between dichotomous variables. Detailed reports on significant relationships can be found in the following sections.

3.3.5.1. The Relationship between Demographic Variables and Scales

In this section, age, driving experience (years), annual mileage (km), lifetime mileage (km), the number of active and passive accidents in last three years, the frequency of interaction with passengers (1 = never, 5 = always), Aggressive Violations, Ordinary Violations, Errors, Slips and Lapses, Positive Driver Behaviors, Perceptual-Motor Skills, Safety Skills, Distraction and Mental Overload, the Sense of Responsibility, Proactive Contribution of Passenger, the Fear of Being Criticized, and Passenger's

Assistance with Non-Driving Tasks variables were included in the analysis (see Table 8).

The relationship between age and the main variables of the study showed that age was positively related to driving experiences ($r = .80, p < .01$), annual mileage ($r = .12, p < .05$); lifetime mileage ($r = .29, p < .01$); passive accidents ($r = .13, p < .05$); Positive Driver Behaviors ($r = .13, p < .05$), and Perceptual-Motor Skills ($r = .17, p < .01$). This means as age increases, driving experience, annual mileage, lifetime mileage, the number of passive accidents, Positive Driver Behaviors and Perceptual-Motor Skills increase as well. On the other hand, age was negatively related to Ordinary Violations ($r = -.13, p < .05$), the Sense of Responsibility ($r = -.14, p < .05$), and Passenger Assistance with Non-Driving Tasks ($r = -.16, p < .05$). That is, as age decreases, Ordinary Violations, the Sense of Responsibility and Passenger's Assistance with Non-Driving Task increase as well.

Correlation analyses indicated relationships between other demographic variables, the main variables used in the current study, and the age variable. Driving experience had a positive relationship with annual mileage ($r = .19, p < .01$); lifetime mileage ($r = .38, p < .01$); passive accidents ($r = .17, p < .01$); and Perceptual-Motor Skills ($r = .37, p < .01$). On the other hand, the driving experience was negatively related to the Sense of Responsibility ($r = -.13, p < .05$), and Passenger's Assistance with Non-Driving Tasks ($r = -.17, p < .01$). That is, as driving experience (years) increase, the Sense of Responsibility and Passenger's Assistance with Non-Driving Tasks decreases whereas these variables mentioned above increase as well.

The findings indicated that annual mileage (km) had a significant and positive relationship with lifetime mileage ($r = .34, p < .01$); active accidents ($r = .13, p < .05$); passive accidents ($r = .11, p < .05$); Ordinary Violations ($r = .18, p < .01$); and Perceptual-Motor Skills ($r = .29, p < .01$). That is, as annual mileage increases, lifetime mileage, the number of active and passive accidents, Ordinary Violations, and Perceptual-Motor Skills increase as well. Moreover, annual mileage was negatively related to Lapses ($r = -.14, p < .05$), Safety Skills ($r = -.14, p < .05$); Distraction and Mental Overload ($r = -.14, p < .05$); and Fear of Being Criticized ($r = -.14, p < .05$).

That is, as annual mileage increases, Lapses, Safety Skills, Distraction and Mental Overload, and the Fear of Being Criticized decrease as well.

The findings indicated that lifetime mileage (km) had a significant and positive relationship with passive accidents ($r = .13, p < .05$); Ordinary Violations ($r = .21, p < .01$); Errors ($r = .12, p < .05$); and Perceptual-Motor Skills ($r = .14, p < .05$). That is, as lifetime mileage increases, passive accidents, Ordinary Violations, Errors, and Perceptual-Motor Skills increase as well. Moreover, lifetime mileage was negatively related to Safety Skills ($r = -.16, p < .01$); and Passenger's Assistance with Non-Driving Tasks ($r = -.19, p < .01$). That is, as lifetime mileage increases, Safety Skills and Passenger's Assistance with Non-Driving Tasks decrease as well.

The findings indicate that the number of active accidents was positively related to the number of passive accidents ($r = .16, p < .01$), the frequency of interaction with the passenger ($r = .13, p < .05$); Ordinary Violations ($r = .13, p < .05$); Perceptual-Motor Skills ($r = .12, p < .05$) while the number of active accidents was negatively related to Safety Skills ($r = -.13, p < .05$). That is, as the number of active accidents increases, the number of passive accidents, the frequency of interaction with passenger, Ordinary Violations, and Perceptual-Motor Skills increases whereas Safety Skills decrease.

The results revealed that the number of passive accidents was positively associated with Aggressive Violations ($r = .16, p < .01$); Perceptual-Motor Skills ($r = .16, p < .01$), whereas the number of passive accidents was negatively associated with Fear of Being Criticized ($r = -.15, p < .01$). This means that as the number of passive accidents increases, Aggressive Violations and Perceptual-Motor Skills increases; on the contrary; the Fear of Being Criticized decrease as well.

The results presented that the frequency of interaction with passengers had a positive relationship with Aggressive Violations ($r = .15, p < .01$); and Perceptual-Motor Skills ($r = .20, p < .01$). That is, as the frequency of interaction with the passenger increases, Aggressive Violations and Perceptual-Motor Skills increase as well. On the other hand, the frequency of interaction with passengers had a significant and negative relationship with Distraction and Mental Overload ($r = -.28, p < .01$). That means that as the frequency of interaction with the passenger increases, Distraction and Mental Overload decreases.

Table 8. Bivariate Correlation Matrix of All Interest Variables

Variables	1	2	3	4	5	6	7	8	9	10
1. Age	-									
2. Driving Exp.	.80**	-								
3. Annual Mileage	.12*	.19**	-							
4. Lifetime Mileage	.29**	.38**	.32**	-						
5. Active Accidents	.03	.05	.13*	.10	-					
6. Passive Accidents	.13*	.17**	.11*	.13*	.16**	-				
7. Freq. of Inter.	.01	.06	.06	.00	.13*	.04	-			
8. Agg_vio	-.06	.04	.07	.07	.11	.16**	.12*	-		
9. Ord_vio	-.13*	.05	.18**	.21**	.13*	.06	.15**	.51**	-	
10. Errors	-.02	.07	.10	.12*	.06	.04	-.10	.17**	.38**	-
11. Lapses	-.10	-.08	-.14*	-.05	.02	-.07	-.09	.19**	.28**	.40**
12. Pos. Dri. Beh.	.13*	.10	.02	-.06	-.03	.04	.11	-.16**	-.23**	-.27**
13. PMS	.17**	.37**	.29**	.14*	.12*	.16**	.20**	.14*	.15**	-.12*
14. SS	.02	-.07	-.14*	-.16**	-.11	-.06	-.05	-.26**	-.51**	-.28**
15. Distraction	.02	-.02	-.14*	-.03	.02	-.01	-.28**	.02	.02	.18**
16. Sense of Resp.	-.14*	-.13*	-.04	-.11	.01	-.01	.02	-.07	-.10	-.01
17. Proactive	-.02	-.07	-.09	-.09	-.06	-.03	.05	-.16**	-.16**	-.05
18. Fear of Criti.	-.07	-.09	-.14*	.06	-.04	-.15**	-.09	.04	.11*	.25**
19. Assis. Non-dri.	-.16*	-.17**	-.10	-.19**	-.05	-.05	.06	-.14*	-.11	-.01

* Correlation significant at the .05 level (2-Tailed). **Correlation significant at the .01 level (2-Tailed).

Note: Driving Exp = driving experience (years), Freq. of Inter. = the frequency of interaction with passenger, Agg_vio = aggressive violations, Ord_vio = ordinary violations, Pos. Dri. Beh. = positive driver behaviors, PMS = perceptual-motor skills, SS = safety skills, Sense of Resp. = the sense of responsibility, Proactive = Proactive Contribution of Passenger, Fear of Criti. = the fear of being criticized, Assis, Non-dri. = passenger's assistance with non-driving tasks.

Table 8. Bivariate Correlation Matrix of All Interest Variables (continued)

	11	12	13	14	15	16	17	18	19
11. Lapses	-								
12. Pos. Dri. Beh.	-.15**	-							
13. PMS	-.35**	.15**	-						
14. SS	-.16**	.35**	-.05	-					
15. Distraction	.28**	-.08	-.26**	-.01	-				
16. Sense of Resp.	.13*	.25**	.04	.17**	.10	-			
17. Proactive	-.01	.14**	-.15*	.11	.06	.28**	-		
18. Fear of Criti.	.27**	-.23**	-.28**	-.19**	.40**	.05	.05	-	
19. Assis. Non-dri.	.14*	.08	-.13*	.11*	-.02	.16**	.35**	.08	-

* Correlation significant at the .05 level (2-Tailed). **Correlation significant at the .01 level (2-Tailed).

Note: Driving Exp = driving experience (years), Freq. of Inter. = the frequency of interaction with passenger, Agg_vio = aggressive violations, Ord_vio = ordinary violations, Pos. Dri. Beh. = positive driver behaviors, PMS = perceptual-motor skills, SS = safety skills, Sense of Resp. = the sense of responsibility, Proactive = Proactive Contribution of Passenger, Fear of Criti. = the fear of being criticized, Assis. Non-dri. = passenger's assistance with non-driving tasks.

3.3.5.2.The Relationships between the Sub-Scales of Instruments

Correlation analyses investigated the relationship between the DBQ dimensions and other study variables. The results showed that Aggressive Violations were positively related to Ordinary Violations ($r = .51, p < .01$); Errors ($r = .17, p < .01$); Slips and Lapses ($r = .19, p < .01$); and Perceptual-Motor Skills ($r = .14, p < .01$). This means that as Aggressive Violations increase, Ordinary Violations, Errors, Slips and Lapses, and Perceptual-Motor Skills increase as well. On the other hand, Aggressive Violations were negatively related to Positive Driver Behaviors ($r = -.168, p < .01$); Safety Skills ($r = -.26, p < .01$); Proactive Contribution of Passengers ($r = -.16, p < .01$); Passenger's Assistance with Non-Driving Task ($r = -.14, p < .05$). That is, as Aggressive Violations increase, Positive Driver Behaviors, Safety Skills, Proactive Contribution of Passenger, and Passenger's Assistance with Non-Driving Task decrease as well. Moreover, Ordinary Violations were positively related to Errors ($r = .38, p < .01$); Slips and Lapses ($r = .28, p < .01$); Perceptual-Motor Skills ($r = .15, p < .01$); and the Fear of Being Criticized ($r = .11, p < .05$) whereas it was negatively related to Positive Driver Behaviors ($r = -.23, p < .01$); Safety Skills ($r = -.51, p < .01$); and Proactive Contribution of Passenger ($r = -.16, p < .01$). In addition, Errors had positive relationship with Slips and Lapses ($r = .40, p < .01$); Distraction and Mental Overload ($r = .18, p < .01$), and the Fear of Being Criticized ($r = .25, p < .01$) while it was negatively related to Positive Driver Behaviors ($r = -.27, p < .01$); Perceptual-Motor Skills ($r = -.12, p < .05$), and Safety Skills ($r = -.28, p < .01$). This means that as Errors increase, Slips and Lapses, Distraction and Mental Overload, and the Fear of Being Criticized increase while Positive Driver Behaviors, Perceptual-Motor Skills and Safety Skills decrease as well.

The findings demonstrated that Slips and Lapses had a significant and negative relationship with Positive Driver Behaviors ($r = -.15, p < .01$); Perceptual-Motor Skills ($r = -.35, p < .01$); and safety skills ($r = -.16, p < .01$). That is, as slips and lapses increase, Positive Driver Behaviors, Perceptual-Motor Skills and Safety Skills decrease as well. On the other hand, Slips and Lapses were positively related to Distraction and Mental Overload ($r = .28, p < .01$), the Sense of Responsibility ($r = .13, p < .05$), the Fear of Being Criticized ($r = .27, p < .01$), and Passenger's Assistance with Non-Driving Tasks ($r = .14, p < .05$). This means that as Slips and Lapses

increase, Distraction and Mental Overload, the Sense of Responsibility, the Fear of Being Criticized, and Passenger's Assistance with Non-Driving Tasks increase. In addition, Positive Driver Behaviors were positively related to Perceptual-Motor Skills ($r = .15, p < .01$); Safety Skills ($r = .35, p < .01$); the Sense of Responsibility ($r = .25, p < .01$); and Proactive Contribution of Passenger ($r = .14, p < .01$). This means that as Positive Driver Behaviors increase, Perceptual-Motor Skills, Safety Skills, the Sense of Responsibility, and Proactive Contribution of Passenger increase. On the other hand, Positive Driver Behaviors were negatively related to the Fear of Being Criticized ($r = -.23, p < .01$). This means that as Positive Driver Behaviors increase, the Fear of Being Criticized decreases.

Bivariate correlation analysis was done to examine the relationship between the subscales of the DSI and other variables. The results presented that Perceptual-Motor Skills were negatively related to Distraction and Mental Overload ($r = -.26, p < .01$); Proactive Contribution of Passenger ($r = -.15, p < .05$); the Fear of Being Criticized ($r = -.28, p < .01$); and Passenger's Assistance with Non-Driving Task ($r = -.13, p < .05$). That is as Perceptual-Motor Skills increases, Distraction and Mental Overload, the Fear of Being Criticized, Proactive Contribution of Passenger, and Passenger's Assistance with Non-Driving Tasks decrease. Furthermore, Safety Skills had a significant and positive relationship with the Sense of Responsibility ($r = .17, p < .01$); and Passenger's Assistance with Non-Driving Tasks ($r = .11, p < .05$), while it had a negative relationship with the Fear of Being Criticized ($r = -.19, p < .01$). This means that as Safety Skills increase, the Sense of Responsibility, and Passenger's Assistance with Non-Driving Tasks increase whereas the Fear of Being Criticized decreases..

Finally, examining the DPIQ factors and other study variables provided a significant relationship in correlation analyses. Distraction and Mental Overload were positively related to the Fear of Being Criticized ($r = .40, p < .01$). That is, as Distraction and Mental Overload increase, the Fear of Being Criticized also increases. In addition, the Sense of Responsibility was positively related to the Proactive Contribution of the Passenger ($r = .28, p < .01$) and the Passenger's Assistance with Non-Driving Tasks ($r = .16, p < .01$). This means that as the Sense of Responsibility increases, Proactive Contribution of Passenger and Passenger's Assistance with Non-Driving Task increases. Last, the Proactive Contribution of Passengers had a positive relationship

with Passenger's Assistance with Non-Driving Tasks ($r = .35, p < .01$). This means that as the Proactive Contribution of Passengers increases, Passenger's Assistance with Non-Driving Tasks increases as well.

3.3.5.3. The Relationships between Dichotomous Variables

The Point-biserial Correlation analyses were conducted in order to examine the relationship between study variables and driver's sex, passenger's sex, preference of passenger, accident due to passenger in the vehicle, and whether the presence of passenger is positive or negative (see Table 9). Findings indicated that driver's sex had negative relationship with the Fear of Being Criticized ($r_{pb} = -.17, p < .01$), and Slips and Lapses ($r_{pb} = -.17, p < .01$) whereas positive relationship with Ordinary Violations ($r_{pb} = .26, p < .01$), and Perceptual-Motor Skills ($r_{pb} = .37, p < .01$). Furthermore, passenger's sex had positive relationship with the Fear of Being Criticized ($r_{pb} = .15, p < .01$) negative relationship with Safety Skills ($r_{pb} = -.14, p < .05$).

Preference of driving with passenger had positive relationship with Distraction and Mental Overload ($r_{pb} = .17, p < .01$); the Fear of Being Criticized ($r_{pb} = .21, p < .01$); and Aggressive Violations ($r_{pb} = .18, p < .01$). On the other hand, preference of driving with passenger had negative relationship with Proactive Contribution of Passenger ($r_{pb} = -.26, p < .01$) and Passenger's Assistance with Non-Driving Tasks ($r_{pb} = -.19, p < .01$). Moreover, the variable of accident or near miss caused by the passenger in the vehicle was related to positively the frequency of driving ($r_{pb} = .15, p < .05$), and Proactive Contribution of Passenger ($r_{pb} = .13, p < .05$). On the other hand, the variable of accident or near miss caused by the passenger was negatively related to Distraction and Mental Overload ($r_{pb} = -.25, p < .01$); the Sense of Responsibility ($r_{pb} = -.12, p < .05$); the Fear of Being Criticized ($r_{pb} = -.12, p < .05$); Errors ($r_{pb} = -.14, p < .05$); and Slips and Lapses ($r_{pb} = -.17, p < .01$). Finally, the variable of whether the presence of passenger is positive or negative was positively related to Distraction and Mental Overload ($r_{pb} = .38, p < .01$); and the Fear of Being Criticized ($r_{pb} = .22, p < .01$). On the other hand, the variable of whether the presence of passenger is positive or negative was negatively related to the frequency of driving ($r_{pb} = -.12, p < .05$); Proactive Contribution of Passenger ($r_{pb} = -.22, p < .01$); and Passenger's Assistance with Non-Driving Task ($r_{pb} = -.13, p < .01$); and Perceptual-Motor Skills ($r_{pb} = -.11, p < .05$).

Table 9. Point-biserial Correlation Coefficient Score for Nominal Variables and Other Study Variables

Variables	Driver's sex	Passenger's sex	Preference of passenger	Accident	Presence of passenger
Frequency of driving	.04	-.08	-.07	.15**	-.12*
Distraction and mental overload	-.06	.05	.17**	-.25**	.38**
Sense of responsibility	.01	.02	.05	-.12*	-.00
Proactive contribution of passenger	.06	.05	-.26**	.13*	-.22**
Fear of being criticized	-.17**	.15**	.21**	-.12*	.22**
Passenger's assistance with non-driving task	-.01	-.01	-.19**	.09	-.13**
Aggressive violations	.10	-.03	.18**	-.02	.03
Ordinary violations	.26**	-.01	.10	.04	.03
Errors	.10	-.04	.08	-.14*	.07
Slips and lapses	-.17**	-.04	.04	-.17**	.09
Positive driver behaviors	.04	-.05	-.03	.02	-.08
Perceptual-motor skills	.37**	-.04	.03	.08	-.11*
Safety skills	-.08	-.14*	-.02	.06	.03

*Correlation significant at the .05 level (2-tailed). **Correlation significant at the .01 level (2-tailed).

Finally, Chi-square analysis was performed to find the relationships between dichotomous variables. First, the relationship between the driver's sex and the passenger's sex, the preference for driving with the passenger, and whether the passenger's presence was positive or negative was examined (see Table 10). The findings showed that the relationship between the driver's sex and the passenger's sex was significant $X^2 (1, N = 304) = 9.70, p = .002$. In other words, female drivers generally stated that they traveled with male passengers, and male drivers generally stated that they traveled with female passengers. Furthermore, the relationship between driver's sex and preference for driving with passengers was significant $X^2 (1, N = 304) = 9.46, p = .002$. This means that males were more likely to prefer to travel with passengers than females. Last, the relationship between the driver's sex and whether the passenger's presence was positive or negative $X^2 (1, N = 304) = 9.42, p = .002$. This means that males were more likely to evaluate the passenger's presence positively than females.

Table 10. Cross-tab and Pearson Chi-square Test for Driver's Sex and Other Variables

Variables	Driver's sex		X^2	df	p
	Female	Male			
Passenger's sex					
Female	71	94	9.70	1	.002
Male	92	60			
Preference of passenger					
Yes	79	101	9.46	1	.002
No	84	53			
Presence of passenger					
Positively	110	127	9.42	1	.002
Negatively	53	27			

Note. df = degrees of freedom.

3.3.6. The Main Analyses

The main analysis section consists of two parts. The first part involves conducting a series of hierarchical regression analyses to investigate how driver-passenger interaction dimensions relate to driver behaviors. The second part involves conducting

a series of MANCOVA analyses to explore the impact of driver-passenger interaction at various levels (low, moderate, and high) on driver behavior. All of the analyses in the present study were conducted by using SPSS 26 program. The following sections provide a detailed explanation of the analysis and its results.

3.3.6.1. Hierarchical Regression Analysis

3.3.6.1.1. Requirements of Hierarchical Regression Analysis

Before conducting the hierarchical regression analyses, the variables were checked for appropriateness for the planned regression analyses. First, the dependent variable must be measured on a continuous scale, interval, or ratio to conduct a regression analysis. (Büyüköztürk, 2011). Driver behaviors, dependent variables in the current study, were continuous and met the necessary condition. Secondly, linearity between the variables must be ensured (Hayes, 2013). Scatter plots were created for each relationship between the independent and dependent variables to ensure linearity. After analyzing the plots, it was confirmed that this requirement was fulfilled. Third, it is necessary for the variables to follow a normal distribution (Büyüköztürk, 2011). The skewed and kurtosis values of independent and dependent variables (IVs and DVs) were analyzed to assess normal distribution. According to Tabachnick and Fidell (2012), skewness and kurtosis values between -1.5 and +1.5 indicate that the variables were normally distributed. According to Table 11, the skewness and kurtosis values for the five driver behavior variables (DVs) and five driver-passenger interaction factors (IVs) were within the expected range in this study. It was also observed that the variables in the study were normally distributed.

It was necessary to ensure no multicollinearity among the independent variables as another prerequisite (Tabachnick & Fidell, 2012). Büyüköztürk (2011) stated that if the Pearson correlation coefficient between independent variables is below .80 ($r < .80$), there is no evidence of multicollinearity. In other words, to perform hierarchical regression, the relationship between independent variables must be less than .80. When the correlation between multicollinearity independent variables was high, the variance explained was high accordingly. Therefore, the effect on the dependent variable was not found accurately because the independent variables affected each other too much. After examining the relationship between the independent variables in Table 10, it was

observed that all correlation coefficient values satisfied the condition. That is, no multicollinearity prerequisite was also ensured.

Table 11. The Skewness and Kurtosis Values of the Factors of IVs and DVs

	Skewness	SE	Kurtosis	SE
Distraction and Mental Overload	-.05	.14	-.20	.28
Sense of Responsibility	-.35	.14	.31	.28
Proactive Contribution of Passenger	-.52	.14	.00	.28
Fear of Being Criticized	.39	.14	-.53	.28
Assistance with Non-Driving Task	-.29	.14	-.43	.28
Aggressive Violations	.87	.14	.70	.28
Ordinary Violations	.84	.14	.54	.28
Errors	.71	.14	.14	.28
Slips and Lapses	.77	.14	.59	.28
Positive Driver Behaviors	-.19	.14	-.15	.28

The fifth requirement is that cases cannot have extreme values. The Residual Statistics table was evaluated by checking if the standardized error line falls within the range of -3.29 to +3.29, which indicates the minimum and maximum values (Büyüköztürk, 2011). Table 12 shows that the standardized errors for all five dependent variables were within the desired ranges. In other words, this requirement was fulfilled because there were no outliers or extreme values. In addition, to ensure accuracy, the Cook's Distance must be below 1. In Table 12, it was observed that all Cook's Distance values were less than one.

The sixth prerequisite was that the errors of the estimations should be normally distributed. When the histogram graphs of the standardized residuals were examined, it was observed that they were normally distributed, and this prerequisite was met. In order to ensure accuracy, it is crucial that the errors are not related to one another. The standardized predicted values scatter plots were examined and spread out on the graph and rectangular. After providing this prerequisite, it has been concluded that the errors were not related to each other.

Table 12. Residual Statistics Values

DV	Minimum	Maximum	Cook's Distance	
			Minimum	Maximum
Aggressive Violations	-1.65	3.13	.00	.08
Ordinary Violations	-1.79	3.13	.00	.07
Errors	-1.91	3.11	.00	.04
Lapses	-2.39	3.05	.00	.04
Positive Driver Behaviors	-2.98	2.39	.00	.05

3.3.6.1.2. Results of Hierarchical Regression Analyses

In this section, the hierarchical regression analyses were conducted in order to test the relationship between driver-passenger interaction and driver behaviors. In these hierarchical regression analyses, driver behaviors were identified as dependent variable (DV). A total of five hierarchical regression analyses were performed for DVs, namely Aggressive Violations, Ordinary Violations, Errors, Slips and Lapses, and Positive Driver Behaviors, respectively. The driver and passenger interaction were the independent variables (IV). IVs as Distract and Mental Overload, the Sense of Responsibility, Proactive Contribution of Passenger, the Fear of Being Criticized, and Passenger's Assistance with Non-Driving Task were used in all regression analyses, respectively. In order to control the statistical effects of age, sex, and exposure, these variables were entered in the first step of the analysis. Later, to statistical effects of between type of passenger and driver behaviors, Type of the Passenger variable was entered in the second step of the analysis. In addition, to control the possibility of association between driver skills and driver behaviors, Perceptual-Motor Skills and Safety Skills were entered in the third step of the analysis. Finally, to test prediction, the driver and passenger interaction factors were entered at fourth and last step.

Five different hierarchical regression analyses were performed. Aggressive Violations, Ordinary Violations, Errors, Lapses, and Positive Driver Behaviors were used as dependent variables, respectively. The dummy variables technique was used for Types of Passengers. According to the literature (Fleiter, Lennon, & Watson, 2010), the Boss and Coworker were the reference group because the passenger type was expected to affect the driver's behaviors the least and the degree of proximity.

No significant relationship was found between driver behaviors and driver-passenger interaction as a result of the first two regression analyses in which Aggressive Violations and Ordinary Violations were DVs, respectively.

3.3.6.1.2.1. The Relationship between the Factors of Driver-Passenger Interaction and Errors

Third hierarchical regression analysis was conducted in order to test whether the factors of driver-passenger interaction were related to Errors when controlling to the type of passenger and driver skills. In the hierarchical regression analysis, Errors were identified as the DV; and the factors of the driver-passenger interaction such as Distraction and Mental Overload, the Sense of Responsibility, Proactive Contribution of Passenger, the Fear of Being Criticized, and the Passenger's Assistance with Non-Driving Tasks were the IVs. In order to control the statistical effects of age, sex, and exposure, these variables were entered in the first step of the analysis. In addition, to control the possibility of association between the Types of Passenger and Errors, the variable of the Types of Passenger was entered in the second step of the analysis. Moreover, to control the possibility of association between driver skills such as Perceptual-Motor Skills and Safety Skills and Errors, driver skills were entered in the third step of the analysis. Finally, the factors of the driver-passenger interaction were entered at fourth step. The results (see Table 13) of the regression analysis indicated that controlled variables in the first step contributed significantly to regression model and accounted for 3% variation in Errors ($F(3, 300) = 2.87, p < .05, R^2 = .03$). Introducing the Types of Passenger explained an additional 1% of variation in errors ($F_{change}(4, 296) = 1.22, p > .05, R^2 = .04$). In addition, driver skills entered in the third step significantly increases the explained variance in Errors ($F_{change}(2, 294) = 13.78, p < .001, R^2_{change} = .08$). Finally, introducing the factors of driver-passenger interaction explained an additional 5% of variation in Errors ($F_{change}(5, 289) = 3.75, p < .01, R^2 =$

.18); in total, the factors of driver-passenger interaction explained 18% of variance in Errors. In addition, after controlling the effects of the Types of Passenger and driver skills, the Fear of Being Criticized was found to be positively related to Errors ($\beta = .10$, $t(289) = 2.68$, $p < .01$, 95% CI [.03, .18]). This means that one unit increases in the Fear of Being Criticized leads to .10 unit increases in Errors.

Table 13. The Hierarchical Regression of Errors on the Driver-Passenger Interaction When Controlled Driver Skills and the Type of Passenger

Variable	β	t	p	R^2	ΔR^2
Step 1				.03	.03
Age	-.00	-1.08	.280		
Sex	.09	1.81	.071		
Lifetime mileage	1,833E-7	2.11	.036		
Step 2				.04	.01
Friend	-.18	-2.03	.043		
Parent	-.16	-1.67	.093		
Spouse	-.09	-1.09	.277		
Child	-.07	-.80	.424		
Step 3				.13	.08
Perceptual-Motor Skills	-.11	-2.65	.009		
Safety Skills	-.21	-4.44	.000		
Step 4				.18	.05
Distraction and Mental Overload	.07	1.47	.144		
Sense of Responsibility	.05	1.12	.265		
Proactive Contribution	-.05	-1.70	.089		
Fear of Being Criticized	.10	2.68	.008		
Non-Driving Tasks	.02	.65	.519		

Note: N = 304; Proactive Contribution = proactive contribution of passenger, Non-driving tasks = passenger's assistance non-driving tasks; Dependent variable = errors.

3.3.6.1.2.2. The Relationship between the Factors of Driver-Passenger

Interaction and Slips and Lapses

Fourth regression analysis was conducted in order to test whether the factors of driver-passenger interaction are related to Slips and Lapses when controlling to the Type of Passenger and driver skills (see Table 14). In the hierarchical regression analysis, Slips and Lapses were identified as the DV; and the factors of the driver-passenger interaction such as Distraction and Mental Overload, the Sense of Responsibility, Proactive Contribution of Passenger, the Fear of Being Criticized, and the Passenger's Assistance with Non-Driving Tasks were the IVs. In order to control the statistical effects of age, sex, and lifetime mileage, these variables were entered in the first step. In addition, the Types of Passengers were entered in the second step of the analysis to control the statistical effects of the variable. Moreover, driver skills were entered in the third step of the analysis to control the possibility of an association between driver skills. Finally, the factors of the driver-passenger interaction were entered at fourth step.

The findings of the regression analysis showed that controlled variables in the first step contributed significantly to regression model and accounted for 4% variation in Slips and Lapses ($F(3, 300) = 3.67, p < .05, R^2 = .04$). Introducing the Types of Passenger explained an additional 1% of variation in Slips and Lapses ($F_{change}(4, 296) = .70, p > .05, R^2 = .04$). In addition, driver skills entered in the third step significantly increases the explained variance in Lapses ($F_{change}(2, 294) = 18.78, p < .001, R^2_{change} = .11$). Finally, introducing the factors of driver-passenger interaction explained an additional 11% of variation in Slips and Lapses ($F_{change}(5, 289) = 7.79, p < .001, R^2 = .25$). In addition, after controlling the effects of the Types of Passenger and driver skills, Distraction and Mental Overload ($\beta = .13, t(289) = 3.28, p < .01, 95\% \text{ CI } [.05, .21]$), the Sense of Responsibility ($\beta = .12, t(289) = 3.21, p < .01, 95\% \text{ CI } [.05, .20]$), and Passenger's Assistance with Non-Driving tasks ($\beta = .08, t(289) = 2.41, p < .05, 95\% \text{ CI } [.01, .14]$) were found to be positively related to Slips and Lapses. This means that one-unit increases in Distraction and Mental Overload leads to .13 unit, one-unit increase in the Sense of Responsibility causes .12 unit, and one-unit increase in Passenger's Assistance with Non-Driving Tasks leads to .08 unit increases in Slips and Lapses, respectively.

Table 14. The Hierarchical Regression of Slips and Lapses on the Driver-Passenger Interaction When Controlled Driver Skills and the Type of Passenger

Variable	β	t	p	R^2	ΔR^2
Step 1				.04	.04
Age	-.00	-1.30	.196		
Sex	-.13	-2.86	.005		
Lifetime mileage	-2,756E-8	-.35	.726		
Step 2				.04	.00
Friend	-.09	-1.12	.264		
Parent	-.11	-1.25	.211		
Spouse	-.02	.29	.774		
Child	-.08	-1.01	.312		
Step 3				.15	.11
Perceptual-Motor Skills	-.19	-5.30	.000		
Safety Skills	-.12	-2.90	.004		
Step 4				.25	.10
Distraction and Mental Overload	.13	3.28	.001		
Sense of Responsibility	.12	3.21	.001		
Proactive Contribution	-.05	-1.80	.073		
Fear of Being Criticized	.04	1.32	.188		
Non-Driving Tasks	.08	2.41	.016		

Note: N = 304; Proactive Contribution = proactive contribution of passenger, Non-driving tasks = passenger's assistance non-driving tasks; Dependent variable = slips and lapses.

3.3.6.1.2.3. The Relationship between the Factors of Driver-Passenger Interaction and Positive Driver Behaviors

Fifth hierarchical regression analysis was conducted in order to test whether the factors of driver-passenger interaction are related to Positive Driver Behaviors when

controlling to the Type of Passenger and driver skills (see Table 15). In the hierarchical regression analysis, Positive Driver Behaviors were identified as the DV; and the factors of the driver-passenger interaction such as Distraction and Mental Overload, the Sense of Responsibility, Proactive Contribution of Passenger, the Fear of Being Criticized, and the Passenger's Assistance with Non-Driving Tasks were the IVs. In order to control the statistical effects of age, sex, and lifetime, these variables were entered in the first step of the analysis. In addition, the Types of Passengers were entered in the second step of the analysis to control the statistical effects of the variable. Moreover, driver skills were entered in the third step of the analysis to control the possibility of an association between driver skills. Finally, the factors of the driver-passenger interaction were entered at fourth step.

The results of fifth hierarchical regression analysis indicated that controlled variables (such as age, sex, and lifetime mileage) in the first step contributed significantly to regression model and accounted for 3% variation in Positive Driver Behaviors ($F(3, 300) = 3.01, p < .05, R^2 = .03$). Introducing the Types of Passenger explained an additional 2% of variation in Positive Driver Behaviors ($F_{change}(4, 296) = .70, p > .05, R^2 = .05$). In addition, driver skills entered in the third step significantly increases the explained variance in Positive Driver Behaviors ($F_{change}(2, 294) = 23.59, p < .001, R^2_{change} = .13$). Finally, introducing the factors of driver-passenger interaction explained an additional 8% of variation in Positive Driver Behaviors ($F_{change}(5, 289) = 5.89, p < .001, R^2_{change} = .08$); in total, the factors of driver-passenger interaction explained 26% of variance in Positive Driver Behaviors.

In addition, after controlling the effects of the types of passenger and driver skills, the Sense of Responsibility ($\beta = .21, t(289) = 4.00, p < .001, 95\% \text{ CI } [.11, .32]$) was found to be positively associated; and the Fear of Being Criticized ($\beta = -.12, t(289) = -2.60, p < .015, 95\% \text{ CI } [-.21, -.03]$) were found to be negatively associated with to Positive Driver Behaviors. This means that one-unit increases in the Sense of Responsibility leads to .21 unit increases in Positive Driver Behaviors. On the other hand, one-unit increase in the Fear of Being Criticized causes .12 unit decreases in Positive Driver Behaviors.

Table 15. The Hierarchical Regression of Positive Driver Behaviors on the Driver-Passenger Interaction When Controlled Driver Skills and the Type of Passenger

Variable	β	t	p	R^2	ΔR^2
Step 1				.03	.03
Age	.01	2.76	.006		
Sex	.03	.40	.689		
Lifetime mileage	-2,049E-7	-1.89	.059		
Step 2				.05	.02
Friend	-.01	-.13	.898		
Parent	.22	1.94	.053		
Spouse	.15	1.51	.132		
Child	.07	.63	.529		
Step 3				.18	.13
Perceptual-Motor Skills	.15	3.18	.002		
Safety Skills	.33	5.97	.000		
Step 4				.26	.08
Distraction and Mental Overload	-.02	-.28	.779		
Sense of Responsibility	.21	4.00	.001		
Proactive Contribution	.03	.89	.376		
Fear of Being Criticized	-.12	-2.60	.010		
Non-Driving Tasks	.04	.95	.345		

Note: N = 304; Proactive Contribution = proactive contribution of passenger, Non-driving tasks = passenger's assistance non-driving tasks; Dependent variable = positive driver behaviors.

3.3.6.2. MANCOVA Analysis

Five multivariate analyses of covariance (MANCOVA) analyses were conducted to determine whether different types of passengers and the levels of variables of driver-passenger interaction make any difference between driver behaviors. Five factors

make up driver behaviors (DVs): Aggressive Violations, Ordinary Violations, Errors, Slips and Lapses, and Positive Driver Behaviors. A separate MANCOVA was conducted for each factor. The driver-passenger interaction (IV-1) consisted of five factors with three levels; low, moderate, and high. The factors of IV-1 were Distraction and Mental Overload, the Sense of Responsibility, the Proactive Contribution of Passengers, the Fear of Being Criticized, and Passenger Assistance with Non-Driving Tasks. In addition, the type of passengers (IV-2) included five different passenger types; Friend, Parent, Spouse/Lover, Boss and Coworker, and Child/Baby. Finally, for each MANCOVA analysis, driver age, sex, and exposure (lifetime mileage) were added as the control variables.

3.3.6.2.1. Distraction and Mental Overload and the Types of Passenger Differences for Driver Behaviors

In order to investigate how different levels of Distraction and Mental Overload and the types of passengers differ in driver behaviors, 3 (Distraction and Mental Overload: low, moderate, high) X 5 (types of passenger: Friend, Parent, Spouse/Lover, Boss and Coworker, and Child/Baby) between-subjects multivariate analysis of covariance (MANCOVA) was performed on five dependent variables: Aggressive Violations, Ordinary Violations, Errors, Slips and Lapses, and Positive Driver Behaviors). In the analysis, driver age, driver sex, and exposure (lifetime mileage) were treated as the control variables. With the use of Wilk's criterion, the combined DVs were significantly different by levels of Distraction and Mental Overload (Wilk's $\Lambda = .87$, $F(10, 564) = 4.25$, $p < .001$, $partial \eta^2 = .07$). However, there was no significant main effect of Type of Passenger (Wilk's $\Lambda = .92$, $F(20, 936) = 1.28$, $p = .184$, $partial \eta^2 = .02$), and no significant interaction between these two variables on driver behaviors (Wilk's $\Lambda = .85$, $F(40, 1232) = 1.14$, $p = .256$, $partial \eta^2 = .03$).

A separate univariate analysis was conducted to investigate the impact of Distraction and Mental Overload on the individual DVs. Initially, Bonferroni adjustment was applied so that the critical alpha level was determined as .01 (i.e., .05/5). The results showed that Errors ($F(2, 286) = 4.76$, $p < .01$, $partial \eta^2 = .03$) and Lapses ($F(2, 286) = 17.26$, $p < .001$, $partial \eta^2 = .11$) were significantly different for different levels of Distraction and Mental Overload (see Table 16). Bonferroni post-hoc tests for multiple comparisons found that compared to a high level of Distraction and Mental Overload

($M = 1.74$), drivers tend to show a lower frequency of Errors at a low level of Distraction and Mental Overload ($M = 1.53$). In addition, the Bonferroni post-hoc test for multiple comparisons found that a low level of Distraction and Mental Overload ($M = 1.49$) cause a lower frequency of Lapses compared to a moderate ($M = 1.68$) and high level ($M = 1.83$) of Distraction and Mental Overload. Also, high levels of Distraction and Mental Overload led to a higher frequency of Lapses than moderate levels. In other words, as the level of Distraction and Mental Overload increases, the frequency of Lapses also increases.

Table 16. Univariate F values and Mean Scores for Errors and Lapses on Distraction and Mental Overloads

	Distraction and mental overload			<i>F</i>	<i>df</i>	<i>p</i>
	Low	Moderate	High			
Errors	1.53 ^a	1.63 ^{ab}	1.74 ^b	4.76	2, 286	.009
Lapses	1.49 ^a	1.68 ^b	1.83 ^c	17.26	2, 286	.000

Note: The mean values that do not share the same superscript on the same row were significantly different from each other.

3.3.6.2.2. Sense of Responsibility and the Types of Passenger Differences for Driver Behaviors

In order to investigate how different levels of Sense of Responsibility and the types of passengers differ in driver behaviors, 3 (Sense of Responsibility: low, moderate, high) X 5 (types of passenger: Friend, Parent, Spouse/Lover, Boss and Coworker, and Child/Baby) between-subjects multivariate analysis of covariance (MANCOVA) was performed on five dependent variables: Aggressive Violations, Ordinary Violations, Errors, Slips and Lapses, and Positive Driver Behaviors). In the analysis, driver age, driver sex, and exposure (lifetime mileage) were treated as the control variables. With the use of Wilk's criterion, the combined DVs were significantly different by levels of Sense of Responsibility (Wilk's $\Lambda = .90$, $F(10, 564) = 3.07$, $p = .001$, $partial \eta^2 = .05$). However, there was no significant main effect of Type of Passenger (Wilk's $\Lambda = .93$, $F(20, 936) = 1.07$, $p = .382$, $partial \eta^2 = .02$), and no significant interaction between

these two variables on driver behaviors (Wilk's $\Lambda = .87$, $F(40, 1232) = 1.05$, $p = .396$, partial $\eta^2 = .03$).

A separate univariate analysis was conducted to investigate the impact of a Sense of Responsibility on the individual DVs. Initially, Bonferroni adjustment was applied so that the critical alpha level was determined as .01 (i.e., .05/5). The results indicated that Positive Driver Behaviors were significantly different for different levels of Sense of Responsibility ($F(2, 286) = 10.80$, $p < .001$, partial $\eta^2 = .07$). Univariate F values and mean scores for Positive Driver Behaviors on the Sense of Responsibility could be seen in Table 17. Bonferroni post-hoc test for multiple comparisons revealed that drivers with low ($M = 4.24$) and moderate ($M = 4.40$) Sense of Responsibility had a lower frequency of Positive Driver Behaviors compared to drivers with high ($M = 4.61$) Sense of Responsibility. However, there was not a significant difference between low and moderate Sense of Responsibility groups in terms of displaying Positive Driver Behaviors.

Table 17. Univariate F Values and Mean Scores for Positive Driver Behaviors on the Sense of Responsibility

	Sense of responsibility			<i>F</i>	<i>df</i>	<i>p</i>
	Low	Moderate	High			
Positive Driver Behaviors	4.24 ^a	4.40 ^a	4.61 ^b	10.80	2, 286	.000

Note: The mean values that do not share the same superscript on the same row were significantly different from each other.

3.3.6.2.3. Proactive Contribution of Passengers and the Types of Passenger Differences for Driver Behaviors

In order to investigate how different levels of Proactive Contribution of Passengers and the types of passengers differ in driver behaviors, 3 (Proactive Contribution of Passengers: low, moderate, high) X 5 (types of passenger: Friend, Parent, Spouse/Lover, Boss and Coworker, and Child/Baby) between-subjects multivariate analysis of covariance (MANCOVA) was performed on five dependent variables: Aggressive Violations, Ordinary Violations, Errors, Slips and Lapses, and Positive

Driver Behaviors). In the analysis, driver age, driver sex, and exposure (lifetime mileage) were treated as the control variables. With the use of Wilk's criterion, the combined DVs were significantly different by levels of Proactive Contribution of Passengers (Wilk's $\Lambda = .90$, $F(10, 564) = 3.06$, $p = .001$, $partial \eta^2 = .05$). However, there is no significant main effect of Types of Passenger (Wilk's $\Lambda = .93$, $F(20, 936) = 1.00$, $p = .464$, $partial \eta^2 = .02$), and no significant interaction between these two variables on driver behaviors (Wilk's $\Lambda = .90$, $F(40, 1232) = .77$, $p = .850$, $partial \eta^2 = .02$).

Table 18. Univariate F Values and Mean Scores for Aggressive and Ordinary Violations on the Proactive Contribution of Passenger

	Proactive Contribution of Passenger			<i>F</i>	<i>df</i>	<i>p</i>
	Low	Moderate	High			
Aggressive Violations	2.45 ^a	2.12 ^b	2.11 ^b	4.61	2, 286	.011
Ordinary Violations	2.05 ^a	1.80 ^b	1.81 ^b	5.69	2,286	.004

Note: The mean values that do not share the same superscript on the same row were significantly different from each other.

A separate univariate analysis was conducted to investigate the impact of the Proactive Contribution of Passengers on the individual DVs. Initially, Bonferroni adjustment was applied so that the critical alpha level was determined as .01 (i.e., .05/5). The results showed that Aggressive Violations ($F(2, 286) = 3.45$, $p = .01$, $partial \eta^2 = .03$) and Ordinary Violations ($F(2, 286) = 1.76$, $p < .01$, $partial \eta^2 = .03$) were significantly different for different levels of Proactive Contribution of Passengers (see Table 18). Bonferroni post-hoc test for multiple comparisons found that compared to moderate ($M = 2.12$) and high ($M = 2.11$) levels, a low ($M = 2.45$) level of Proactive Contribution of Passengers led to a higher frequency of Aggressive Violations. However, there was no significant difference moderate level of Proactive Contribution of Passengers and a high level of Proactive Contribution of Passengers on Aggressive Violations. Moreover, compared to moderate ($M = 1.80$) and high ($M = 1.81$) levels, a low ($M =$

2.05) level of Proactive Contribution of Passengers caused a higher frequency of Ordinary Violations. However, there was no significant difference moderate level of Proactive Contribution of Passengers and a high level of Proactive Contribution of Passengers on Ordinary Violations.

3.3.6.2.4. Fear of Being Criticized and the Types of Passenger Differences for Driver Behaviors

In order to investigate how different levels of Fear of Being Criticized and the types of passengers differ in driver behaviors, 3 (Fear of Being Criticized: low, moderate, high) X 5 (types of passenger: Friend, Parent, Spouse/Lover, Boss and Coworker, and Child/Baby) between-subjects multivariate analysis of covariance (MANCOVA) was performed on five dependent variables: Aggressive Violations, Ordinary Violations, Errors, Slips and Lapses, and Positive Driver Behaviors). In the analysis, driver age, driver sex, and exposure (lifetime mileage) were treated as the control variables. With the use of Wilk's criterion, the combined DVs were significantly different by levels of Fear of Being Criticized (Wilk's $\Lambda = .88$, $F(10, 564) = 3.87$, $p < .001$, *partial* $\eta^2 = .06$). However, there was no significant main effect of Type of Passenger (Wilk's $\Lambda = .90$, $F(20, 936) = 1.30$, $p = .167$, *partial* $\eta^2 = .02$), and no significant interaction between these two variables on driver behaviors (Wilk's $\Lambda = .89$, $F(40, 1232) = .86$, $p = .723$, *partial* $\eta^2 = .02$).

A separate univariate analysis was conducted to investigate the impact of the Fear of Being Criticized on the individual DVs. Initially, Bonferroni adjustment was applied so that the critical alpha level was determined as .01 (i.e., .05/5). The results indicated that Errors ($F(2, 286) = 7.01$, $p = .001$, *partial* $\eta^2 = .05$), Lapses ($F(2, 286) = 7.20$, $p = .001$, *partial* $\eta^2 = .05$), and Positive Driver Behaviors ($F(2, 286) = 10.73$, $p < .001$, *partial* $\eta^2 = .07$) were significantly different for different levels of the Fear of Being Criticized (see Table 19). Bonferroni post-hoc test for multiple comparisons revealed that drivers with a high level ($M = 1.76$) of Fear of Being Criticized were more likely to have a higher frequency of Errors compared to drivers at low ($M = 1.52$) and moderate ($M = 1.59$) levels. However, there was no significant difference between low and moderate levels of Fear of Being Criticized for Errors. In addition, drivers with a high level ($M = 1.78$) of Fear of Being Criticized had a higher frequency of Lapses than drivers at a low ($M = 1.56$) level. However, there were no significant

differences neither between low and moderate levels of Fear of Being Criticized nor between high and moderate levels of Fear of Being Criticized on Lapses. Finally, drivers with a low level ($M = 4.63$) of Fear of Being Criticized were more likely to have a higher frequency of Positive Driver Behaviors compared to drivers at moderate ($M = 4.31$) and high levels ($M = 4.26$). However, there was no significant difference between high and moderate Fear of Being Criticized for Positive Driver Behaviors.

Table 19. Univariate F Values and Mean Scores for Errors, Lapses, and Positive Driver Behaviors on the Fear of Being Criticized

	Fear of Being Criticized			<i>F</i>	<i>df</i>	<i>p</i>
	Low	Moderate	High			
Errors	1.52 ^a	1.59 ^a	1.76 ^b	7.01	2, 286	.001
Lapses	1.56 ^a	1.66 ^{ab}	1.78 ^b	7.20	2, 286	.001
Positive Driver Behaviors	4.63 ^a	4.31 ^b	4.26 ^b	10.73	2,286	.000

Note: The mean values that do not share the same superscript on the same row were significantly different from each other.

3.3.6.2.5. Passenger's Assistance with Non-Driving Tasks and the Types of Passenger Differences for Driver Behaviors

In order to investigate how different levels of Passenger's Assistance with Non-Driving Tasks and the types of passengers differ in driver behaviors, 3 (Passenger's Assistance with Non-Driving Tasks: low, moderate, high) X 5 (types of passenger: Friend, Parent, Spouse/Lover, Boss and Coworker, and Child/Baby) between-subjects multivariate analysis of covariance (MANCOVA) was performed on five dependent variables: Aggressive Violations, Ordinary Violations, Errors, Slips and Lapses, and Positive Driver Behaviors). In the analysis, driver age, driver sex, and exposure (lifetime mileage) were treated as the control variables. With the use of Wilk's criterion, the combined DVs were significantly different by levels of Passenger's Assistance with Non-Driving Tasks (Wilk's $\Lambda = .92$, $F(10, 564) = 2.46$, $p < .01$, *partial*

$\eta^2 = .04$). However, there was no significant main effect of Type of Passenger (Wilk's $\Lambda = .94$, $F(20, 936) = .91$, $p = .580$, *partial* $\eta^2 = .02$). In addition, there was a significant interaction between these two variables on driver behaviors (Wilk's $\Lambda = .81$, $F(40, 1232) = 1.56$, $p < .05$, *partial* $\eta^2 = .04$).

Table 20. Univariate F Values and Mean Scores for Aggressive Violations on Passenger's Assistance with Non-Driving Tasks

	Passenger's Assistance with Non-driving Tasks			<i>F</i>	<i>df</i>	<i>p</i>
	Low	Moderate	High			
Aggressive violations	2.50 ^a	2.19 ^{ab}	2.11 ^b	5.14	2, 286	.006

Note: The mean values that do not share the same superscript on the same row were significantly different from each other.

A separate univariate analysis was conducted to investigate the impact of Passenger Assistance with Non-Driving Tasks on the individual DVs. Initially, Bonferroni adjustment was applied so that the critical alpha level was determined as .01 (i.e., .05/5). The results indicated that Aggressive Violations were significantly different for different levels of Passenger Assistance with Non-Driving Tasks ($F(2, 286) = 5.14$, $p < .01$, *partial* $\eta^2 = .04$). Univariate F values and mean scores for Aggressive Violations on Passenger's Assistance with Non-Driving Tasks could be seen in Table 20. Bonferroni post-hoc test for multiple comparisons revealed that compared to a high level ($M = 2.11$), a low ($M = 2.50$) level of Passenger Assistance with Non-Driving Tasks led to a higher frequency of Aggressive Violations. However, there is no significant difference between Passenger Assistance with Non-Driving Tasks at a moderate level, neither the high level nor the low level on Aggressive Violations.

A separate univariate analysis was conducted to investigate the impact of the interaction between Passenger Assistance with Non-Driving Tasks and the Type of Passengers on the individual DVs. Initially, Bonferroni adjustment was applied so that the critical alpha level was determined as .01 (i.e., .05/5). No significant effect was found for any DVs.

3.4. Discussion

3.4.1. General Discussion

The main aim of the current study was to investigate how driver-passenger interaction (Distraction and Mental Overload, the Sense of Responsibility, Proactive Contribution of Passengers, the Fear of Being Criticized, Passenger Assistance with Non-Driving Tasks) is related to driver behaviors (Aggressive Violations, Ordinary Violations, Errors, Slips and Lapses, and Positive Driver Behaviors). While doing this, first, it was aimed to focus on the concept of driver-passenger interaction in detail by determining its content via figuring out factors composing it. Afterward, the determined factors were analyzed in relation to driver behavior factors in different analyses by controlling the critical demographic and safety-related variables.

Although different previous studies have investigated the relationship between the presence of passengers and driver behaviors, the risk of being involved in an accident or risk of injury (Vollrath, Meilinger, & Krüger, 2002; Rueda-Domingo et al., 2004; Preusser Ferguson, & Williams, 1998; Braitman, Chaudhary, & McCartt, 2014), there was almost no research on whether the presence of passengers causes risky driver behaviors or contributes to driving safety. In other words, little information about what occurs within the vehicle exists. So, the study would be accepted as a pioneering contribution to the existing literature on in-vehicle interaction between drivers and passengers.

The Driver-Passenger Interaction Questionnaire (DPIQ) became the first questionnaire developed with this aim. To our knowledge, there are very few previous studies about driver-passenger interaction, but none of them studied that interaction in detail. For example, Fleiter, Lennon, and Watson (2010) conducted a study to investigate how different people (e.g., passengers, someone they know, or someone they do not know) affect the speed behavior of drivers. The findings showed that drivers drove slower because they considered the safety of their passengers as their responsibility. Since the mentioned study was conducted only on speeding behavior, it has led to the continuation of the literature gap about the effect of the presence of passengers on other driver behaviors, especially positive driver behaviors. Moreover, Hu, Xie, Han, and Ma (2012) conducted a study to examine the effects of different passenger types

(supervisors and friends) on angry driving. Likewise, the need for more information about other driver behaviors continues in that study, as it only focuses on angry driving.

In summary, it could be said that very few previous studies did not provide the literature with either a detailed understanding of the concept of driver-passenger interaction or its relationships with driver behaviors. The current study differs from the previous ones in that, it examined aberrant driver behaviors, such as violations, errors, slips, lapses, and positive driver behaviors, not focusing only on a specific one. As it is mentioned in detail in the following sections, the critical value of the present study could be observed from the detail analyses results showing the relationships between driver-passenger interaction and driver behaviors.

3.4.2. Evaluations of the Findings

The following sections discussed general findings about the DPIQ and its factors, passenger demographics, and the relationship between study variables. Moreover, the evaluations of the main analysis findings, Hierarchical Regression Analyses, and MANCOVAs, were mentioned in order to examine the relationship between the driver-passenger interaction and driver behaviors. Finally, critical remarks, implications of the study, and recommendations for future studies were presented.

3.4.2.1. Structure and Content of the DPIQ

Before examining the relationship between the driver-passenger interaction and driver behaviors, the factors of the questionnaire should be discussed with their descriptive characteristics.

First, since the DPIQ was the first tool to measure driver-passenger interaction based on different aspects of this interaction, the factor analysis was performed to test the proposed factor structure. As a result of the factor analysis, although the factor structure was compatible with the proposed model, the 6-factor structure in the proposed model decreased to five. "Distraction" and "Mental Overload" were not separated in the factor structure and were used as a single factor. Even though these two concepts were different cognitive processes, such a result may have been obtained because of their close psychological origins. For example, the workload can be

described as information processing limited capacity (Gaillard & Kramer, 2000), while distraction relates to the division of attention (Stutts et al., 2005). However, it can be a distraction due to mental overload (Ruscio, Bos, & Ciceri, 2017). In other words, when faced with too many stimuli while driving (for example, the activation of multiple alarms in-vehicle warning systems at similar times), attention may be diverted to activities other than driving (for example, being unable to pay attention to the road while trying to turn off the vehicle warning system alarms and nearly colliding with another vehicle). Therefore, it was also significant in the literature that "Distraction" and "Mental Overload" cannot be separated and used as a single factor.

According to the findings, having a passenger in the car can moderately distract and mentally overload the driver. The results were consistent with the studies on whether passengers cause distracted driving. For example, in McEvoy, Stevenson, and Woodward's (2006) study, passengers were among the top five causes of distraction for drivers. Consistent with the present study, it can be deduced that it causes distraction for the passengers, but not at a very high rate. For example, adjusting in-vehicle equipment is more of a distraction for the driver than the passenger (Stutts et al., 2001). In addition, studies in the literature indicated that young drivers and passengers are more distracted driving due to interaction verbally (Sullman, 2012; Toxopeus, Ramkhakawabsingh, & Trick, 2011). Since the average age of the participants in the current study (mean age 33) was not very low, distraction and mental overload may have been moderate.

The DPIQ had another aspect related to a sense of responsibility. The research showed that the presence of the passenger resulted in a strong feeling of accountability. Studies, both qualitative and quantitative, have also indicated that drivers perceive themselves as responsible for ensuring the safety of their passengers (Rosenbloom & Perlman, 2016). It was found that they made fewer violations and obeyed traffic rules more because of a sense of responsibility (Taubman-Ben-Ari, & Noy, 2011). Moreover, it was stated that the sense of responsibility is higher if the passenger is familiar (Fleiter, Lennon, & Watson, 2010). Notably, most passengers in the current study were close relations, such as spouses, parents, children, and friends. As a result, it is significant that the sense of responsibility was high.

The findings indicated that having a passenger present resulted in an increased level of proactive involvement from the passenger. This means they helped promote safe driving by alerting the driver about potential road hazards like potholes or defects, pointing out other drivers' traffic mistakes, and reminding the driver to follow speed limits (Charlton, & Starkey, 2020). Furthermore, the research on the DPIQ revealed that the presence of a passenger caused a moderate level of apprehension regarding potential criticism. Peer pressure and the fear of being criticized as a bad or novice driver by the passenger are often adequate for young drivers (Weston & Hellier, 2018; Bingham et al., 2016). Hence, it is reasonable to conclude that the present research showcased a relatively low level of apprehension towards being offended, given that the participants' average age did not predominantly comprise young drivers.

Finally, the findings indicated that when passengers were present, they provided significant help with non-driving tasks, which was the final aspect of the DPIQ. For example, passengers can assist the driver by answering their phone or adjusting the radio and air conditioning. According to various studies, it has been found that passengers who assist with non-driving tasks can significantly contribute to safer driving (Geyer, & Ragland, 2004; Charlton, & Starkey, 2020). This indicates that having an additional pair of eyes and hands to help with tasks such as navigation, changing the radio station, or monitoring blind spots can help reduce the risk of accidents on the road. Overall, it appears that collaboration between the driver and passengers can lead to a more secure and comfortable driving experience for everyone involved.

3.4.2.2. Evaluating the Results of the Descriptive Analyses

The Bivariate Correlation Analyses were conducted to explore the relationships between study variables. Age was positively related to positive driver behaviors and perceptual-motor skills; on the other hand, it was negatively related to ordinary violations, the sense of responsibility, and passenger assistance with non-driving tasks. This means that as individuals' age, they tend to display more favorable driving habits and possess superior perceptual-motor abilities. Studies in the literature showed that perceptual-motor skills improved with practice and training (Elander, West, & French, 1993). As individuals progress in age and acquire more experience, their perceptual-

motor abilities typically enhance. On the other hand, as drivers age, the frequency of ordinary violations, the tendency of the sense of responsibility, and perceived passenger assistance with non-driving tasks decrease. Studies, especially those for child passengers, have shown that many engage in less risky behaviors because drivers feel their passengers' safety is their responsibility (Rosenbloom & Perlman, 2016). Since the probability of traveling with a child passenger decreases with age, it may be expected for the sense of responsibility to decrease. In addition, with practice and age, automation of car-handling skills may increase (Fisher, Pollatsek, & Pradhan, 2006). Thus, unlike novice drivers, drivers can more efficiently allocate their physical and mental capacities to non-driving activities as they do things related to driving more automatically (Sagberg & Bjørnskau, 2006). In this case, drivers' propensity to seek assistance from passengers in non-driving tasks may decrease with age. Moreover, exposure (lifetime mileage) was positively related to ordinary violations, errors, and perceptual-motor skills. As the drivers' lifetime mileage (km) increases, the tendency to ordinary violations, errors, and perceptual-motor skills would increase. On the other hand, as the drivers' lifetime mileage increases, safety skills and passenger assistance with non-driving tasks decrease as well.

The Point-biserial Correlation analyses were performed to investigate the relationship between study variables and driver's sex, passenger's sex, preference of passenger, and whether the passenger's presence is positive or negative. The results showed that being female was associated with feeling more fear of being criticized, less frequency of ordinary violations, more frequency of slips and lapses, and more perceptual-motor skills. In the literature, the study conducted by Spolander (1983) showed consistent findings that males overrate their driving skills. In other words, being male was associated with higher perceptual-motor skills (Özbay, 2017). In addition, the study by Dillon and Dunn (2005) found that male drivers did not think there was a problem when their passengers complained. The fact that male drivers both believe that their perceptual-motor skills are good and that there is nothing more severe than what their passengers say may cause their fear of being criticized less than females. Furthermore, traveling with female passengers was related to feeling more fear of being criticized. This may be because a study found that females make more accurate predictions of possible harm in risky traffic situations (Eagly & Steffen, 1986). Therefore, when

traveling with a female passenger, females may be more comments about driving, which can lead to the drivers feeling more fear of being criticized.

The findings indicated that driver behaviors and driver-passenger interaction aspects are related to each other. Such that a negative relationship between aggressive violations and the proactive contribution of passengers and passengers' assistance with non-driving tasks was observed. When passengers become more proactive and alert drivers about potential dangers like roadworks or potholes that suddenly appear on the road or notify drivers when they exceed the speed limit, it can help reduce aggressive driving violations. Studies have also shown that having passengers in the car can have a calming effect on drivers. This is evidenced by decreased aggressive behaviors such as abrupt lane changes, honking, and passing on the shoulder (Shinar & Compton, 2004). Similarly, there was a positive relationship between ordinary violations and the proactive contribution of passengers. In addition, ordinary violations are positively related to the fear of being criticized. It can be said that the fear of being criticized increases, and the tendency to commit ordinary violations increases. Researchers have explored the connection between a driver's emotions of stress, anxiety, or fear while driving and their driving behavior in literature (Kontogiannis, 2006; Panayiotou, 2015). The current study is crucial as it sheds light on the relationship between fear of criticism and violations, despite the absence of any direct studies investigating this connection between driver behaviors and fear of criticism.

Regarding the variable of errors, there were correlations between distraction, mental overload, and the fear of criticism. That is, it can be said that as the distraction and mental overload, and the fear of being criticized increase, the frequency of errors increases. In certain situations, drivers may experience difficulty noticing traffic signs on the road due to potential distractions, such as holding conversations with passengers (Precht, Keinath, & Krems, 2017b). Such incidents can be viewed as instances of cognitive failure or error. In addition, it is worth noting that a driver's apprehension regarding potential criticism from their passenger may result in heightened nervousness while operating a vehicle. This, in turn, can lead to an increased likelihood of errors or mistakes while driving. This relationship underscores the significance of acknowledging the link between the fear of criticism and its potential impact on performance. Furthermore, the results indicated that slips and lapses were positively

related to distraction and mental overload, the sense of responsibility, the fear of being criticized, and passenger assistance with non-driving tasks. This means that the mentioned variables would increase with the frequency of slips and lapses. Similar to errors, it was expected that distraction and mental overload, and the fear of being criticized were positively related to cognitive failures because nervously/anxious driving can be caused more failure (Haustein, Humpe, & Gössling, 2022).

Concerning positive driver behaviors variables, there was a negative relationship with the fear of being criticized. On the other hand, positive driver behaviors were positively related to the passengers' sense of responsibility and proactive contribution. The literature states that drivers showed less risky behaviors because they felt the safety of passengers was their responsibility (Aldridge et al., 1999; Engström, Gregersen, Granström, & Nyberg, 2008; Nakagawa & Park, 2014). Similarly, this current study found that the frequency of positive driver behaviors increases as the sense of responsibility increases.

The results showed that the factors of DPIQ were related to each other. Distraction and mental overload were positively related to the fear of being criticized. That is the distraction and mental overload increase as the tendency of the fear of being criticized increases. In situations where driving on roads with mentally taxing conditions is required, it is crucial to recognize that anxiety can have a deleterious effect on cognitive load and consume a significant portion of our working memory capacity (Wong, Mahar, & Titchener, 2015). In this context, the increased anxiety caused by fear of being criticized causes increased distraction and mental overload. In addition, the sense of responsibility was positively related to the proactive contribution of passengers and passengers' assistance with non-driving tasks. It can be said that increases in the sense of responsibility, as increases in the proactive contribution of passengers and passengers' assistance with non-driving tasks. All three of these factors are associated with the positive consequences of the passenger's presence. At last, concerning the proactive contribution of passenger variable, there was a positive relationship between passengers' assistance with non-driving tasks. That is, it can be said that the tendency for the proactive contribution of passengers increases, and passengers' assistance with non-driving tasks increases. Studies indicate that passengers are more inclined to intervene with tasks related to driving when they

perceive a sense of insecurity or danger (Kaye et al., 2022; Basse, Twisk, & Kaye, 2020). It is expected that the passengers who prioritize safety contribute proactively and help the driver in non-driving tasks so that the driver does not deal with things other than driving and does not endanger his safety.

Finally, a Chi-square analysis was done in order to examine the relationships between the driver's sex and the passenger's sex, the preference of the passenger, and attitudes toward the passenger. The analysis showed that female drivers prefer to drive without passengers; on the contrary, male drivers prefer to drive with passengers. Furthermore, both female and male drivers evaluated driving with passengers as positive. However, male drivers found the presence of passengers more positive than female drivers. There may be several reasons females prefer driving without passengers more than males. For example, females generally had less lifetime mileage for all age groups (Kweon & Kockelman, 2003). This means that male drivers were exposed to driving more frequently than females. It is possible that females rated their perceptual-motor skills lower than males (Spolander, 1983; Lajunen & Summala, 1995). The current study found that stronger perceptual-motor skills were associated with more positive attitudes toward the presence of passengers in the vehicle. Based on the given information, it is possible that females tend to avoid driving with passengers because they perceive their perceptual-motor skills to be less than that of males.

3.4.2.3. Evaluating the Relationships between the Main Variables of the Study: Hierarchical Regression Analyses

Five hierarchical regression analyses were performed to examine the relationship between the DPIQ factors and the DBQ factors. In these analyses, no significant relationship was found between the DPIQ factors and aggressive and ordinary violations. Discussion of the relationships between the DPIQ factors and error, slips and lapses, and positive driver behaviors factors of driver behaviors were mentioned.

The relationship between the DPIQ factors and errors was investigated after controlling for the statistical effects of age, sex, lifetime mileage, types of passengers, perceptual-motor skills, and safety skills. The results indicated that the fear of being criticized was positively related to errors, consistent with the literature. For example, a study conducted by Taylor and Deane (2000) found that the fear of being criticized

for performing poorly while driving was the most common fear for drivers. In fact, 51% of the participants stated that they had moderate to high anxiety levels due to the fear of being criticized. In addition, there is a positive relationship between anxious driving and more frequent errors (Matthews et al., 1998; Kontogiannis, 2006; Clapp et al., 2011). In other words, anxious driving increases as the frequency of performance errors, such as using incorrect lanes and improper speed adjustment, increases (Taylor, Deane, & Podd, 2007). In light of this information, the fear of being criticized could be caused make more errors due to anxious driving. The present study contributed by showing that previously evidenced relationships still exist even when controlling the statistical effect of types of passengers and driver skills. This means that it can be said that the fear of being criticized, regardless of who the passenger is, increases the frequency of errors. In addition, there is a negative relationship between errors and driver skills, such as perceptual-motor and safety skills (Martinussen, Møller, & Prato, 2014). So, the increases in driver skills, as the decreases in the frequency of errors. However, although these driving skills' statistical effects were controlled, the fear of being criticized can be led to increases in the frequency of errors.

The current study analyzed the correlation between DPIQ factors and slips and lapses while controlling the statistical effects of variables such as age, gender, lifetime mileage, passenger types, perceptual-motor skills, and safety skills. This study aims to provide valuable insights into the interplay between these variables and their impact on driving performance. The findings showed that distraction, mental overload, the fear of being criticized, and passenger assistance with non-driving tasks positively related to slips and lapses. As mentioned in the previous parts, slips can be described as attention-related failure, while lapses can be described as memory-related failure (Mattsson, 2012). Therefore, slips and lapses have already contained distraction and mental overload as context. For example, when the item, "not being able to notice the pedestrians crossing the street while turning from the main road to a street," which is related to the slips and lapses factor, is examined, it can be said that the reason for this is distraction or inattention. In addition, many studies revealed that distraction has positively related to slips and lapses (Reason et al., 1990; Jin, Guo, Jiang, & Hua, 2021; Koustamaï, Boloix, Elslande, & Bastein, 2008). Therefore, slips and lapses are expected to be positively associated with distraction and mental overload. The other positive relationship between slips and lapses and the fear of being criticized is also

expected because slips and lapses were positively related to anxiety. For example, the findings of a study showed that drivers with high and medium levels of anxiety tend to have a higher frequency of Slips and Lapses (Shahar, 2009). Another study has shown that young drivers experience higher anxiety levels, which can lead to more slips and lapses while driving (Lucidi et al., 2010). As mentioned before, the fear of being criticized can cause an increase in the level of anxiety (Taylor & Deane, 2000). Therefore, it is possible to argue that the fear of criticism can lead to anxiety, which in turn can cause more frequent slips and lapses. It can be deduced that the anxiety trait mediates the relationship between slips and lapses and the fear of being criticized. At final, interestingly, there was a positive relationship between the passenger's assistance with non-driving tasks and slips and lapses. One possible reason for this could be that the driver is not entirely focused on driving while the passenger engages in non-driving activities. In other words, being too active while assisting with non-driving tasks may affect the mental processes of the driver, resulting in an increased frequency of slips and lapses.

After controlling the statistical effects of factors such as age, sex, lifetime mileage, types of passengers, perceptual-motor skills, and safety skills, the correlation between DPIQ factors and positive driver behaviors was examined. The results indicated that one of the DPIQ factors negatively related to positive driver behaviors was the fear of being criticized. On the other hand, the findings indicated that the sense of responsibility was positively related to positive driver behaviors. These findings were expected because the positive effect of the presence of passengers has been found by many studies (Lee & Abdel-Aty, 2008; Rueda-Domingo et al., 2004; Vollrath, Meilinger, & Krüger, 2002), and one of the reasons for this protective effect is that the driver feels the safety of the passenger under her responsibility (Rosenbloom, & Perlman, 2016). For example, it was found that the accident risk of a driver with a child passenger between the ages of 4 and 15 is %25 less than a driver without a passenger (Rueda-Domingo et al., 2004). In addition, it has been reported that most drivers do not drive after drinking alcohol if a child passenger is in the vehicle (Romano et al., 2019). This means that the reason for the child passenger's protective effect despite the distraction effect may be that the driver feels a sense of responsibility. In addition, the findings of a study indicated that the number of passengers increases as the frequency of violations decreases (Rosenbloom &

Perlman, 2016). Similarly, as the number of passengers increases, the driver's sense of responsibility may increase, resulting in an increased frequency of positive driver behaviors.

In summary, the findings of this study provide valuable insights into the relationships between errors, slips, lapses, positive driver behaviors, and DPIQ factors. The fear of being criticized was found to be associated with increased errors and decreased positive driver behaviors, while slips and lapses were influenced by factors such as distraction, mental overload, and passenger assistance with non-driving tasks. These findings contribute to a better understanding of the psychological and situational factors that impact driving performance. In addition, the fear of being criticized was found to be negatively associated with positive driver behaviors, while the sense of responsibility was positively related to such behaviors. These findings highlight the importance of addressing the psychological factors that impact driving performance and promoting a supportive and non-judgmental driving environment.

3.4.2.4. Evaluating the Relationships between the Main Variables of the Study in More Detail: The MANCOVA Analyses

Different MANCOVA analyses were conducted to determine whether the relationship between the DPIQ factors and driver behaviors changes based on different types and/or levels of these variables and types of passengers. The DPIQ is divided into three categories for each factor: low, medium, and high. The present study indicated that regardless of who the passenger is, drivers experiencing high levels of distraction and mental overload had a higher frequency of errors than low levels of distraction and mental overload. On the other hand, regardless of who the passenger is, drivers were likelier to have a frequency of slips and lapses when distraction and mental overload are at high levels compared to moderate and low levels. Distraction can be said to be three-dimensional: visual (e.g., taking your eyes off the road, looking at the passenger), physical (e.g., not holding the steering wheel, physical interaction with the passenger, holding hands with the passenger partner), and cognitive (e.g., taking your mind off driving, discuss with the passenger) (National Highway Traffic Safety Administration, 2012). For example, merely glancing at a passenger could be classified as a minor distraction due to its visual nature, resulting in fewer errors. Conversely, both visual

distractions (such as looking at the passenger) and cognitive distractions (such as arguing with the passenger) can cause higher levels of distraction, leading to more lapses or errors in cognitive processing (Overton et al., 2015). Distinguishing between errors and lapses attributed to distraction and mental overload involves recognizing that moderate levels of these factors significantly differ from low and high levels in terms of slips and lapses. This may be because distractions arising from interaction with the passenger differ from other distraction factors. Since the passengers are also in the vehicle, they share the responsibilities of the traffic environments with drivers and can prevent the driver's distraction by ending the conversation in demanding traffic environments (Bavelas, Coates, & Johnson, 2000). Since slips and lapses are less risky for traffic safety than errors (Reason et al., 1990), as the traffic situations where the driver made an error can be detected more easily by the passenger, it may be more common for the passenger to terminate the conversation. On the other hand, minor memory failures as lapses, such as forgetting the route traveled, are not perceived as dangerous by the passenger, so the passenger may continue to interact with the driver and cause a moderate distraction.

When examining the connection between sense of responsibility levels and various passenger types on driver behavior, it was found that drivers with high levels of sense of responsibility were more likely to exhibit positive driver behaviors, regardless of the passenger's identity. This trend was observed compared to drivers with low or moderate levels of sense of responsibility. In addition, a low level of proactive contribution of passengers led to higher aggressive and ordinary violations compared to moderate and high levels of proactive contribution of passengers. In the literature, it was found that drivers with at least one passenger had less frequency of violations than drivers without passengers, based on crash data (Orsi et al., 2013); or on simulated driving (Chung et al., 2014); or on observation of naturalistic driving (Rosenbloom, & Perlman, 2016). The current study differs from other literature studies on this subject by also explaining how the presence of passengers can decrease the frequency of driver violations. Based on the results of the study, it can be concluded that passenger involvement proactively reduces violations. For instance, passengers may inform drivers when speed limits are exceeded or encourage them to follow traffic rules. In addition, according to Haddon's Matrix (1972), when examining the environmental factor, which is one of the three factors of accidents, that is, the effect of passengers

on the human factor, which is another factor, it should be considered whether there will be differences before, during, and after the accident. Considering the driver-passenger interaction dimensions examined in this study, the driver-passenger interaction is related to the pre-accident. For example, the proactive contribution of a passenger may be effective in preventing the accident before the accident, or the distraction and mental overload is related to the pre-accident as an element that increases the risk of the accident. In other words, the driver-passenger interaction scale focuses on pre-accident.

Considering the relationship between the levels of fear of being criticized and different passenger types on driver behaviors, regardless of who the passenger is, a high level of fear of being criticized cause a more likely frequency of errors rather than low and moderate levels. In addition, the results of the current study showed that a high level of fear of being criticized cause a more likely frequency of lapses compared to a low level of fear of being criticized. Moreover, the low level of fear of being criticized cause a more likely frequency of positive driver behaviors than a moderate and high level of fear of being criticized. The fear of being criticized may lead to anxiety levels rising, deteriorating performance rather than improving it (Rosenbloom et al., 2007). Therefore, as the fear of being criticized increases, the frequency of aberrant driver behaviors, such as errors and lapses, increases, while the frequency of positive driver behaviors decreases. Social facilitation theory is one of the theories used in social psychology to explain this situation (Zajonc, 1965). This theory argues that the existence of someone, that is, being observed or being watched, causes a change in people's behaviors. In addition, the theory states that the presence of someone improves performance if the task is familiar and easy and deteriorates performance if the task is complex and challenging (Cottrell, 1972). Considering that driving is a complex task because traffic situation requires multi-dimensional skills such as motor skills, attention, knowledge of traffic rules, handling, and the presence of others with the fear of being criticized can cause poor performance (i.e., Non-intentionally aberrant behaviors such as errors and lapses).

The last MANCOVA analysis was conducted to investigate the relationship between the levels of passenger assistance with non-driving tasks and different passenger types on driver behaviors. The findings indicated that regardless of who the passenger is,

compared to a high level, the low level of passenger assistance with non-driving tasks brought about a higher frequency of aggressive violations. This may be because when the passenger helps the driver in non-driving tasks, the driver can reduce the stress level by not dealing with these activities. So, as the stress level decreases, less frequent aggressive driver behaviors and aggressive violations occur. In the literature, many studies indicated that frustrating conditions such as traffic congestion are strongly related to aggressive behaviors in traffic (Shinar, 1998; Sleet, 1996; Parker, Lajunen, & Stradling, 1998). In light of this information, assisting the passenger in non-driving tasks can keep the frustration level low for drivers.

After conducting multiple MANCOVA analyses, it was found that there was no distinction in driver behaviors based on the passenger types. Likewise, no interaction effect was observed between driver-passenger interaction and passenger types on any driver behaviors. The reason for this may be because most of the types of passengers (i.e., friends, parents, siblings, and spouse/partners) included in the present study are the ones who have an intimate relationship with the driver. It is possible that there was no discernible difference in the driving behavior of individuals based on the passenger type they were traveling with.

In the scenario where a passenger is not well-known to the driver, it would be possible to observe different results on whether the type of passenger might create differences in driver behaviors. For example, peer pressure is commonly perceived when one is afraid of being criticized. According to Weston and Hellier (2018) and Bingham et al. (2016), this is a common occurrence. However, being criticized by someone unfamiliar to the individual may induce less anxiety. On the other hand, in situations where a driver is accompanied by a passenger with whom they have established a trust-based relationship, they may experience an increased sense of duty toward ensuring the passenger's safety and comfort. However, when driving with an unfamiliar passenger who lacks an established history of trust and familiarity, the driver may not feel the same level of responsibility toward the passenger (Fleiter, Lennon, & Watson, 2010). Due to such differences, the effect of passenger type may not have been observed. However, researchers face a significant challenge in identifying drivers who transport passengers they are not familiar with. This is primarily due to the limited availability of car-sharing platforms that facilitate the connection of foreign travelers or

hitchhikers with route-matching capabilities within our country. Therefore, while it is possible for a stranger to travel as a passenger, it is not typically the most common occurrence.

3.4.2.5. Combining the Hierarchical Regression and MANCOVA Results

In the current study, both hierarchical regression and MANCOVA analyses were conducted. Regression analysis only shows the relationship between one dependent and independent variable. At the same time, MANCOVA controls for the effects of multiple independent variables and assesses their combined effects on the dependent variable. Additionally, MANCOVA considers the correlations between independent variables, which can be overlooked in regression analysis. In addition to regression analyses, MANCOVA analyses were conducted to examine driver-passenger interaction at different levels and the impact of different passenger types on driver behaviors. According to the results obtained, it is stated in regression results that as the fear of being criticized increases, errors also increase. However, MANCOVA added into that the results vary at different levels of fear of being criticized. The identification of differences in fear of being criticized for both slips and lapses and errors at its higher levels compared to the effects on lower levels through MANCOVA analyses, as opposed to regression analyses, may allow us to make the following inference: When the fear of being criticized is at high levels, its effect becomes more pronounced.

Indeed, fear of being criticized can lead to stress and anxiety, potentially resulting in increased errors and slips and lapses during driving. A lack of self-confidence or distrust in driving skills can also contribute to this effect. Therefore, in this study, driving skills were controlled for in regression and MANCOVA analyses. This implies that regardless of whether driving skills are excellent or poor if the fear of being criticized is high, there is a higher frequency of errors, slips, and lapses. The results suggest that fear of being criticized significantly impacts driving behavior, independent from the driver's skill level.

Other intriguing results demonstrate that passengers' prosocial behaviors influence driver behavior. The fact that neither aggressive nor ordinary violation was significantly related to the DPIQ factors in the regression analysis might suggest that

these factors were insufficient to explain the dependent variable. However, in the MANCOVA results, it was observed that a low level of passenger assistance with non-driving tasks and proactive contribution of the passenger led to more violations, indicating that the dosage of prosocial passenger behavior significantly affects driver behavior. Furthermore, the results indicate that when prosocial behaviors are performed "too little" or "too much," they result in a notable change in the frequency of violations. However, when performed at a moderate level, there was no significant difference in violation frequency. This suggests that prosocial behaviors do not impact driver behavior when a moderate level is executed.,

When looking at the results of regression and MANCOVA in general, it is possible to evaluate the factors of DPIQ as having a positive and a negative effect. As indicated in Figure 3, DPIQ has three positive interactions (Passenger's Assistance with Non-Driving Tasks, Proactive Contribution of Passenger, and Sense of Responsibility) and two negative interactions (Distraction and Mental Overload and Fear of Being Criticized) factors. In neither Regression nor MANCOVA analyses, it was observed that the nature of the factors being based on positive or negative interaction did not reflect on the results in a particular pattern. For example, fear of being criticized, a negative interaction, is associated with errors. However, slips and lapses did not relate to the fear of being criticized. Thus, it has been seen that the positive or negative nature of the driver-passenger interaction concept will not change anything regarding how it can affect behavior.

These findings highlighted the potential influence of passenger behavior on driver performance during driving and underscore the importance of managing prosocial behaviors carefully. Understanding and considering such effects could be crucial for enhancing traffic safety and promoting positive driver behavior.

3.4.3. Critical Remarks

There are some critical methodological issues to discuss regarding the present study. The first one is a self-reported method of data collection. A significant drawback of this approach could be the presence of social desirability bias (Paulhus, 1991). Social desirability bias is described as the tendency of participants to choose responses that they believe are more socially acceptable rather than their attitudes or beliefs (Grimm,

2010). However, it has been suggested that the social desirability bias may be more prevalent when the researcher and participant are in direct physical contact (Grimm, 2010). In the current study, the online collection of measurements slightly reduces this bias.

3.4.4. Implications of the Study and Recommendations of the Future Study

There are some critical implications of the present study, based on its findings and the pioneering role in understanding the nature of driver-passenger interaction concept. Developing a new scale for driver-passenger interaction has several implications for the theoretical approach. Firstly, this study is unique because it uses the combination of both qualitative and quantitative ways of data collection in different steps of it. Furthermore, the scale provided a new way to measure the complex and multifaceted concept of driver-passenger interaction. This was used to study the relationship between driver-passenger interaction and various driving behaviors, such as violations, errors, slips and lapses, and positive driver behaviors. Moreover, the scale can potentially be used to study different passenger types, such as children, older people, and passengers with disabilities. This could help identify specific passenger groups at risk for being involved in traffic crashes. Furthermore, the scale can be utilized to create new strategies for enhancing communication between drivers and passengers and decreasing the likelihood of traffic accidents.

From an applied perspective, the results of the current study could be used to prepare a safety campaign both to increase the positive effects of passenger presence on driver behaviors and to decrease the negative effects of passenger presence on driver behaviors. For example, one of the results of this study is that a high level of sense of responsibility increases the frequency of positive driver behaviors. Based on this data, broadcasting public service announcements will enhance drivers' positive behavior and positively impact traffic safety. These announcements will encourage drivers to take responsibility for the safety of their passengers by cultivating a safety-first mindset. Also, it has been found that when passengers do not contribute proactively, there is a higher likelihood of aggressive violations. Based on this information, developing a safety campaign intended for passengers would be appropriate. For instance, safety campaigns can be conducted to promote safe driving practices by highlighting the

importance of passenger safety and raising awareness about potential hazards on the road. These campaigns aim to educate drivers on the potential dangers they may encounter while driving and encourage them to take necessary precautions to avoid accidents.

It is possible to create training programs for passengers. For example, informing the passengers of actions that lead to distraction or mental overload can reduce the frequency of errors and lapses. It is essential to mention the role of assisting in non-driving tasks during passenger training programs and being a co-pilot during driving instead of just being present in the vehicle. In addition, drivers can receive psychological assistance to help lessen the effects of fear regarding criticism of their driving behaviors.

To improve the usefulness of the DPIQ, it would be advantageous to expand its application beyond a single sample and nationality. This would increase its statistical, theoretical, and practical strength. For instance, it collects data from different cultures to see the scale's cross-cultural applicability. It is also recommended to use the DPIQ when examining the effect of the presence of passengers on driver behaviors for other driver groups, incredibly professional drivers such as taxi, bus, and minibus drivers. It is thought that examining variables such as professional drivers' sense of responsibility towards unfamiliar passengers, whether the passengers make a proactive contribution to the drivers they only board for transportation and are not familiar with, or whether passenger help in non-driving tasks will contribute to the literature.

3.5. Conclusion

The present study serves as a valuable contribution to the current body of literature by introducing the novel concept of driver-passenger interaction and identifying and exploring sub-concepts within this overarching theme. The recent study has made significant strides in the field by introducing a novel scale that quantifies driver-passenger interaction. This marks the first time such a scale has been developed, and its introduction could prove to be a valuable tool for future research. Effective communication and interaction between the driver and passenger are essential. The mere presence of a passenger in the car is not enough; how the driver perceives and engages with the passenger can significantly influence their behavior in various traffic

situations. Therefore, it is crucial to maintain a positive and respectful exchange between the driver and passenger to ensure safe and responsible driving practices. The current study is crucial as it seeks to analyze and evaluate the effects of driver-passenger interaction on driver behaviors. As a result, it showed that, with the newly defined construct of the driver-passenger interaction, it is obvious that different type and levels of interaction are related to different driver behaviors. In addition to its theoretical contribution to the literature, this research holds potential implications for the transportation industry as well, by providing valuable insights into possible ways to enhance safety and improve overall driving practices.



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APPENDICES

APPENDIX A

ETHICAL PERMISSION FOR INTERVIEW

UYGULAMALI ETİK ARAŞTIRMA MERKEZİ
APPLIED ETHICS RESEARCH CENTER



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14 OCAK 2022

Konu : Değerlendirme Sonucu

Gönderen: ODTÜ İnsan Araştırmaları Etik Kurulu (İAEK)

İlgi : İnsan Araştırmaları Etik Kurulu Başvurusu

Sayın Doç.Dr. Bahar ÖZ

Danışmanlığımı yürüttüğünüz İrem ÖZBAY'ın "Farklı Yolcu Tiplerine Göre Sürücü ile Yolcu Arasındaki Etkileşim Vasıtasıyla Sürücü Davranışlarının Farklılaşmasının İncelenmesi" başlıklı araştırmanız İnsan Araştırmaları Etik Kurulu tarafından uygun görülmüş ve 0046-ODTÜİAEK-2022 protokol numarası ile onaylanmıştır.

Saygılarımızla bilgilerinize sunarız.



Prof.Dr. Mine MISIRLISOY
İAEK Başkan

APPENDIX B

SEMI-STRUCTURED INTERVIEW FORM

YARI YAPILANDIRILMIŞ GÖRÜŞME FORMU

Demografik Bilgiler

Cinsiyetiniz: _____

Yaşınız: _____

Kaç yıldır ehliyetiniz var? _____

Geçtiğimiz yıl ortalama kaç km araç kullandınız? _____

Sürücü-Yolcu Etkileşimine Dair Yarı Yapılandırılmış Mülakat Soruları

Bu mülakat, sürücü ile yolcu arasındaki etkileşimin genel anlamda olumlu mu yoksa olumsuz mu olduğunu ve nasıl farklılaştığını belirlemek için hazırlanacak Sürücü-Yolcu Etkileşimi ölçeğine ön hazırlık olması için yapılmaktadır. Aşağıdaki soruları lütfen kendinize göre içtenlikle cevaplayınız. Soruların tek bir doğru cevabı yoktur. Konu hakkında genel bir fikir edinme ve bilgi edinme amacıyla yapılmaktadır.

1. Araçta yolcu ile seyahatlerinizi düşündüğünüzde, yolcunun sürücü davranışlarınızı genellikle nasıl etkilediğini düşünüyorsunuz?

2. Araçta yolcu ile seyahatlerinizi düşündüğünüzde, yolcunun sürücü becerilerinizi genellikle nasıl etkilediğini düşünüyorsunuz?

3. Araç içinde yolcu ile seyahat ederken, yolcu ile ne tür etkileşimleriniz olur?

4. Araçtaki yolcunun “kim” olduğu sürücü davranışlarınızı ve becerilerinizi etkiler mi? Nasıl?

5. Araçta yolcunun varlığının, sürüş dışı işler için (araç içi ekipmanların kullanımı, bir şeyler atıştırmak, telefonlarıma cevap verilmesi vs.) size herhangi bir yardımı olur mu? Nasıl?

6. Araçtaki yolcunun varlığı potansiyel riskleri veya tehlikeleri fark etmeniz konusunda fark yaratır mı? Nasıl?

7. Araçta yolcu varken, onların güvenliğinin sorumluluğunu hissediyor musunuz?

a) Cevap “Evet” ise, bu sorumluluk duygusu sürücü davranışlarınızı nasıl etkiliyor?

b) Cevap “Hayır” ise, neden böyle düşünüyorsunuz?

8. Araçta yolcu ile seyahat etmek dikkatinizi etkiler mi? Nasıl?

9. Yolcu ile seyahat etmek zihinsel yoğunluğunuzu etkiler mi? Nasıl?

10. Araçta yolcu ile seyahat ederken, sürücü davranışlarınıza dair eleştirileceğinizi düşünüyor musunuz? Neden? Bu durum davranışlarınızı nasıl etkiler?

APPENDIX C

ETHICAL PERMISSION

UYGULAMALI ETİK ARAŞTIRMA MERKEZİ
APPLIED ETHICS RESEARCH CENTER



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Saygılarımızla bilgilerinize sunarız.



Prof.Dr. Mine MISIRLISOY
İAEK Başkan

APPENDIX D

INFORMED CONSENT FORM

GÖNÜLLÜ KATILIM FORMU

Bu çalışma Orta Doğu Teknik Üniversitesi (ODTÜ) Trafik ve Ulaşım Psikolojisi Doktora Programı öğrencisi İrem ÖZBAY tarafından, Psikoloji Bölümü öğretim üyelerinden Doç. Dr. Bahar ÖZ danışmanlığında yürütülmektedir. Çalışmanın amacı, farkı yolcu tiplerinin (anne/baba, eş/sevgili/partner, çocuk, arkadaş, yabancı vs.) sürücü ile etkileşimleri ile sürücü davranışlarının nasıl farklılaştığını araştırmaktadır. Çalışmada kimlik belirleyici hiçbir bilgi istenmemektedir. Anket cevapları gizli tutulacak ve sadece araştırmacılar tarafından değerlendirilecektir. Elde edilecek bilgiler sadece bilimsel yayımlarda kullanılacaktır. Katılım tamamıyla gönüllülük esasına dayalıdır.

Çalışma genel olarak kişisel rahatsızlık verecek bir etkileşim içermemektedir. Ancak, katılım sırasında herhangi bir nedenden ötürü kendinizi rahatsız hissederseniz çalışmayı bırakmakta serbestsiniz. Çalışmanın sonunda, bu çalışmayla ilgili sorularınız cevaplanacaktır. Çalışma hakkında daha fazla bilgi almak için İrem ÖZBAY [REDACTED] ile iletişim kurabilirsiniz.

Bu çalışmaya tamamen gönüllü olarak katılıyorum ve istediğim zaman yarıda kesip çıkabileceğimi biliyorum. Verdiğim bilgilerin bilimsel amaçlı yayınlarda kullanılmasını kabul ediyorum. (Formu doldurup imzaladıktan sonra uygulayıcı geri veriniz).

Bu çalışmaya ehliyeti olan ve araç kulanmış veya kullanıyor olan kişilerin katılması uygundur.

İsim Soyadı

Tarih

İmza

----/----/----

APPENDIX E

DEMOGRAPHIC INFORMATION FORM

Demografik Bilgi Formu

1. Yaşınız: _____
2. Cinsiyetiniz: ___ Kadın ___ Erkek
3. Eğitim Düzeyi: ___ Okur-yazar ___ İlkokul ___ Ortaokul ___ Lise
___ Yüksekokul ___ Üniversite ___ Yüksek Lisans/Doktora
4. Ehliyetiniz var mı? ___ Evet ___ Hayır
5. Kaç yıldır ehliyetiniz var? _____
6. Kaç yıldır araç kullanıyorsunuz? _____
7. Son bir yılda toplam kaç km araç kullandınız? _____
8. Ehliyeti aldığınızdan bu yana toplam kaç km araç kullandınız? _____
9. Ticari (profesyonel) amaçla mı araç kullanıyorsunuz? ___ Evet ___ Hayır
➤ Eğer cevabınız Evet ise ne tür araç kullanıyorsunuz (taksi, ağır vasıta vb.)

10. Ne sıklıkta araç kullanırsınız?
___ Neredeyse hiç ___ Yılda 1-2 kez ___ Ayda 1-2 kez
___ Haftada 1-2 kez ___ Neredeyse her gün

11. Son üç yılda kaç kez araç kullanırken aktif olarak (sizin başka bir yol kullanıcısına veya bir nesneye çarptığınız durumlar) kaza yaptınız?

- Eğer yaptıysanız, bu sırada araçta yolcu var mıydı yoksa tek başınıza mı seyahat ediyordunuz?

☐ Tek başımaydım.

☐ Araçta yolcu vardı.

12. Son üç yılda kaç kez araç kullanırken pasif olarak (başka bir yol kullanıcısının size çarptığı durumlar) kaza yaptınız? _____

- Eğer yaptıysanız, bu sırada araçta yolcu var mıydı yoksa tek başınıza mı seyahat ediyordunuz?

☐ Tek başımaydım.

☐ Araçta yolcu vardı.

13. Son üç yılda aşağıdaki ceza tiplerinden hangilerini aldınız? (Birden fazla işaretleyebilirsiniz.)

Hız ihlali _____ Işık ihlali _____ Kemer ihlali _____ Alkollü araç kullanma _____

Diğer _____

- Eğer ceza aldıysanız, bu sırada araçta yolcu var mıydı yoksa tek başınıza mı seyahat ediyordunuz?

☐ Tek başımaydım.

☐ Araçta yolcu vardı.

APPENDIX F

PASSENGER INFORMATION FORM

Yolcu Bilgileri Formu

1. Son 6 ayınızı düşünerek, araç kullanırken aşağıdaki durumları ne sıklıkla yaşadığınızı lütfen belirtiniz.

	Her gün	Hafta da bir kez	Ayda iki kez	Ayda bir kez	6 ayda bir kez	Hiçbir zaman
Araçta tek başıma olurum.	1	2	3	4	5	6
Yanımda bir yolcu olur.	1	2	3	4	5	6
Yanımda birden fazla yolcu olur.	1	2	3	4	5	6

Not: Araçta tek başıma olurum “Her gün” işaretleyen veya Yanımda bir/birden fazla yolcu olur “Hiçbir zaman” işaretleyenler yolcusuz olarak değerlendirilecekler.

2. Son 6 ayınızı düşündüğünüzde, aşağıdaki yolcu tiplerini birlikte seyahat etme sıklığınıza göre sıralayınız. (1 = en çok seyahat ettiğiniz, 11 = en az seyahat ettiğiniz)

- Arkadaş _____
- Ebeveyn (anne/baba) _____
- Kardeş _____
- Eş/sevgili/partner _____
- Akraba _____
- Patron _____
- İş arkadaşı _____
- Yaşlı _____
- Çocuk/bebek _____

- Engelli _____
- Tanımadığım biri (otostop, yolculuk _____
paylaşımı uygulamaları vb.)

3. Lütfen aşağıdaki soruları, bir önceki soruda en sık seyahat ettiğinizi belirttiğiniz yolcuyu düşünerek cevaplayınız.

➤ Yolcunun yaşı

- ☐ Bebek (0-6 yaş) ☐ Çocuk (6-18 yaş) ☐ Genç (18-25 yaş)
☐ Yetişkin (25-65 yaş) ☐ Yaşlı (65+ yaş)

➤ Yolcunun cinsiyeti

- ☐ Kadın ☐ Erkek

4. Son 6 ayınızı düşündüğünüzde, araçta genellikle kaç yolcu ile seyahat ettiniz?

- ☐ 1 yolcu ☐ 2 yolcu ☐ 3 veya daha fazla yolcu

5. Sizin seçiminize kalsaydı, araçta yolcu ile mi seyahat etmek isterdiniz yoksa yolcusuz mu seyahat etmek isterdiniz?

- ☐ Yolcu ile seyahat etmeyi tercih ederim.
☐ Yolcusuz (tek başıma) seyahat etmeyi tercih ederim.

6. Araçta yolcu ile seyahat ederken yolcu ile ne sıklıkta etkileşim/iletişim içinde olursunuz?

- ☐ Hiçbir zaman ☐ Nadiren ☐ Ara sıra ☐ Çoğunlukla ☐ Her zaman

7. Araç kullanırken yolcunun dikkatinizi dağıtmasından veya yolcu ile ilgili başka bir sebepten dolayı hiç kaza yaptınız mı? Ya da neredeyse kaza yapıyor muydunuz?

- ☐ Evet ☐ Hayır

8. Yolcuyla yaptığınız şimdiye kadarki tüm seyahatleri düşündüğünüzde, araçta yolcunun varlığının sürücü davranışlarınızı nasıl etkilediğini düşünüyorsunuz?

- ☐ Olumlu ☐ Olumsuz

APPENDIX G

THE DRIVER-PASSENGER INTERACTION QUESTIONNAIRE

Sürücü-Yolcu Etkileşimi Anketi

Bu bölümdeki soruları, sizin kullandığınız araçta bir veya birden fazla yolcu ile seyahat ettiğiniz durumları genel olarak düşünerek cevaplamanız beklenmektedir. Lütfen her bir maddede ifade edilen duruma ne oranda katıldığınızı sunulan beş basamaklı ölçek üzerinde ilgili rakamın bulunduğu kutucuğu işaretleyerek belirtiniz.

	Kesinlikle katılmıyorum	Katılmıyorum	Ne katılıyorum ne katılmıyorum	Katılıyorum	Kesinlikle katılıyorum
1. Araç kullanırken telefonum çalarsa araçtaki yolcunun telefonuma cevap vermesi güvenli sürüşüme katkı sağlar.	1	2	3	4	5
2. Yolcunun trafikteki tehlikeleri görerek beni uyarması daha güvenli araç kullanmama katkı sağlar.	1	2	3	4	5
3. Yolcunun aniden karşıma çıkabilecek yoldaki engellere (yol çalışması, çukur, vb) karşı beni uyarması güvenli sürüşe katkı sağlar.	1	2	3	4	5
4. Araçta yolcu varken onun güvenliği için gereksiz risk almaktan kaçınırım.	1	2	3	4	5

5. Yolcu ile konuşmak dikkatimi dağıtabilir.	1	2	3	4	5
6. Araçta yolcu varken, davranışlarımın onun tarafından izlendiği düşüncesi sürüşümü olumsuz etkiler.	1	2	3	4	5
7. Sürüş sırasında yolcu ile konuşurken yoldaki tabelaları/levhaları/trafik ışıklarını vs. kaçırabilirim.	1	2	3	4	5
8. Ben araç kullanırken, araçtaki yolcunun haritayı kullanarak yol tarif etmesi güvenli sürüşüme katkı sağlar.	1	2	3	4	5
9. Araçtaki yolcunun can güvenliği sürücü olarak benim sorumluluğumdadır.	1	2	3	4	5
10. Yorgun olduğumda yolcunun uyanık kalmam için benimle konuşması daha güvenli araç kullanmamı sağlar.	1	2	3	4	5
11. Yolcu ile etkileşim halinde olmak hava koşulları kötü iken güvenli sürüşümü olumsuz etkiler.	1	2	3	4	5
12. Tek başıma seyahat etmek dikkatimi dağıtır.	1	2	3	4	5
13. Sürüş sırasında, arkada oturan yolcu ile konuşmak için arkaya dönmek güvenliği riske atar.	1	2	3	4	5
14. Yolcu ile iletişim halindeyken trafik kurallarına uymayı unutabilirim.	1	2	3	4	5
15. Yolcunun beni yavaş sürücü olarak değerlendirmesini istemediğim için, yolcu varken daha hızlı araç kullanırım.	1	2	3	4	5
16. Hız limitlerini aştığımda yolcunun beni uyarması güvenli bir sürüşe katkı sağlar.	1	2	3	4	5

17. Araçta yolcu varken yolcunun rahat edebilmesi için kavrşaklar, dönüşler vb. durumlarda yol hakkımdan vazgeçebilirim.	1	2	3	4	5
18. Yolcunun araç içi ekipmanların (radyo, klima gibi) ayarı ile benim yerime ilgilenmesi daha güvenli bir sürüş ortamı sağlar.	1	2	3	4	5
19. Yolcunun beni daha dikkatli araç kullanmam konusunda motive etmesi güvenli sürüşüme katkı sağlar.	1	2	3	4	5
20. Yolcu ile sohbet ederken mutlu olduğum bir anıyı hatırlamaya çalışmak yola odaklanmama engel olur.	1	2	3	4	5
21. Yolcunun kendini rahat hissetmesi için araçta yolcu varken daha dikkatli kullanırım.	1	2	3	4	5
22. Yolcu ile fiziksel etkileşim halinde olmak hava koşulları kötü olsa bile sürüşümü etkilemez.	1	2	3	4	5
23. Araçta yolcu varken diğer sürücülerin hatalarını telafi ederek yolcuların daha güvenli yolculuk yapmasına katkı sağlarım.	1	2	3	4	5
24. Yolcunun aniden karşıma çıkabilecek herhangi bir canlının (insan, kedi, köpek vb) varlığına karşı beni uyarması güvenli sürüşe katkı sağlar.	1	2	3	4	5
25. Yolcu ile seyahat etmek dikkatimi dağıtır.	1	2	3	4	5
26. Yolcu ile tartışmak hız limitlerini aşmama sebep olabilir.	1	2	3	4	5
27. Araçta yolcu varken daha güvenli araç kullanırım.	1	2	3	4	5

28. Yolcu araçta ulaşamadığım yerdeki eşyaları vererek sürüş güvenliğine katkı sağlar.	1	2	3	4	5
29. Sürüş esnasında yolcunun rahatsız olmasını engellemek için ani fren ve gaz yapmaktan kaçınırım.	1	2	3	4	5
30. Yolcunun beni yol bozuklukları veya yoldaki aksaklıklar ile ilgili uyarması daha güvenli araç kullanmamı sağlar.	1	2	3	4	5
31. Tek başımayken araç kullandığımda daha güvenli bir sürücüyüm.	1	2	3	4	5
32. Yolcu ile sohbet ederken akan trafikteki potansiyel tehlikeleri algılayamam.	1	2	3	4	5
33. Yoğun trafikte, yolcunun varlığı güvenli sürüşümü katkı sağlar.	1	2	3	4	5
34. Ben araç kullanırken, araçtaki yolcunun navigasyonu kullanarak yol tarif etmesi güvenli sürüşüme katkı sağlar.	1	2	3	4	5
35. Araçta yolcu ile beraber şarkı söylemek dikkatimi dağıtabilir.	1	2	3	4	5
36. Araçta yolcu varken gerginlik olmaması için trafikte karşılaştığım sinir bozucu durumlarda daha sakin davranırım.	1	2	3	4	5
37. Yolcu ile sözlü etkileşimde bulunmak dikkatimi dağıtır.	1	2	3	4	5
38. Yolcunun sürüşümü beğenmeyeceği düşüncesi gergin araç kullanmama sebep olur.	1	2	3	4	5
39. Yolcunun sürüş sırasında tabela ve cadde/sokak ismi gibi yönlendirici işaretlemeleri takip etmesi bana kolaylık sağlar.	1	2	3	4	5

40. Araç kullanırken yolcunun konforlu seyahat etmesini sağlarım.	1	2	3	4	5
41. Yolcu ile sözlü etkileşim halinde olmak yol koşulları kötü olsa bile sürüşümü etkilemez.	1	2	3	4	5
42. Yolcu ile sohbet ederken mutsuz olduğum bir anıyı hatırlamaya çalışmak yola odaklanmama engel olur.	1	2	3	4	5
43. Araçtaki yolcu ile fiziksel etkileşimde bulunmak dikkatimi dağıtır.	1	2	3	4	5
44. Araçta yolcu varken trafik kurallarına daha çok dikkat ederim.	1	2	3	4	5
45. Yolcunun uyarılarına göre araç kullanma davranışlarımı ve tercihlerimi yeniden düzenlerim.	1	2	3	4	5
46. Araç kullanırken yolcunun benim bir şeyler atıştırmama veya içmeme yardımcı olması güvenli sürüşe katkı sağlar.	1	2	3	4	5
47. Araçta yolcu varken trafikte başka sürücülerle gerginlik yaşamaktan kaçınırım.	1	2	3	4	5
48. Yolcunun seyahat sırasında bana veya araçtaki başka kişilere dış çevredeki şeyleri (insanlar, reklam panoları, dükkânlar vb.) göstermesi dikkatimi dağıtır.	1	2	3	4	5
49. Yolcunun beni acemi sürücü olarak değerlendirmesini istemediğim için araç kullanırken daha çok risk alırım.	1	2	3	4	5

APPENDIX H

THE DRIVER BEHAVIOR QUESTIONNAIRE (DBQ)

Sürücü Davranışları Ölçeği

Lütfen her bir madde için verilen durumun ne sıklıkta başınızdan geçtiğini belirtiniz. Soruları, nasıl araç kullandığınızı düşünerek cevaplandırınız ve her bir soru için sizi tam olarak yansıtan cevabı, yanındaki kutudaki uygun rakamı daire içine alarak belirtiniz.

		Hiçbir zaman	Nadiren	Bazen	Oldukça sık	Sık sık	Her zaman
1	Geri geri giderken önceden fark etmediğiniz bir şeye çarpmak	0	1	2	3	4	5
2	Trafikte, diğer sürücülere engel teşkil etmemeye gayret göstermek	0	1	2	3	4	5
3	A yönüne gitmek amacıyla yola çıkmışken kendinizi daha alışkın olduğunuz B yönüne doğru araç kullanırken bulmak	0	1	2	3	4	5
4	Geçiş hakkı sizde dahi olsa diğer sürücülere yol vermek	0	1	2	3	4	5
5	Yasal alkol sınırlarının üzerinde alkollü olduğunuzdan şüphelenseniz de araç kullanmak	0	1	2	3	4	5
6	Aracınızı kullanırken yol kenarında birikmiş suyu ve benzeri maddeleri	0	1	2	3	4	5

	yayaların üzerine sıçratmamaya dikkat etmek						
7	Dönel kavşakta dönüş istikametinize uygun olmayan şeridi kullanmak	0	1	2	3	4	5
8	Anayoldan sola dönmek için kuyrukta beklerken, anayol trafiğine dikkat etmekten neredeyse öndeki araca çarpacak duruma gelmek	0	1	2	3	4	5
9	Trafikte, herhangi bir sürücü size yol verdiğinde veya anlayış gösterdiğinde, elinizi sallayarak, korna çalarak vb. şekilde teşekkür etmek	0	1	2	3	4	5
10	Anayoldan bir sokağa dönerken karşıdan karşıya geçen yayaları fark edememek	0	1	2	3	4	5
11	Başka bir sürücüye kızgınlığı belirtmek için korna çalmak	0	1	2	3	4	5
12	Karşıdan gelen araç sürücüsünün görüş mesafesini koruyabilmesi için uzunları mümkün olduğunca az kullanmak	0	1	2	3	4	5
13	Bir aracı sollarken ya da şerit değiştirirken dikiz aynasından yolu kontrol etmemek	0	1	2	3	4	5
14	Kaygan bir yolda ani fren veya patinaj yapmak	0	1	2	3	4	5
15	Arkanızdan hızla gelen aracın yolunu kesmemek için sollamadan vazgeçip eski yerinize dönmek	0	1	2	3	4	5
16	Kavşağa çok hızlı girip geçiş üstünlüğü olan aracı durmak zorunda bırakmak	0	1	2	3	4	5
17	Şehir içi yollarda hız sınırını aşmak	0	1	2	3	4	5

18	Önünüzdeki aracın sürücüsünü, onu rahatsız etmeyecek bir mesafede takip etmek	0	1	2	3	4	5
19	Sinyali kullanmayı niyet ederken silecekleri çalıştırmak	0	1	2	3	4	5
20	Sağa dönerken yanınızdan geçen bir bisiklet ya da araca neredeyse çarpmak	0	1	2	3	4	5
21	“Yol ver” işaretini kaçırıp, geçiş hakkı olan araçlarla çarpışacak duruma gelmek	0	1	2	3	4	5
22	Yeşil ışık yandığı halde hareket etmekte geciken öndeki araç sürücüsünü korna çalarak rahatsız etmemek	0	1	2	3	4	5
23	Trafik ışıklarında üçüncü vitesle kalkış yapmaya çalışmak	0	1	2	3	4	5
24	Yayaların karşıdan karşıya geçebilmeleri için geçiş hakkı sizde dahi olsa durarak yol vermek	0	1	2	3	4	5
25	Sola dönüş sinyali veren bir aracın sinyalini fark etmeyip onu sollamaya çalışmak	0	1	2	3	4	5
26	Trafikte sinirlendiğiniz bir sürücüyü takip edip ona haddini bildirmeye çalışmak	0	1	2	3	4	5
27	Arkanızdaki aracın ileriye iyi göremediği durumlarda sinyal vb. ile işaret vererek sollamanın uygun olduğunu belirtmek	0	1	2	3	4	5
28	Otoyolda ileride kapanacak bir şeritte son ana kadar ilerlemek	0	1	2	3	4	5
29	Sollama yapan sürücüye kolaylık olması için hızınızı onun geçiş hızına göre ayarlamak	0	1	2	3	4	5
30	Aracınızı park alanında nereye bıraktığınızı unutmak	0	1	2	3	4	5

31	Solda yavaş giden bir aracın sağından geçmek	0	1	2	3	4	5
32	Trafik ışığında en hızlı hareket eden araç olmak için yandaki araçlarla yarışmak	0	1	2	3	4	5
33	Trafik işaretlerini yanlış anlamak ve kavşakta yanlış yöne dönmek	0	1	2	3	4	5
34	Acil bir durumda duramayacak kadar, öndeki aracı yakın takip etmek	0	1	2	3	4	5
35	Trafik ışıkları sizin yönünüze kırmızıya döndüğü halde kavşaktan geçmek	0	1	2	3	4	5
36	Otobanda trafik akışını sağlayabilmek için en sol şeridi gereksiz yere kullanmaktan kaçınmak	0	1	2	3	4	5
37	Bazı tip sürücülere kızgın olmak (illet olmak) ve bu kızgınlığı bir şekilde onlara göstermek	0	1	2	3	4	5
38	Seyahat etmekte olduğunuz yolu tam olarak hatırlamadığınızı fark etmek	0	1	2	3	4	5
39	Sollama yaparken karşıdan gelen aracın hızını olduğundan daha yavaş tahmin etmek	0	1	2	3	4	5
40	Gereksiz yere gürültü yapmamak için kornayı kullanmaktan kaçınmak	0	1	2	3	4	5
41	Otobanda hız limitlerini dikkate almamak	0	1	2	3	4	5
42	Aracınızı park ederken diğer yol kullanıcılarının (yayalar, sürücüler vb.) hareketlerini sınırlamamaya özen göstermek	0	1	2	3	4	5

APPENDIX I

THE DRIVER SKILL INVENTORY (DSI)

Sürücü Becerileri Ölçeği

Özellikle araç kullanmanın farklı yönlerinde sürücüler arasında pek çok farklılıklar vardır. Hepimizin güçlü ve zayıf yönleri vardır. Lütfen, sizin bir sürücü olarak güçlü ve zayıf yönlerinizi size göre doğru olan seçeneği işaretleyerek belirtiniz. Her bir soru için cevap seçenekleri şu anlamdadır:

		Çok zayıf	Zayıf	Ne zayıf ne de güçlü	Güçlü	Çok Güçlü
1	Seri araç kullanma	1	2	3	4	5
2	Sabırsızlanmadan yavaş bir aracın arkasından sürme	1	2	3	4	5
3	Hızlı karar alma	1	2	3	4	5
4	Yeterli takip mesafesi bırakma	1	2	3	4	5
5	Geriye kaçırmadan aracı yokuşta kaldırma	1	2	3	4	5
6	Sollama	1	2	3	4	5
7	Hız sınırlarına uyma	1	2	3	4	5
8	Gereksiz risklerden kaçınma	1	2	3	4	5
9	Trafik ışıklarına dikkatle uyma	1	2	3	4	5
10	Dar bir yere geri geri park edebilme	1	2	3	4	5

APPENDIX J

THE DRIVER-PASSENGER INTERACTION QUESTIONNAIRE (UPDATED AFTER FACTOR ANALYSIS)

Sürücü-Yolcu Etkileşimi Anketi

Bu bölümdeki soruları, sizin kullandığınız araçta bir veya birden fazla yolcu ile seyahat ettiğiniz durumları genel olarak düşünerek cevaplamanız beklenmektedir. Lütfen her bir maddede ifade edilen duruma ne oranda katıldığınızı sunulan beş basamaklı ölçek üzerinde ilgili rakamın bulunduğu kutucuğu işaretleyerek belirtiniz.

	Kesinlikle katılmıyorum	Katılmıyorum	Ne katılıyorum ne katılmıyorum	Katılıyorum	Kesinlikle katılıyorum
1. Araç kullanırken telefonum çalarsa araçtaki yolcunun telefonuma cevap vermesi güvenli sürüşüme katkı sağlar.	1	2	3	4	5
2. Yolcunun trafikteki tehlikeleri görerek beni uyarması daha güvenli araç kullanmama katkı sağlar.	1	2	3	4	5
3. Yolcunun aniden karşıma çıkabilecek yoldaki engellere (yol çalışması, çukur, vb) karşı beni uyarması güvenli sürüşe katkı sağlar.	1	2	3	4	5
4. Araçta yolcu varken onun güvenliği için gereksiz risk almaktan kaçınırım.	1	2	3	4	5
5. Yolcu ile konuşmak dikkatimi dağıtabilir.	1	2	3	4	5

6. Araçta yolcu varken, davranışlarımın onun tarafından izlendiği düşüncesi sürüşümü olumsuz etkiler.	1	2	3	4	5
7. Sürüş sırasında yolcu ile konuşurken yoldaki tabelaları/levhaları/trafik ışıklarını vs. kaçırayabilirim.	1	2	3	4	5
8. Ben araç kullanırken, araçtaki yolcunun haritayı kullanarak yol tarif etmesi güvenli sürüşüme katkı sağlar.	1	2	3	4	5
9. Yolcu ile etkileşim halinde olmak hava koşulları kötü iken güvenli sürüşümü olumsuz etkiler.	1	2	3	4	5
10. Yolcu ile iletişim halindeyken trafik kurallarına uymayı unutabilirim.	1	2	3	4	5
11. Yolcunun beni yavaş sürücü olarak değerlendirmesini istemediğim için, yolcu varken daha hızlı araç kullanırım.	1	2	3	4	5
12. Hız limitlerini aştığımda yolcunun beni uyarması güvenli bir sürüşe katkı sağlar.	1	2	3	4	5
13. Araçta yolcu varken yolcunun rahat edebilmesi için kavşaklar, dönüşler vb. durumlarda yol hakkımdan vazgeçebilirim.	1	2	3	4	5
14. Yolcunun araç içi ekipmanların (radyo, klima gibi) ayarı ile benim yerime ilgilenmesi daha güvenli bir sürüş ortamı sağlar.	1	2	3	4	5
15. Yolcunun beni daha dikkatli araç kullanmam konusunda motive etmesi güvenli sürüşüme katkı sağlar.	1	2	3	4	5
16. Yolcu ile sohbet ederken mutlu olduğum bir anıyı hatırlamaya çalışmak yola odaklanmama engel olur.	1	2	3	4	5
17. Yolcunun kendini rahat hissetmesi için araçta yolcu varken daha dikkatli kullanırım.	1	2	3	4	5
18. Yolcu ile fiziksel etkileşim halinde olmak hava koşulları kötü olsa bile sürüşümü etkilemez.	1	2	3	4	5
19. Araçta yolcu varken diğer sürücülerin hatalarını telafi ederek yolcuların daha güvenli yolculuk yapmasına katkı sağlarım.	1	2	3	4	5

20. Yolcunun aniden karşıma çıkabilecek herhangi bir canlının (insan, kedi, köpek vb) varlığına karşı beni uyarması güvenli sürüşe katkı sağlar.	1	2	3	4	5
21. Yolcu ile seyahat etmek dikkatimi dağıtır.	1	2	3	4	5
22. Yolcu ile tartışmak hız limitlerini aşmama sebep olabilir.	1	2	3	4	5
23. Araçta yolcu varken daha güvenli araç kullanırım.	1	2	3	4	5
24. Sürüş esnasında yolcunun rahatsız olmasını engellemek için ani fren ve gaz yapmaktan kaçınırım.	1	2	3	4	5
25. Yolcunun beni yol bozuklukları veya yoldaki aksaklıklar ile ilgili uyarması daha güvenli araç kullanmamı sağlar.	1	2	3	4	5
26. Yolcu ile sohbet ederken akan trafikteki potansiyel tehlikeleri algılayamam.	1	2	3	4	5
27. Ben araç kullanırken, araçtaki yolcunun navigasyonu kullanarak yol tarif etmesi güvenli sürüşüme katkı sağlar.	1	2	3	4	5
28. Araçta yolcu ile beraber şarkı söylemek dikkatimi dağıtabilir.	1	2	3	4	5
29. Araçta yolcu varken gerginlik olmaması için trafikte karşılaştığım sinir bozucu durumlarda daha sakin davranırım.	1	2	3	4	5
30. Yolcu ile sözlü etkileşimde bulunmak dikkatimi dağıtır.	1	2	3	4	5
31. Yolcunun sürüşümü beğenmeyeceği düşüncesi gergin araç kullanmama sebep olur.	1	2	3	4	5
32. Araç kullanırken yolcunun konforlu seyahat etmesini sağlarım.	1	2	3	4	5
33. Yolcu ile sözlü etkileşim halinde olmak yol koşulları kötü olsa bile sürüşümü etkilemez.	1	2	3	4	5
34. Yolcu ile sohbet ederken mutsuz olduğum bir anıyı hatırlamaya çalışmak yola odaklanmama engel olur.	1	2	3	4	5
35. Araçtaki yolcu ile fiziksel etkileşimde bulunmak dikkatimi dağıtır.	1	2	3	4	5

36. Araçta yolcu varken trafik kurallarına daha çok dikkat ederim.	1	2	3	4	5
37. Yolcunun uyarılarına göre araç kullanma davranışlarımı ve tercihlerimi yeniden düzenlerim.	1	2	3	4	5
38. Araçta yolcu varken trafikte başka sürücülerle gerginlik yaşamaktan kaçınırım.	1	2	3	4	5
39. Yolcunun seyahat sırasında bana veya araçtaki başka kişilere dış çevredeki şeyleri (insanlar, reklam panoları, dükkânlar vb.) göstermesi dikkatimi dağıtır.	1	2	3	4	5
40. Yolcunun beni acemi sürücü olarak değerlendirmesini istemediğim için araç kullanırken daha çok risk alırım.	1	2	3	4	5

APPENDIX K

CIRRICULUM VITAE

Personal Information

Surname, Name: Özbay, İrem

Nationality: The Republic of Türkiye (TC)

Date and Place of Birth: [REDACTED]

Email: [REDACTED]

Education

Institution [Date from – Date to]	Degree(s) or Diploma(s) obtained:
Middle East Technical University, Türkiye, 2017-2023	Ph.D. in Psychology, GPA: 4.00/4.00
Middle East Technical University, Türkiye, 2014-2017	M. Sc. in Psychology, GPA: 4.00/4.00
Middle East Technical University, Türkiye, 2008-2014	B. A. in Psychology, GPA: 3.46/4.00
Hasan Ali Yücel Anatolian Teacher High School, Türkiye, 2004-2008	High School Diploma, GPA: 89.21/100

Thesis Title

Ph.D. Thesis: How the Interaction between Driver and Passenger Is Related to Driver Behaviors? A Study Based On the Newly Developed Driver-Passenger Interaction Questionnaire– 2023/Middle East Technical University

Supervisor: Assoc. Prof. Dr. Bahar ÖZ

M. Sc. Thesis: The Relationship between the Health Belief Model Constructs and Driver Behaviors: Mediating Role of Driving Skills – 2017/ Middle East Technical University

Supervisor: Assoc. Prof. Dr. Bahar ÖZ

Co-Supervisor: Prof. Dr. Türker ÖZKAN

National Education Specialization Thesis: Öğretmenlerin Eğitim Bilişim Ağına (EBA) İlişkin Tutum ve Görüşlerinin İncelenmesi [Investigation of Teachers' Attitudes and Opinions Regarding the Educational Information Network (EBA)] – 2019/The Ministry of National Education

Supervisor: İlkay AYDIN

Professional Experience

Date from – Date to	Company	Location	Position
August 2020- present	Ministry of National Education	Ankara, Türkiye	National Education Specialist
August 2015- August 2020	Ministry of National Education	Ankara, Türkiye	National Education Assistant Specialist
April 2013- June 2013	Ministry of Youth and Sports	Ankara, Türkiye	Master of Ceremonies
January 2013 – March 2013	Minister of National Education	Ankara, Türkiye	Intern
July 2012 – September 2012	Ankara Atatürk Training and Research Hospital	Ankara, Türkiye	Intern Psychologist

Awards and Certificates

Date	Title	Company
September 2019	Course Performance Award	Middle East Technical University
January 2022	Certificate of Achievement (Reason for Award: Diligence)	Ministry of National Education
June 2022	Certificate of Achievement (Reason for Award: Diligence)	Ministry of National Education
July 2022	Certificate of Achievement (Reason for Award: Diligence)	Ministry of National Education
July 2022	Certificate of Excellence (Reason for Award: Diligence)	Ministry of National Education

Publications and Projects

Fındık, G., Özbay, İ., Öz, B., Lajunen, T., & Özkan, T. (2015). *Sürücü davranışları, becerileri ve kaza değerlendirmesinde atıf yanlılıkları ve stilleri*. ROTRASA Sürdürülebilir Ulaşım İçin Yol ve Trafik Güvenliği Kongresi, 07 - 08 December 2015.

As a researcher: Türkiye Analizi: Takip Çalışması, Sürücü Ve Ön Koltuk Yolcularının Emniyet Kemerini Kullanımı (2013).

As a contributors: OECD. (2020). *TALIS 2018 Results (Volume II): Teachers and School Leaders as Valued Professionals*. OECD Publishing.

As a coordinating team member: MEB. (2022). Başöğretmenlik Yetiştirme Programı Çalışma Kitabı.

As a coordinating team member: MEB. (2022). Uzman Öğretmenlik Yetiştirme Programı Çalışma Kitabı.

APPENDIX L

TURKISH SUMMARY / TRKE ZET

SRC VE YOLCU ARASINDAKİ ETKİLEŞİMİN SRC DAVRANIŞLARIYLA NASIL BİR İLİŞKİSİ VARDIR? YENİ GELİŞTİRİLEN SRC-YOLCU ETKİLEŞİMİ ANKETİNE DAYALI BİR ALIŞMA

BİRİNCİ BLM

Giriş

Karayolu trafik kazaları en byk kresel sorunlardan biri olarak rapor edilmiştir. Her yıl dnya genelinde yaklaşık 1.35 milyon insan trafik kazalarında hayatını kaybetmekte ve 20-50 milyon insan yaralanmaktadır (Dnya Saėlık rgt, [DS], 2018). Trafik kazalarının sonuları tm dnyada olduėu gibi Trkiye'de de benzerdir. Trkiye İstatistik Kurumu'nun yayınladıėı verilere gre 2021 yılında trafik kazalarında 5.600'den fazla kiři hayatını kaybetti ve yaklaşık 275.000 kiři yaralandı. Daha da kts, bir nceki yıla gre trafik kazalarında hayatını kaybedenlerin sayısı %10.2 oranında artmıştır. Dnya nfusundaki artış ve hareketlilik dikkate alındıėında trafik kazalarının her geen gn artması ve daha ciddi bir sorun haline gelmesi kaınılmaz bir gerektir.

Trafik Gvenliėi ile İlgili Faktrler

Trafik ortamlarında bireylerin gvenli hareketini saėlamak iin bu ortamları oluřturan ve insanların gidecekleri yere gvenli bir řekilde ulařmasını saėlayan unsurların incelenmesi gerekmektedir. Trafik gvenliėi alanında, eřitli nedenlerin potansiyel etkilerini ayrı ayrı analiz etmek yerine, bunların etkileřimlerini anlamaya

odaklanılmaktadır. Haddon (1972), trafik kazalarının nedenlerini üç ana faktöre ayıran bir matris ortaya koydu: insan faktörleri, çevresel faktörler ve araç faktörleri. Bu matris içinde, bu üç temel unsur ayrıca kaza öncesi, kaza anı ve kaza sonrası olarak sınıflandırılmıştır.

Bu çalışmada karayolu güvenliğinin üç temel unsurundan ikisi olan insan faktörü ve çevresel faktör arasındaki ilişki incelenmiştir. Sürücü-yolcu etkileşiminin sürücü davranışlarını nasıl etkilediğinin araştırılması amaçlanmaktadır.

Trafikte İnsan Faktörü

Trafik güvenliği araştırmalarında trafik kazalarının altında yatan ana sebeplerden biri olduğu düşünüldüğünden insan faktörü popüler bir alan olarak kullanılmıştır. Ayrıca bu alandaki müdahalelerin en etkili sonuçları vereceği beklentisi göz önüne alındığında, çalışmaların insan faktörü ve etkilerine odaklanması kaçınılmaz olmuştur. Ayrıca Türkiye'de 2022 yılında meydana gelen 234.814 kazanın 203.923'ünün sürücü kaynaklı olduğu belirtilmiştir (Emniyet Genel Müdürlüğü, 2022). Diğer bir deyişle kazaların %87'si sürücü hatasından kaynaklanmaktadır.

İnsan faktörlerindeki trafik araştırmaları iki ana bileşene odaklanmıştır: sürücü davranışı/stil ve sürüş becerileri/performansı. Temel olarak, sürücü davranışları/stilleri “sürücünün genellikle yaptığı şey” olarak kabul edilebilirken, sürüş becerisi/performansı “sürücünün yapabildikleri” olarak değerlendirilebilir.

Sürücü Davranışları

Sürücü davranışları, sürücülerin araç kullanmayı tercih etme biçimleri olarak tanımlanmıştır; başka bir deyişle, sürücülerin araç kullanma alışkanlıkları ile ilgilidir (Elander vd., 1993). Sürücü davranışını incelemenin önemi, yalnızca sürücülerin yolda nasıl davrandıklarıyla ilgili değil, aynı zamanda sürücülerin çok fazla olası tehlikeye ve güvenlik önlemlerine nasıl tepki verdiklerinin nasıl tahmin edilebileceğiyle ilgilidir (Donges, 1978). Davranış üzerine geliştirilen birçok teori ve modelin yanı sıra, sürücü davranışı için en popüler model Reason ve arkadaşları (1990) tarafından yapılmıştır. Ona göre, sapkın sürücü davranışları hata ve ihlal olarak ikiye ayrılmış ve farklı psikolojik temellere dayanan iki tür hata olduğu varsayılmıştır.

Hatalar ve ihlaller arasındaki ayrım, Manchester Sürücü Davranışı Anketi'nin (DBQ) geliştirilmesi için temel oluşturdu. DBQ, beş farklı anormal sürücü davranışını ölçmek için geliştirildi; kasıtsız sapmalar, yanılğılar, hatalar, kasıtsız ihlaller ve kasıtlı ihlaller (Reason ve diğerleri, 1990). Anket geliştirildikten sonra birçok ülkede çok sayıda araştırmacı anketi kullanarak çalışmalar yapmıştır. DBQ Türkçe'ye çevrilmiş ve uyarlanmıştır ve faktör yapısı Lajunen ve Özkan (2004) tarafından doğrulanmıştır. Hatalar, kasıtsız sapmalar, olağan ihlaller ve saldırgan ihlaller gibi özgün bir faktör yapısı ile kullanılmıştır. DBQ, trafik güvenliği ile ilişkisi nedeniyle anormal sürücü davranışlarına odaklanmaktadır. Ancak sürücü davranışlarının çok boyutlu olması nedeniyle sabırlı ve dikkatli sürüş tarzı ile sürücü davranışlarının incelenmesine ihtiyaç duyulmuştur (Taubman-Ben-Ari, Mikulincer ve Gillath, 2003). Bu nedenle, DBQ ile birlikte sürücülerin olumlu davranışlarını ölçmek için 2005 yılında Özkan ve Lajunen tarafından geliştirilen "Olumlu Sürücü Davranışları Ölçeği" de kullanılmaktadır. Mevcut çalışmada hatalar, kasıtsız sapmalar ve yanılğılar, ihlaller ve olumlu sürücü davranışları kullanılmıştır.

Hatalar, “planlanan eylemlerin amaçlanan sonuçlara ulaşmadaki başarısızlığı” olarak tanımlandı (Reason vd., 1990). Kasıtsız sapmalar ve yanılğılar, eylem iyi organize edilmiş olmasına rağmen “bir eylem dizisinin yürütülmesi ve/veya saklanma aşamasındaki bazı başarısızlıklardan kaynaklanan hatalar” olarak tanımlandı (Reason vd., 1990). Bu iki terim arasında anlam farkı bulunmaktadır. Kasıtsız sapmalar “planlandığı gibi olmayan dışsallaştırılmış eylemler olarak potansiyel olarak gözlemlenebilir” olarak tanımlanırken, yanılğılar “büyük ölçüde hafıza başarısızlıklarını içeren daha gizli bir hata” olarak tanımlandı (Wierwille vd., 2002). İhlaller, “potansiyel olarak tehlikeli sistemin güvenli çalışmasını sürdürmek için gerekli olduğuna inanılan uygulamalardan kasıtlı sapmalar” olarak tanımlandı (Reason vd., 1990).

Sürücü Becerileri

Sürücü becerileri, bilgi işleme, motor beceriler ve güvenlik becerilerinden oluşur ve uygulama ve eğitimle geliştirilebilir (Elander, West, & French, 1993). Ayrıca Spolander (1983) sürücü becerilerini ikiye ayırmıştır; hızlı ve akıcı araç kontrolü ve trafik ortamlarının yönetimi olarak tanımlanan teknik sürüş becerileri ve tahmine dayalı kaza becerileri olarak tanımlanan defansif sürüş becerileridir. Spolander (1983),

bu becerileri ölçmek için bir öz-değerlendirme aracı kullanarak sürücü becerilerinin deneyimle arttığını buldu. Öte yandan, Näätänen ve Summala (1976), Spolander (1983) ile tutarlı sonuçlar vermemiştir. Näätänen ve Summala'nın (1976) çalışmasında, önceki çalışmadan farklı olarak, uygulama ve maruz kalmanın artmasıyla sürüş becerilerinin geliştiği, ancak güvenlik becerilerine verilen önemin azaldığı bulunmuştur. Bunun nedenlerinden biri de teknik ve güvenlik becerilerinin iç içe geçmesi olarak yorumlanabilir. Bunun da ötesinde, sürüş becerilerinin yapısına ilişkin daha fazla açıklama yapılmıştır. Spolander (1983) sürücülerden kendilerini ortalama bir sürücü ile karşılaştırarak yanıt vermelerini isterken Hatakka, Keskinen, Laapotti, Katila ve Kiiski (1992) sürücülerden kendi becerilerini farklı bir bakış açısıyla değerlendirmelerini istemiştir. Daha sonra, Lajunen ve Summala (1995) Sürücü Becerileri Envanterini (DSI) geliştirerek sürüş becerileri sınıflandırmasını genişletti. Bahsi geçen araç iki faktörden oluşmaktadır; algısal-motor beceriler ve güvenlik becerileridir.

Algısal-motor beceriler, bilgi işleme ve motor beceriler, sürücü becerilerinin bileşenlerinden biridir (Lajunen ve Summala, 1995). Diğer yandan, Güvenlik becerileri, hem geçici motivasyonel hem de daha kalıcı kişilik özelliklerinden ve güvenliğe yönelik tutumlardan oluşan güdüler olarak tanımlanmıştır (Lajunen ve Summala, 1995).

Sürücü Davranışı ile Sürücü Becerileri Arasındaki İlişki

Martinussen, Møller ve Prato (2014) tarafından yapılan araştırmanın bulgusu, ihlallerin algısal-motor becerilerle pozitif, güvenlik becerileriyle negatif ilişkili olduğunu göstermiştir. Ayrıca, hatalar ve yanlışlar hem algısal-motor beceriler hem de güvenlik becerileri ile negatif olarak ilişkilendirilmiştir (Martinussen, Møller ve Prato, 2014). Sürücü becerileri yüksek ve aynı zamanda anormal sürücü davranışı sıklığı düşük olan sürücüler en güvenli sürücü grubu olarak belirlenmiştir. Bu bulgular, bu alandaki diğer çalışmalarla uyumlu olarak, algısal-motor becerileri yüksek sürücülerin, güvenlik becerileri düşük olduğunda da en riskli sürücü grubu olduğunu göstermiştir (Lajunen, Parker ve Stradling, 1998; Sümer, Özkan ve Lajunen, 2006). Sürücü becerileri ile olumlu sürücü davranışları arasındaki ilişki incelendiğinde, olumlu sürücü davranışları hem algısal-motor beceriler hem de güvenlik becerileri ile pozitif yönde ilişkilidir (Xu vd., 2018). Mevcut çalışmada, olumlu sürücü davranışları

da dâhil olmak üzere sürücü davranışları incelenmiş ve yukarıda bahsedildiği gibi sürücü davranışları ile sürücü becerileri arasındaki ilişkiler nedeniyle sürücü becerileri ortak değişken olarak kullanılmıştır.

Sürüşte Çevresel Faktörler: Sürücü ile Yolcu Arasındaki Sosyal Etkileşim

İnsanlar sosyal varlıklardır. Bu nedenle sosyal çevrelerinden izole yaşamaları beklenemez. Bu durumda içinde bulundukları sosyal çevreden etkilenmeleri kaçınılmazdır. Sosyal psikolojiye göre tutumlar, inançlar, normlar insanların nasıl davranacağını belirleyen önemli faktörlerdir (Ajzen, 1985). Bugüne kadar yapılan birçok çalışmanın sonuçları bunu kanıtlamış ve insanların çevresel faktörlerden, sübjektif normlardan ve diğer insanların görüşlerinden/inançlarından etkilenerek davranışlarını değiştirebildiklerini göstermiştir (Ajzen, 1991). Benzer şekilde araç kullanmak da izole bir etkinlik olamaz çünkü araç kullanırken ve trafik ortamlarında sosyal çevre ve diğer yol kullanıcıları ile etkileşim kaçınılmazdır.

Yolcunun varlığı sürücü ile ilgili bir faktör olmasa bile sürücünün davranışını etkileyerek kazaya karışma riskini artırmaktadır (Lee, & Abdel-Aty, 2008). Aksine yapılan çalışmalarda yolcunun varlığının sürücünün davranışlarını olumlu yönde etkilediği ve kazayı önlediği belirtilmiştir (Rueda-Domingo vd., 2004). Yolcularla ilgili literatür incelendiğinde çelişkili sonuçların olduğu görülmektedir. Bu çelişkili sonuçların nedeni, sürücü-yolcu etkileşiminin yaş, cinsiyet, yolcu sayısı, yolcu tipi gibi bazı özelliklere bağlı olarak değişkenlik göstermesidir.

Yolcunun Varlığının Olumsuz Etkileri

Sürücünün dikkatinin dağılması, sürücünün sürüşten başka bir yöne sapmasına neden olabilecektir, araç kullanmak dışında herhangi bir ikincil faaliyette bulunma olarak tanımlanmaktadır (Stutts, et al., 2005). Sürücü dikkatinin dağılması, karayolu trafik kazalarına neden olan önemli faktörlerden biri olarak kabul edilmektedir (McEvoy, Stevenson ve Woodward, 2007). Ayrıca bu alanda yapılan başka bir çalışmada yolcu ile konuşmanın en sık yapılan beş dikkat dağıtıcı aktiviteden biri olduğu kişisel bildirim anketi ile belirlenmiştir (McEvoy, Stevenson, & Woodward, 2006). Dikkat dağınıklığına benzer şekilde, sürücülerin yolcular tarafından aşırı zihinsel yüklenmesi de kaza riskini artırır. Örneğin karmaşık ve daha dikkat gerektiren durumlarda yolcunun varlığının trafik güvenliğini olumsuz etkilediği gözlemlenmiştir.

Sürücülerin davranışlarını veya sürüş becerilerini eleştirerek sürücülerin daha gergin veya saldırgan araç kullanmasına neden olabilir (Simons-Morton ve diğerleri, 2005).

Yolcunun Varlığının Olumlu Etkileri

Yolcu, yoldaki veya çevredeki tehlikeler konusunda sürücüyü uyararak sürücünün sürüş güvenliğine katkıda bulunabilir. Vollrath, Meilinger ve Krüger (2002), trafiğin yavaş aktığı ve havanın karanlık olduğu durumlarda araçta yolcu bulunmasının kaza riskini azalttığını belirtmişlerdir. Bunun nedeni, yolcunun trafik sıkışıklığında sürücüyü daha sabırlı hale getirebilmesi ve akşam hava karardığında sürücünün görünürlüğüne yardımcı olabilmesidir. Yolcu varlığının sürücü davranışı üzerindeki bir diğer olumlu etkisi de sürücülerin yolcunun hayatının sorumluluğunu hissetmesi ve bu sayede daha güvenli araç kullanabilmesidir. Özellikle çocuk yolcu, sürücünün yaşı ve cinsiyeti ne olursa olsun, sürücüler daha az ihlal yapmakta ve daha güvenli araç kullanmaktadır (Taubman-Ben-Ari ve Noy, 2011). Bunun nedeninin ise sürücünün yolcunun hayatının sorumluluğunu hissetmesi olduğu söylenebilir. Stutts ve meslektaşları (2001), araçtaki ekipmanı ayarlamanın, dikkati dağıtmanın en yaygın nedenlerinden biri olduğunu bildirmiştir. Benzer bulgular ışığında, sürücüye radyo veya klimayı ayarlamak veya cep telefonlarına cevap vermek gibi sürüş dışı görevlerde yardımcı olmanın güvenli sürüş üzerinde olumlu ve koruyucu bir etkiye sahip olduğu önerilebilir.

Sürücü-Yolcu Etkileşiminde Yolcu ile İlgili Faktörler

Rosenbloom ve Perlman (2016) tarafından yapılan çalışmanın bulguları, araçta en az bir çocuk yolcu bulunmasının düşük bir ihlal yüzdesi sağladığını ortaya koymuştur. Taubman-Ben-Ari ve Noy (2011) tarafından ebeveynliğin sürücü davranışlarını nasıl değiştirdiği incelenmiş ve aşırı hız gibi olumsuz davranışlarda azalma olumlu sürücü davranışlarında ise bir artış olduğu tespit edilmiştir. Bu bulguların aksine çocuk yolcunun olumsuz etkilerinin olduğunu belirten araştırmalar da bulunmaktadır (Aldrige vd., 1999). Örneğin bir çalışmada kadın sürücülerin, özellikle 0-4 yaş arası küçük çocuklarla araç kullanırken erkek sürücülere göre kaza yapma eğilimi vardır.

Ebeveyni yolcu, arkadaşı yolcu olan sürücülerin hız davranışları ile yolcusu olmayan sürücülerin hız davranışları karşılaştırıldığında, ebeveynleri ile birlikte araç

kullanan sürücülerin hız limiti aşma davranışının, araç kullanan sürücülerden önemli ölçüde daha az olduğu görülmektedir. Mevcut çalışmada bahsedilen bir diğer yolcu tipi ise eş/sevgili/partnerdir. Bildiğimiz kadarıyla bu yolcu tipi ile ilgili yapılan çalışma sayısı oldukça sınırlıdır. Dillon ve Dunn (2015) tarafından yapılan çalışma, sürücüler ne kadar riskli davranışlarda bulunursa, yolcularının (eşlerinin) o kadar çok şikâyet ettiklerini bulmuşlardır. Ancak hem yolcular hem de sürücüler, yolcu şikâyet ettikçe sürücünün olumsuz etkilendiği konusunda hemfikirdir.

Son olarak işle ilgili kişilerle aynı araçta seyahat etmek ve sürücü-yolcu ilişkisi oluşturmak mümkündür. Örneğin, Hu, Xie, Han ve Ma (2012), yolcunun saldırgan sürücü davranışı üzerindeki etkisini araştırmak için amirleri ve arkadaşlarıyla araba kullanmak arasındaki farkları karşılaştırdılar. Bulgu, sürücülerin arkadaşlarıyla seyahat ederken daha saldırgan sürücü davranışı gösterirken, amirleri ile daha az saldırgan sürüş sergilediklerini ortaya koydu.

Sürücü Davranışları ile Sürücü-Yolcu Etkileşimi Arasındaki İlişki

İnsanlar, özellikle birinin onları izlediğini düşündüklerinde farklı sosyal davranışlar gösterebilirler (Camilleri ve Kozak, 2022). Sürüş ortamının yolcu tarafından gözlemlenen veya izlenen sosyal bir ortam olduğu düşünüldüğünde yolcu, sürücünün davranışlarını etkiler. Çoğu çalışma, sürücü davranışı, karayolu trafik güvenliği ve sürücü becerileri gibi değişkenlerden ziyade kaza raporlarına ve veri setlerine dayanmaktadır (Doherty, Andrey ve MacGregor, 1998; Vollrath, Meilinger ve Krüger, 2002; Engström, Gregersen, Granström, Nyberg, 2008). Mevcut bilgi eksikliğinden dolayı, kaza sırasında yolcunun sürücü üzerindeki potansiyel etkisine ilişkin belirli ayrıntıları elde etmek şu anda mümkün değildir. Ek olarak, yolcunun ne ölçüde katkıda bulunmuş olabileceği veya genel sonuç üzerindeki etkisinin türü bilinmemektedir. Yolculuk sırasında veya riskli durumlarda bir yolcunun varlığının sürücü üzerinde yaratabileceği psikolojik etkinin kapsamlı bir şekilde analiz edilmesi son derece önemlidir. Mevcut çalışmada böyle bir inceleme mevcut literatürdeki boşluğu doldurmak açısından önemlidir.

Bu çalışmada, sürücü-yolcu etkileşimi ile ilgili sürücü davranışları incelenmiştir. Birçok çalışma, sürücü davranışları ile yolcuların varlığı arasında bir ilişki olduğunu göstermiştir (Lee & Abdel-Aty, 2008; Rosenbloom & Perlman, 2016; Vollrath, Meilinger ve Krüger, 2002). Ayrıca yolcunun varlığının sürücü davranışları

ve kazaya karışma riski üzerinde bazen olumlu bazen de olumsuz bir etkiye sahip olduđu literatürdeki birçok çalışma ile bulunmuştur (Rueda-Domingo vd., 2004; Simons-Morton vd. al., 2011). Ancak bu çelişkili bulguların altında yatan neden, yolcunun sürücüler üzerindeki varlığının psikolojik mekanizmasının henüz tam olarak çözülememiş olmasıdır (Nakawaga ve Park, 2014a). Görünüşe göre bir yolcunun varlığı, sürücünün onları nasıl algıladığını ve aralarındaki etkileşimi etkileyebilir (Hu, Xie, Han ve Ma, 2012). Bu çalışma, bu konuda sınırlı bilgi olduğundan, sürücüler ve yolcular arasındaki etkileşim türlerini belirlemeyi amaçlamıştır. Ek olarak, çalışma bu etkileşimlerin sürücünün davranışını nasıl etkilediğini araştırmaktadır.

Çalışmanın Amacı

Mevcut çalışma ile sürücü-yolcu etkileşiminin içeriği, faktörleri, ilgili kavram ve değişkenlerle ilişkisi incelenerek literatürdeki eksikliğin giderilmesi amaçlanmıştır. Bu amaç ışığında, literatürde ilk kez sürücü-yolcu etkileşimi için geçerli ve güvenilir bir ölçüm aracı geliştirmek çalışmanın temel amaçlarından biridir. Bu çalışma, sürücü-yolcu etkileşimi kavramını ölçmek için yeni geliştirilen anket ile ayrıntılı olarak anlamak amacının yanı sıra, bu kavramın sürüşle ilgili temel değişkenler ve sürücü davranışları ile ilişkisini test etmeyi de amaçlamıştır.

İKİNCİ BÖLÜM

Çalışma 1:

“Sürücü-Yolcu Etkileşimi Anketi’nin Geliştirilmesi

Katılımcılar

Bu çalışmaya toplamda 17 sürücü (10 kadın, 7 erkek) katılmıştır. Katılımcıların yaş aralığı 24 ile 63 arasında olup, ortalama yaş 35.88’dir. Bütün katılımcılar günlük olarak ya da en az hafta 3-4 gün araç kullandıklarını ve aktif olduklarını belirtmişlerdir.

Prosedür

Veri toplamaya başlamadan önce Orta Doğu Teknik Üniversitesi İnsan Denekler Etik Kurulu'ndan etik izin alınmıştır. Ocak 2022 tarihinde yapılan mülakatlar telefonla görüşme yaparak tamamlanmıştır.

Materyaller

Yarı yapılandırılmış görüşme formu kullanılmıştır. Görüşme formunun ilk bölümü, katılımcıların cinsiyet, yaş, araç kullanma deneyimi ve yıllık kilometre gibi demografik bilgilerine yönelik sorulardan oluşmuştur. Ek olarak, sürücü-yolcu etkileşiminin farklı yönlerini belirlemek için on açık uçlu soru eklenmiştir. Sorular, yolcuların sürücünün davranış ve becerilerini nasıl etkilediği, sürücüler ve yolcular arasındaki farklı etkileşim türleri ve farklı türdeki yolcuların sürücü davranış ve becerilerini nasıl etkilediği gibi konuları kapsamaktadır. Ayrıca, yolcunun varlığının olumlu ve olumsuz yönlerini belirlemek için de sorular bulunmaktadır.

Sonuçlar

Çalışma 1'deki görüşmelerin bulgularına göre, sürücülerin yolcuları hakkındaki algıları, aralarındaki etkileşim düzeyine bağlı olarak değişebilmekte, bazen olumlu bazen de olumsuz bir algı ile sonuçlanmaktadır. Ankete katılan kişilerin çoğu, yolcu onlarla etkileşime girmediği sürece, bir sürücünün davranışının bir yolcunun varlığından veya yokluğundan etkilenmediğini bildirdi. Bununla birlikte, yolcu etkileşiminin dikkat dağınıklığı veya zihinsel gerginlik gibi olumsuz sonuçlara yol açabileceği kaydedilmiştir. Aksine, çoğu katılımcı, yolcunun sürücü-yolcu etkileşimine proaktif katılımı ile sürüşün olumlu bir deneyim haline geldiğini belirtti. Örneğin yolcular, sürüş dışı görevlerde yardım ve sürücünün fark etmemiş olabileceği potansiyel tehlikelere karşı uyarılar yoluyla gelişmiş sürüş güvenliğinden de yararlanabilir. Bir sürücünün yolcusuyla nasıl etkileşime girdiğinin, birlikte seyahat ettikleri kişiye bağlı olarak değişebileceğini kabul etmek önemlidir. Mülakatlar, hasta, yaşlı veya bebek gibi savunmasız yolcularla araç kullanırken sürücülerin daha dikkatli olma eğiliminde olduklarını ve güvenliğe öncelik verdiklerini göstermiştir. Kendini yolcularından sorumlu hissedenler, savunmasız veya tanıdık yolcuları taşıırken daha güvenli sürüş alışkanlıkları ve daha az riskli davranışlar sergileme eğilimindedir.

Görüşme sonuçlarını analiz ettikten ve DPIQ için potansiyel öğeleri belirledikten sonra, yolcularla seyahat etmenin dinamiklerini daha derinlemesine incelemek için bir literatür taraması yapıldı. İnceleme, sürücüler ve yolcular arasındaki etkileşimleri keşfetmeye ve bu etkileşimleri ölçmek için mevcut araçları incelemeye odaklandı. Kapsamlı bir literatür analizi, sürücü ve yolcu arasındaki ilişkiyi inceledi. Nitel veri toplama araçları da gözden geçirilmiş ve sürücü-yolcu-araç içi etkileşimine ilişkin maddeler buna göre uyarlanmıştır. Son aşamada ise toplam altı alt boyut ve 49 madde belirlenmiştir.

Tartışma

Yolcunun varlığı ile ilgili yapılan çalışmalar, yol güvenliğinde da yalnızca sürücünün değil yolcunun, sürücü-yolcu etkileşiminin de önemini göstermiştir. Tipik olarak literatür, çalışmaların birincil sonucu olarak kazalara odaklanmıştır. Sürücü davranışları, sürücü becerileri, olumlu sürücü davranışları, güvenli sürüş ve yolcuların varlığı arasındaki bağlantıyı da dikkate almak önemlidir (Charlton ve Starkey, 2020). Mevcut çalışma, yolcu ve sürücü davranışları arasındaki ilişkiyi inceleyerek mevcut literatüre değerli bir katkı sağlamaktadır.

Sürücünün, yolcunun fiziksel varlığı veya yokluğundan ziyade varlığını algılaması ve onunla etkileşim kurması daha önemlidir. Görüşmeler sırasında sürücüler, yolcu onlara aşına olduğunda daha dikkatli ve dikkatli araç kullandıklarını bildirdiler. Bu, sürücü ve yolcu arasındaki bağlantının, yolcunun orada olup olmadığına bakılmaksızın yol güvenliğinin sağlanmasında önemli bir rol oynadığı anlamına gelir. Mevcut çalışma, yalnızca yolcunun varlığından ziyade sürücü ve yolcu arasındaki etkileşime odaklanmanın önemini vurgulamaktadır. Ayrıca bu etkileşimi ölçmek için bir ölçme aracı oluşturulmuştur.

ÜÇÜNCÜ BÖLÜM

Ana Çalışma:

Sürücü Yolcu Etkileşimi Anketinin Faktör Yapısının Belirlenmesi Ve Sürücü Davranışları İle İlişkisinin İncelenmesi

Katılımcılar

Bu çalışmaya toplamda 317 sürücü (163 kadın, 154 erkek) katılmıştır. Katılımcıların yaş aralığı 19 ve 70 olup, ortalama yaş 33.28'dir. Bütün katılımcıların en az bir yıllık ehliyetleri bulunmaktadır. Hem yıllık hem de toplam yaptıkları kilometreler sorulmuştur. Katılımcıların, ortalama toplam kilometreleri 133,294.80'dir.

Prosedür

Veri toplamaya başlamadan önce Orta Doğu Teknik Üniversitesi İnsan Denekler Etik Kurulu'ndan etik izin alınmıştır. Tüm anketler internet tabanlı bir sitede hazırlanmış ve Qualtrics çevrimiçi araştırma yazılımı (www.qualtrics.com) aracılığıyla çevrimiçi veriler toplanmıştır. Çevrimiçi araştırma platformu üzerinden oluşturulan bağlantı ile anketler e-posta yoluyla veya Facebook, Twitter ve/veya Instagram gibi sosyal medya aracılığıyla katılımcılara dağıtılmıştır. Ayrıca veri toplamada Orta Doğu Teknik Üniversitesi Psikoloji Bölümü öğrencilerinin erişimine açık olan Sona Sistemi de kullanılmıştır. Tüm katılımcılara bilgilendirilmiş onam verilerek çalışmanın amacı hakkında bilgi verilmiştir. Araştırmaya katılım tamamen gönüllülük esasına dayanmaktadır.

Materyaller

Demografik Bilgi Formu

Demografik bilgi formu; yaş, cinsiyet, eğitim düzeyi, ehliyete sahip olunan yıl sayısı, aracın kullanım yılı, yıllık km, ömür boyu km sorularından oluşmaktadır. Ayrıca, katılımcılara son üç yıldaki aktif kaza sayısı (başka bir yol kullanıcısına

çarpma), pasif kaza sayısı (başka bir yol kullanıcısına çarpma) ve ceza sayısı ve ceza türleri sorulmuştur.

Yolcu Bilgi Formu

Bu form yolcunun araçta bulunup bulunmadığı ve yolcunun demografik bilgileri gibi bilgileri elde etmek amacıyla sekiz sorudan oluşmaktadır. Öncelikle üç maddeden oluşan küçük bir matris ile araçta yolcu varlığını tespit edildi. Formun diğer soruları araçta bulunan yolcu ile ilgili bilgileri, Sürücü-Yolcu Etkileşimi Anketi ise yolcusu olan sürücülere ilişkin sorulardan oluştuğu için yolcusu olmayan sürücülere Sürücü Davranışları Anketi uygulanmıştır. Ayrıca, katılımcılara, en sık seyahat ettikleri yolcu tipi sorulmuştur. Bunlara ek olarak, yolcunun yaşı, cinsiyeti, kaç yolcu ile seyahat edildiği, yolcu ile seyahat etmeyi tercih edip etmediği ve yolcunun varlığını olumlu bulup bulmadığı sorulmuştur.

Sürücü-Yolcu Etkileşimi Anketi

Sürücü-Yolcu Etkileşimi Anketi (DPIQ), araç içindeki sürücü-yolcu etkileşimini incelemek için geliştirilmiştir. Bu anket ile araçta sürücü-yolcu etkileşimi hakkında daha detaylı bilgi elde edilmesi amaçlanmıştır. Toplam 49 madde ve 6 faktörden oluşan anket oluşturulmuştur. Bu faktörler; Yolcunun Sürüş Dışı Görevlerde Yardımı, Yolcunun Proaktif Katılımı, Sorumluluk Hissi, Dikkat Dağınıklığı, Zihinsel Aşırı Yükleme ve Eleştirilme Korkusudur.

Sürücü Davranışları Anketi

Sürücü Davranışları Anketi (SDA), anormal sürücü davranışlarını ölçmek için Reason ve arkadaşları (1990) tarafından geliştirilmiştir. SDA, Lajunen ve Özkan (2004) tarafından Türkçe'ye adapte edilmiş ve faktör yapısına uyarlanarak kullanılmıştır. SDA, ihlaller (sıradan ihlal ve saldırgan ihlal), hatalar, kasıtsız sapmalar ve yanılılardan oluşan bir kişisel bildirim anketidir. Bu çalışmada Özkan ve Lajunen (2005) tarafından geliştirilen Pozitif Sürücü Davranışları Ölçeği de SDA'ya eklenmiştir. Pozitif Sürücü Davranışları Ölçeği, güvenlik endişesi ne olursa olsun, sürücülerin trafik ortamında diğer yol kullanıcılarına yardım etme, dikkat etme ve onlara karşı nazik olma davranışlarını ölçmeyi amaçlamaktadır. Bu çalışmada kullanılan SDA 42 maddeden oluşmaktadır.

Sürücü Becerileri Ölçeği

Sürücü Becerileri Ölçeği (SBÖ), katılımcıların kendileri tarafından bildirilen algısal-motor ve güvenlik becerileri yönelimlerini ölçmek için Lajunen ve Summala (1995) tarafından geliştirilmiştir. DSÖ, Sümer ve Özkan (2002) tarafından Türkçe'ye uyarlanarak kullanılmıştır. Bu çalışmada kullanılan kısa versiyon 10 maddeden oluşmaktadır; 5 tanesi algısal-motor beceri, 5 tanesi güvenlik becerisidir.

Bulgular

Mevcut çalışmada, analizler üç bölüm altında toplanmıştır. Bunlardan ilki, bu çalışmada geliştirilen Sürücü-Yolcu Etkileşimi Anketinin faktör yapı analizine ilişkin istatistiksel bilgilerin verildiği bölümdür. İkinci bölümde, bu çalışmada kullanılan ilgili değişkenler ilişkin betimsel istatistikler verilmiştir. Üçüncü bölümde, ilgili değişkenlerin için hiyerarşik regresyon ve MANCOVA analizleri gibi temel analizler yapılmış ve bu analizlerin bulguları paylaşılarak sürücü-yolcu etkileşimi ile yolcu davranışları arasındaki ilişkinin yolcu türü ve sürücü becerileri kontrol edildiğinde nasıl olduğu araştırılmıştır. Bu çalışmadaki tüm analizler SPSS 26 programı kullanılarak yapılmıştır.

Sürücü-Yolcu Etkileşimi Anketinin (SYEA) Faktör Yapısı

49 maddelik SYEA yeni geliştirildiği ve daha önce belirli bir faktör yapısı olmadığı için Açıklayıcı Faktör Analizi yapılmıştır. Çıkarım yöntemi olarak temel bileşenler analizi kullanılarak faktör yapısı analiz edilmiştir. Faktörler arasında ilişki beklendiği için faktör analizi Promax ile Kaiser Normalization döndürme yöntemi olarak yapılmıştır (Tabachnick ve Fidell, 2012).

Faktör analizi sonucunda, Zihinsel Aşırı Yükleme ve Dikkat Dağınıklığı faktörleri tek faktör olarak kabul edilmiş ve beş faktör olarak faktör yapısı kabul edilmiştir. Toplamda dokuz madde anketten çıkarılmıştır. Bunlardan ikisi herhangi bir faktör yüklenmediği için dışlanmıştır. Ayrıca 4 tanesi ilgili faktör yerine başka bir faktöre yüklendiği için elenmiştir. Başka bir deyişle, anlamsal olarak uygun olmadıkları faktörlere yüklenmişlerdir. Son olarak, çapraz yükleme nedeniyle, üç madde anketten çıkartılmıştır.

Faktör analizi sonrası ankette meydana gelen değişikliğe göre DPIQ geneli için iç tutarlılık güvenirlik puanı .85 olarak bulunmuştur. Ayrıca, Faktör 1, Dikkat Dağınıklığı ve Zihinsel Aşırı Yükleme, 15 maddeden oluşmakta ve Cronbach alfa'sı .84' idi. Faktör 2, Sorumluluk Duygusu, 10 maddeden oluşmakta ve Cronbach alfa'sı .82' idi. Ayrıca faktör 3, Yolcunun Proaktif Katkısı 7 maddeden oluşmakta ve Cronbach alfa'sı .86' idi. Faktör 4, Eleştirilme Korkusu, 4 maddeden oluşmakta ve Cronbach alfa'sı .71' idi. Son olarak, faktör 5, Yolcunun Sürüş Dışı Görevlerde Yardımı, 4 maddeden oluşmakta ve Cronbach alfa'sı .70' idi.

Temel Analizler: Hiyerarşik Regresyon Analizleri

Sürücü-yolcu etkileşimi faktörlerinin, yolcu tipi ve sürücü becerilerine göre kontrol edilirken Hatalar ile ilgili olup olmadığını test etmek için hiyerarşik bir regresyon analizi yapılmıştır. Regresyon analizinin sonuçları, ilk adımda kontrol edilen değişkenlerin regresyon modeline önemli ölçüde katkıda bulunduğunu ve Hatalarda %3'lük bir varyasyonu açıkladığını gösterdi ($F(3, 300) = 2.87, p < .05, R^2 = .03$). Yolcu Türlerinin tanıtılması, hatalarda %1'lik ek bir varyasyonu açıkladı ($F_{change}(4, 296) = 1.22, p > .05, R^2 = .04$). Ayrıca, üçüncü adımda girilen sürücü becerileri, Hatalarda açıklanan varyansı önemli ölçüde artırmaktadır ($F_{change}(2, 294) = 13.78, p < .001, R^2_{change} = .08$). Son olarak, sürücü-yolcu etkileşimi faktörlerinin tanıtılması, Hatalarda %5'lik ek bir varyasyonu açıkladı ($F_{change}(5, 289) = 3.75, p < .01, R^2 = .18$); toplamda, sürücü-yolcu etkileşimi faktörleri, Hatalardaki varyansın %18'ini açıkladı. Ayrıca, Yolcu Türleri ve sürücü becerilerinin etkileri kontrol edildikten sonra, Eleştirilme Korkusunun Hatalar ile olumlu yönde ilişkili olduğu bulundu.

Yolcu tipi ve sürücü becerileri kontrol edilirken sürücü-yolcu etkileşimi faktörlerinin Kasıtsız Sapmalar ve Yanılgılar ile ilişkili olup olmadığını test etmek için hiyerarşik bir regresyon analizi yapılmıştır. Regresyon analizinin bulguları, ilk adımdaki kontrol edilen değişkenlerin, Kasıtsız Sapmalar ve Yanılgılarda %4'lük değişimi açıkladığını gösterdi ($F(3, 300) = 3.67, p < .05, R^2 = .04$). Son olarak, sürücü-yolcu etkileşimi faktörlerinin tanıtılması, Kasıtsız Sapmalar ve Yanılgılardaki %11'lik ek değişimi açıkladı ($F_{change}(5, 289) = 7.79, p < .001, R^2 = .25$). Ayrıca Yolcu Türleri ve sürücü becerileri etkileri kontrol edildikten sonra, Dikkat Dağıtma ve Zihinsel Aşırı

Yükleme, Sorumluluk Duygusu ve Sürüş Dışı Görevlerde Yolcu Yardımı Kasıtsız Sapmalar ve Yanılgılar ile pozitif ilişkili bulunmuştur.

Sürücü-yolcu etkileşimi faktörlerinin, Yolcu Tipi ve sürücü becerileri kontrol edildiğinde Olumlu Sürücü Davranışı ile ilişkili olup olmadığını test etmek için hiyerarşik bir regresyon analizi yapılmıştır. Sonuçlar, ilk adımdaki kontrol edilen değişkenlerin regresyon modeline önemli ölçüde katkıda bulunduğunu ve Pozitif Sürücü Davranışında %3'lük bir varyasyonu açıkladığını gösterdi ($F(3, 300) = 3.01, p < .05, R^2 = .03$). Son olarak, sürücü-yolcu etkileşimi faktörlerinin tanıtılması, Pozitif Sürücü Davranışındaki %8'lik ek değişimi açıkladı ($F_{change}(5, 289) = 5.89, p < .001, R^2_{change} = .08$); toplamda, sürücü-yolcu etkileşimi faktörleri, Olumlu Sürücü Davranışındaki varyansın %26'sını açıkladı. Ayrıca, yolcu türlerinin ve sürücü becerilerinin etkileri kontrol edildikten sonra, Sorumluluk Duygusunun pozitif ve Eleştirilme Korkusunun Olumlu Sürücü Davranışı ile negatif ilişkili olduğu bulunmuştur.

Temel Analizler: MANVOCA Analizleri

3 (Dikkat Dağınlıklığı ve Zihinsel Aşırı Yük: düşük, orta, yüksek) X 5 (yolcu tipi: Arkadaş, Ebeveyn, Eş/Sevgili, Patron ve İş Arkadaşı ve Çocuk/Bebek) denekler arası çok değişkenli kovaryans analizi (MANCOVA) beş bağımsız değişken üzerinde yapıldı. Dikkat Dağınlıklığı ve Zihinsel Aşırı Yüklemeye bağımlı değişkenlere göre farklılık göstermiştir. Hatalar, Kasıtsız Sapmalar ve Yanılgılar, Dikkat Dağınlıklığı ve Zihinsel Aşırı Yük düzeylerine göre önemli ölçüde farklılaştığı bulunmuştur. Düşük düzeyde Dikkat Dağınlıklığı ve Zihinsel Aşırı Yük, yüksek düzeye kıyasla daha az Hataya sebep olmaktadır. Ek olarak, düşük düzeyde Dikkat Dağınlıklığı ve Zihinsel Aşırı Yük, orta ve yüksek düzeye kıyasla daha az Kasıtsız Sapmalar ve Yanılgılara sebep olmaktadır.

3 (Sorumluluk Duygusu: düşük, orta, yüksek) X 5 (yolcu tipi: Arkadaş, Ebeveyn, Eş/Sevgili, Patron ve İş Arkadaşı ve Çocuk/Bebek) denekler arası çok değişkenli kovaryans analizi (MANCOVA) beş bağımsız değişken üzerinde yapıldı. Sorumluluk Duygusu bağımlı değişkenlere göre farklılık göstermiştir. Yüksek düzeyde sorumluluk duygusu, düşük ve orta düzeylere göre, daha çok olumlu sürücü davranışları gösterilmesine sebep olmaktadır.

3 (Yolcunun Proaktif Katkısı: düşük, orta, yüksek) X 5 (yolcu tipi: Arkadaş, Ebeveyn, Eş/Sevgili, Patron ve İş Arkadaşı ve Çocuk/Bebek) denekler arası çok değişkenli kovaryans analizi (MANCOVA) beş bağımsız değişken üzerinde yapıldı. Yolcunun Proaktif Katkısı bağımlı değişkenlere göre farklılık göstermiştir. Düşük düzeyde yolcunun proaktif katkısı olması, orta ve yüksek düzeylere kıyasla, hem saldırgan hem de sıradan ihlallerin sıklığını artırmaktadır.

3 (Eleştirilme Korkusu: düşük, orta, yüksek) X 5 (yolcu tipi: Arkadaş, Ebeveyn, Eş/Sevgili, Patron ve İş Arkadaşı ve Çocuk/Bebek) denekler arası çok değişkenli kovaryans analizi (MANCOVA) beş bağımsız değişken üzerinde yapıldı. Eleştirilme Korkusu bağımlı değişkenlere göre farklılık göstermiştir. Düşük ve orta düzeye kıyasla, yüksek düzeyde eleştirilme korkusu Hataların sıklığının artmasına sebep olmaktadır. Ayrıca, düşük düzeye kıyasla, yüksek düzeyde eleştirilme korkusu Kasıtsız Sapmalar ve Yanılgılar sıklığını artırmaktadır. Son olarak, yüksek ve orta düzeye kıyasla, düşük düzeyde eleştirilme korkusu olumlu sürücü davranışları sıklığını artırmaktadır.

3 (Yolcunun Sürüş Dışı İşlerde Yardımı: düşük, orta, yüksek) X 5 (yolcu tipi: Arkadaş, Ebeveyn, Eş/Sevgili, Patron ve İş Arkadaşı ve Çocuk/Bebek) denekler arası çok değişkenli kovaryans analizi (MANCOVA) beş bağımsız değişken üzerinde yapıldı. Yolcunun Sürüş Dışı İşlerde Yardımı bağımlı değişkenlere göre farklılık göstermiştir. Yüksek düzeye kıyasla, düşük düzeyde Yolcunun Sürüş Dışı İşlerde Yardımı olduğunda, daha çok saldırgan ihlaller yapıldığı bulunmuştur.

Tartışma

Mevcut çalışmanın temel amacı, sürücü-yolcu etkileşimi faktörlerinin sürücü davranışları üzerindeki etkisini incelemektir. Yolcuların varlığı ile sürücü davranışları, kazaya karışma riski veya yaralanma riski arasındaki ilişkiyi araştıran birçok çalışma olmasına rağmen (Preusser, Ferguson ve Williams, 1998), yolcuların varlığının riskli sürücü davranışlarına neden olup olmadığına veya sürüş güvenliğine katkıda bulunup bulunmadığına dair çalışmaların sayısı çok kısıtlıdır. Başka bir deyişle, aracın içinde neler olduğu hakkında çok az şey bilinmektedir.

Bu çalışmada, sürücü-yolcu etkileşimi hakkında bilgi edinmek amacıyla literatüre katkı sağlayan Sürücü-Yolcu Etkileşimi Anketi (SYEA) geliştirilmiştir.

Sürücü-yolcu etkileşimini araştırmak için az sayıda çalışma yapılmış olmasına rağmen, bu çalışmalar genellikle bir tür sürücü davranışına odaklanmaktadır. Buna karşılık, mevcut çalışma hem anormal sürücü davranışlarını hem de olumlu sürücü davranışlarını incelemektedir. Ayrıca geliştirilen yeni anket ile sürücü-yolcu etkileşiminin detaylı bir şekilde tanımlanması amaçlanmaktadır.

Sürücü-Yolcu Etkileşimi Anketi (SYEA) ile İlgili Bulguların Değerlendirilmesi

Faktör analizi sonucunda faktör yapısı önerilen modelle uyumlu olmasına rağmen önerilen modeldeki altı faktörlü yapısı beşe düşmüştür. Faktör yapısında “Dikkat Dağınıklığı” ve “Zihinsel Aşırı Yüklenme” ayrıştırılamadığı için tek faktör olarak kullanıldı. Bu iki kavram farklı bilişsel süreçler olsa da psikolojik kökenlerinin birbirine yakın olması nedeniyle böyle bir sonuç elde edilmiş olabilir. Örneğin iş yükü, sınırlı bilgi işleme kapasitesi olarak tanımlanabilirken (Gaillard ve Kramer, 2000), dikkat dağınıklığı ise dikkatin bölünmesiyle ilgilidir (Stutts ve diğerleri, 2005). Ancak araç kullanırken çok fazla uyaranla karşılaşıldığında (örneğin araç uyarı sistemlerinde birden fazla alarmin aynı anda devreye girmesi) dikkat, araç kullanma dışındaki etkinliklere çevrilebilir (örneğin araç kullanmaya dikkat edememek ve araç uyarı sistemi alarmlarını kapatmaya çalışırken ve başka bir araçla neredeyse çarpışmak üzereyken yol). Bu nedenle “Dikkat Dağıtma” ve “Zihinsel Aşırı Yüklenme” kavramlarının birbirinden ayrılamaması ve tek bir faktör olarak kullanılması literatür açısından da anlamlıydı.

SYEA faktörleri ayrı ayrı incelendiğinde, sonuçlar yolcu varlığının sürücüler üzerinde orta düzeyde bir dikkat dağıtma ve zihinsel aşırı yüklenme etkisi olduğunu göstermiştir. Sonuçlar, yolcuların dikkatsiz sürüşe neden olup olmadığına ilişkin çalışmalarla tutarlıydı. Örneğin, McEvoy, Stevenson ve Woodward'ın (2006) çalışmasında, sürücülerin dikkatinin dağılmasına neden olan ilk beş neden arasında yolcular yer almaktadır. Bu çalışma ile tutarlı olarak, aslında yolcular için dikkat dağınıklığına neden olduğu ancak çok yüksek bir oranda olmadığı sonucuna varılabilir. Örneğin; araç içi donanımın ayarlanması, yolcuya kıyasla sürücü için daha fazla dikkat dağıtıcıdır (Stutts ve diğerleri, 2001). SYEA'nın diğer faktörü sorumluluk duygusudur. Bulgular, yolcunun varlığının yüksek düzeyde sorumluluk duygusuna yol açtığını göstermiştir. Bu alandaki hem nitel hem de nicel çalışmaların sonuçları, sürücülerin yolcuların güvenliği konusunda kendi sorumluluklarını hissettiklerini de

göstermiştir (Rosenbloom ve Perlman, 2016). Hatta sorumluluk duygusundan dolayı daha az ihlal yaptıkları ve trafik kurallarına daha çok uydukları saptanmıştır (Taubman-Ben-Ari ve Noy, 2011). Ayrıca yolcunun aşına olması durumunda sorumluluk duygusunun daha yüksek olduğu belirtilmiştir (Fleiter, Lennon ve Watson, 2010). Mevcut çalışmada yolcu türlerinin (eş/sevgili, ebeveyn, çocuk/bebek ve arkadaş gibi) çoğunluğunun yakınlık düzeyi yüksek yolcu türleri olduğu düşünüldüğünde sorumluluk duygusunun yüksek olması anlamlıdır.

Ardından yolcunun proaktif katkısı incelenmiştir. Sonuçlar, yolcunun varlığının, yolcunun yüksek düzeyde proaktif katkısına yol açtığını ortaya koydu. Örneğin, sürücünün farkında olmadığı yoldaki çukurlar veya kusurlar hakkında uyarı verme, başka bir yoldan yapılan trafik hataları konusunda farkındalık yaratma ve hız sınırlarına uymaya teşvik etmek gibi yolcunun varlığının sürücünün güvenli sürüşüne katkı sağladığı söylenebilir (Charlton, & Starkey, 2020). Ayrıca SYEA ile ilgili bulgular, yolcunun varlığının orta düzeyde eleştirilme korkusuna yol açtığını, ancak düşük düzeye yakın eleştirilme korkusuna yol açtığını göstermiştir. Akran baskısı ve yolcu tarafından kötü veya acemi bir sürücü olarak eleştirilme korkusu genellikle genç sürücüler için etkilidir (Weston ve Hellier, 2018). Bu nedenle, katılımcıların yaş ortalaması (33 yaş) genç sürücülere odaklanmadığından, mevcut çalışmanın düşük düzeyde eleştirilme korkusu olması kabul edilebilir.

Son olarak sonuçlar, yolcunun varlığının sürüş dışı görevlerde yüksek düzeyde yolcu yardımına yol açtığını gösterdi. Örnek olarak yolcular, sürücünün cep telefonuna cevap vererek, radyoyu veya klimayı ayarlayarak sürücüye destek olabilmektedirler. Çalışmalar ayrıca, yolcunun sürüş dışı görevlerde yaptığı yardımın sürüş güvenliğine de katkıda bulunduğunu göstermiştir (Geyer ve Ragland, 2004).

Yolcu Bilgi Formu ile İlgili Bulguların Değerlendirilmesi

Yolcu Bilgi Formu, en sık ve en az sefer yapan yolcu tipleri, yolcunun yaşı, yolcunun cinsiyeti, yolcu sayısı gibi genel bilgileri içermektedir. Ayrıca yolcu ile mi yoksa tek başına mı seyahatin tercih edildiği, yolcu ile etkileşim/iletişim sıklığı ve yolcunun varlığının olumlu mu yoksa olumsuz mu algılandığı gibi bilgileri de içermektedir.

En sık seyahat eden yolcu türleri incelendiğinde, katılımcıların yaklaşık %29'u eş/sevgili/partner ile seyahat ettiğini belirtmiştir. Yolcular en çok seyahat ettikleri yolcu grubunun partneri olmalarına rağmen literatürdeki çalışmalar incelendiğinde sürücülerin partneri ile seyahat etmesi ile ilgili çalışma sayısı oldukça sınırlıdır. Bir çalışmada, eşleri ile seyahat eden sürücülerin, eşleri şikâyet ettikçe daha riskli davranışlar sergiledikleri gözlemlenmiştir (Dillon ve Dunn, 2005). Bu çalışmanın sonuçları ile eleştirilme korkusu faktörünün araç kullanmayı olumsuz etkilediği söylenebilir. Ayrıca sürücülerin yolcu olarak arkadaşları, ebeveynleri ve çocukları ile seyahat etme sıklığı da bu çalışmada ortaya konulmuştur. Katılımcıların yaş dağılımında genel olarak yetişkin sürücülerin yer aldığı düşünüldüğünde yolcu tipi olarak en sık belirtilen grupların olması beklenen bir sonuçtur çünkü evli ve çocuklu katılımcıların genellikle çocukları, eşleri veya arkadaşları ile seyahat etmesi olağandır. Öte yandan katılımcılardan hiçbiri en sık seyahat ettiği yolcu tipini engelli veya yabancı olarak belirtmemiştir. Türkiye'de engelli nüfus %7 civarında iken (Engelli ve Yaşlı İstatistikleri Bülteni, 2022), engelli bir kişi ile yolcu olarak seyahat etme olasılığı oldukça düşüktür. Üstelik yabancı biriyle yolcu olarak seyahat söz konusu olduğunda, otostop ya da tanımadığımız kişilerle aynı arabayı paylaşmak gibi uygulamalar Türkiye'de yaygın olarak kullanılmamaktadır. Literatürde bu konuda bilimiz dâhilinde Türkiye örneklemini ile yapılmış bir çalışmaya rastlanmamıştır. Bu nedenlerle, yolcu olarak bir yabancıyla seyahat eden katılımcı olmaması da olağandır.

Katılımcıların yaklaşık %61'i yetişkin yolcularla seyahat ettiğini bildirdi. Katılımcıların yaş dağılımına bakıldığında, %76'sı yetişkin sürücü grubunda yer aldığı için çoğunluğunun eşi veya arkadaşları ile seyahat ettiği söylenebilir. Katılımcıların çoğu, yolcularla seyahat etmeyi tek başlarına seyahat etmeye tercih ettiklerini belirtmişlerdir. Bu bulgu doğrultusunda katılımcıların büyük çoğunluğu yolcu ile seyahat etmeyi olumlu olarak değerlendirmiştir. Ayrıca katılımcı sürücüler, araçta yolcu ile seyahat ederken sıklıkla yolcu ile etkileşime girdiklerini belirtmişlerdir. Literatürdeki benzer sonuçlar, sürücülerin dörtte üçünün araç kullanırken yolcu ile sohbet ettiğini göstermektedir (Stutts vd., 2005).

Hiyerarşik Regresyon ile İlgili Bulguların Değerlendirilmesi

Öncelikle SYEA faktörleri ile Hatalar arasındaki ilişki, yaş, cinsiyet, yaşam boyu kat edilen mesafe, yolcu türleri, algısal-motor beceriler ve güvenlik becerilerinin

istatistiksel etkileri kontrol edildikten sonra incelenmiştir. Sonuçlar, literatürle tutarlı olarak, Eleştirilme Korkusunun Hatalar ile olumlu yönde ilişkili olduğunu göstermiştir. Örneğin, Taylor ve Deane (2000) tarafından yapılan bir çalışmada, araç kullanırken kötü performans gösterdiği için eleştirilme korkusunun sürücüler için en yaygın korku olduğu bulunmuştur. Nitekim katılımcıların %51'i eleştirilmekten korktukları için orta ile yüksek düzeyde kaygı yaşadıklarını belirtmişlerdir. Ayrıca kaygılı araç kullanma ile daha sık hata yapma arasında pozitif bir ilişki vardır (Matthews vd., 1998). Başka bir deyişle, yanlış şerit kullanma, yanlış hız ayarlama gibi performans hatalarının sıklığı arttıkça kaygılı araç kullanma artmaktadır (Taylor, Deane ve Podd, 2007). Bu bilgiler ışığında eleştirilme korkusu, kaygılı araç kullanımına ve daha fazla hata yapılmasına neden olabilir. Mevcut çalışma, yolcu türlerinin ve sürücü becerilerinin istatistiksel etkisini kontrol ederken bile daha önce kanıtlanan ilişkilerin hala var olduğunu göstererek bir katkı yapmıştır. Bu demektir ki yolcu kim olursa olsun eleştirilme korkusunun hata yapma sıklığını artırdığı söylenebilir. Ayrıca hatalar ile hem algısal-motor becerileri hem de güvenlik becerileri gibi sürücü becerileri arasında negatif bir ilişki vardır (Martinussen, Møller ve Prato, 2014). Ancak, bu sürüş becerilerinin istatistiksel etkileri kontrol edilse de, eleştirilme korkusu hata yapma sıklığının artmasına neden olduğu mevcut çalışma ile gösterilmiştir.

Bulgular Dikkat Dağıtma ve Zihinsel Aşırı Yüklenme, Eleştirilme Korkusu ve Yolcunun Sürüş Dışı Görevlerde Yardım Etmesinin, Kasıtsız Sapmalar ve Yanılgılar ile olumlu yönde ilişkili olduğunu gösterdi. Kasıtsız Sapmalar ve Yanılgılar zaten bağlam olarak Dikkat Dağıtma ve Zihinsel Aşırı Yükleme değişkenleri ile ilişkilidir. Örneğin, Kasıtsız Sapmalar ve Yanılgılar faktörü ile ilgili olan “ana yoldan caddeye dönerken karşıdan karşıya geçen yayaları fark edememe” maddesi incelendiğinde; bu dikkatsizliktir. Buna ek olarak, birçok çalışma dikkat dağınıklığının kasıtsız sapmalar ve yanılgılarla olumlu yönde ilişkili olduğunu ortaya koymuştur (Reason vd., 1990). Kasıtsız Sapmalar ve Yanılgılar ile Eleştirilme Korkusu arasındaki pozitif ilişki de beklenmektedir çünkü kasıtsız sapmalar ve yanılgılar da kaygı ile pozitif olarak ilişkilidir. Örneğin, bir çalışmanın bulguları, yüksek ve orta düzeyde kaygıya sahip sürücülerin daha yüksek sıklıkta Kasıtsız Sapmalar ve Yanılgılar yapma eğiliminde olduğunu göstermiştir (Shahar, 2009). Benzer şekilde, başka bir çalışma da genç sürücüler için artan kaygının Kasıtsız Sapmalar ve Yanılgılar değişkeninde yüksek

puanlarla ilişkili olduğunu ortaya koydu (Lucidi vd., 2010). Eleştirilme Korkusunun kaygıya neden olması, Kasıtsız Sapmalar ve Yanılgılar sıklığının artmasına neden olduğu söylenebilir. Kasıtsız Sapmalar ve Yanılgılar ile Eleştirilme Korkusu arasındaki ilişkide kaygı özelliğinin aracı rolü olduğu söylenebilir. Son olarak, ilginç bir şekilde, Sürüş Dışı Görevlerde Yolcu Yardımı ile Kasıtsız Sapmalar ve Yanılgılar arasında pozitif bir ilişki vardı. Bunun nedeni, yolcunun sürüş dışı görevlerde yardımcı olmaya çalışırken aynı zamanda sürücünün dikkatinin dağılması olabilir. Başka bir deyişle, sürüş dışı görevlerde yardımcı olurken çok aktif olmak, sürücünün zihinsel süreçlerini etkileyerek kasıtsız sapmalar ve yanılgılar sıklığının artmasına neden olabilir.

Bulgular Sorumluluk Duygusunun Olumlu Sürücü Davranışları ile olumlu yönde ilişkili olduğunu göstermiştir. Bu bulgular yolcuların varlığının olumlu etkisi birçok çalışmayla da gösterildiği için beklenmekteydi (Lee, & Abdel-Aty, 2008) ve bunun nedenlerinden biri, sürücünün yolcunun güvenliğini kendi sorumluluğunda hissetmesidir (Rosenbloom ve Perlman, 2016). Örneğin, 4-15 yaş arası çocuk yolculu sürücünün kaza riskinin, yolcusuz sürücüye göre %25 daha az olduğu bulunmuştur (Rueda-Domingo vd., 2004). Ayrıca araçta çocuk yolcu varsa sürücülerin alkol aldıktan sonra araç kullanmadığı bildirilmiştir (Romano, vd., 2019). Bu da demek oluyor ki çocuk yolcunun dikkat dağıtma etkisine rağmen koruyucu etkisinin olmasının nedeni, sürücünün sorumluluk duygusu hissetmesi olabilir. Ayrıca yapılan bir çalışmanın bulguları, yolcu sayısı arttıkça ihlal sıklığının azaldığını göstermektedir (Rosenbloom ve Perlman, 2016). Benzer şekilde, yolcu sayısı arttıkça sürücünün sorumluluk duygusu artabilir ve bu da olumlu sürücü davranışlarının sıklığının artmasına neden olabilir.

MANCOVA Analizi ile İlgili Bulguların Değerlendirilmesi

SYEA faktörlerinin sürücü davranışları üzerindeki seviyeleri arasındaki farklarla ilgili olarak MANCOVA analizleri hesaplanmıştır. SYEA'nın her faktörü üçe ayrılmıştır: düşük, orta ve yüksek. Mevcut çalışma, yolcunun kim olduğuna bakılmaksızın, yüksek düzeyde Dikkat Dağılımı ve Zihinsel Aşırı Yük yaşayan sürücülerin, düşük düzeyde Dikkat Dağıtma ve Zihinsel Aşırı Yük ile karşılaştırıldığında daha yüksek Hata sıklığına sahip olduğunu göstermiştir. Öte yandan, yolcunun kim olduğuna bakılmaksızın, sürücülerin, Dikkat Dağıtma ve

Zihinsel Aşırı Yük yüksek seviyedeysen, orta ve düşük seviyeye kıyasla Kasıtsız Sapmalar ve Yanılgılar sıklığı olasılığı daha yüksekti. Dikkat dağınıklığının üç boyutlu olduğu söylenebilir: görsel (örneğin, gözünüzü yoldan ayırma, yolcuya bakma), fiziksel (örneğin, direksiyonu tutmama, yolcu ile fiziksel etkileşim, yolcu partneriyle el ele tutuşma) ve bilişsel (örneğin, araba kullanmaktan vazgeçmek, yolcu ile tartışmak) (Ulusal Karayolu Trafik Güvenliği İdaresi, 2012). Bu boyutlara göre dikkat dağınıklığı arttıkça hata yapma veya kasıtsız sapmalar ve yanılgılar sıklığı da artmaktadır. Örneğin, sadece yolcuya bakmak, sadece görsel olarak düşük düzeyde dikkat dağınıklığı olarak kabul edilebilir ve bu da daha az hata sıklığına neden olur. Öte yandan, hem görsel (örn. yolcuya bakma) hem de bilişsel (örn. yolcu ile tartışma) daha yüksek düzeyde dikkat dağıtmaya neden olacağı için kasıtsız sapmalar ve yanılgılar veya hata sıklığında artışa neden olur (Overton ve ark., 2015). Ancak, Dikkat Dağıtma ve Zihinsel Aşırı Yükleme düzeyi açısından Hatalar ve Kasıtsız Sapmalar ve Yanılgılar arasındaki fark, orta düzeydeki Dikkat Dağıtma ve Zihinsel Aşırı Yüklemenin, Sapmalar için düşük düzey ve yüksek düzeyden önemli ölçüde farklı olmasıydı. Bunun nedeni, yolcu ile etkileşimden kaynaklanan dikkat dağınıklığının diğer dikkat dağıtıcı faktörlerden farklı olması olabilir. Yolcular da araçta olduğu için trafik ortamlarının sorumluluklarını sürücülerle paylaşmakta ve zorlu trafik ortamlarında konuşmayı sonlandırarak sürücünün dikkatinin dağılmasını engelleyebilmektedir (Bavelas, Coates, & Johnson, 2000). Sapmaların trafik güvenliği açısından Hatalara göre daha az riskli olması nedeniyle (Reason vd., 1990), sürücünün hata yaptığı trafik durumları yolcu tarafından daha kolay tespit edilebildiğinden, görüşmeyi sonlandırmak yolcu için daha yaygın olabilir. Öte yandan, gidilen rotayı unutmak gibi sapmalar yolcu tarafından tehlikeli olarak algılanmadığı için yolcunun sürücü ile etkileşimini sürdürebilmesi ve orta düzeyde dikkat dağınıklığına neden olabilmesi gibi sonuçları olabilir.

Yolcu kim olursa olsun, Sorumluluk Duygusu düzeylerinin sürücü davranışları üzerindeki ilişkisine bakıldığında, düşük ve orta düzeylere kıyasla, Sorumluluk Duygusu düzeyi yüksek olan sürücülerin Olumlu Sürücü Davranışları sıklığı daha fazladır. Ayrıca, yolcuların düşük seviyeli Proaktif Katkısı, yolcuların orta ve yüksek Proaktif Katkısına kıyasla daha yüksek Agresif ve Sıradan İhlallere neden olmuştur. Literatürde, kaza verilerine göre en az bir yolcusu olan sürücülerin, yolcusu olmayan sürücülere göre daha az ihlal sıklığına sahip olduğu bulunmuştur (Orsi vd., 2013); veya

simüle edilmiş sürüşte (Chung, ve diğerleri, 2014); veya doğal sürüş gözlemi üzerine (Rosenbloom ve Perlman, 2016). Literatürde bu konuda yapılan diğer çalışmalardan farklı olarak mevcut çalışma, yolcunun varlığının sürücülerin ihlal sıklığını nasıl azalttığını da açıklamaktadır. Bu çalışmanın bulguları ile yolcuların proaktif katkıları sayesinde ihlallerin azaldığı söylenebilir (Örneğin hız limitleri aşıldığında yolcu sürücüyü uyarır veya yolcu sürücüyü trafik kurallarına uymaya teşvik eder).

Yolcu kim olursa olsun, Eleştirilme Korkusu düzeyleri ile sürücü davranışları arasındaki ilişki göz önüne alındığında, Eleştirilme Korkusu düzeyinin yüksek olması, düşük ve orta düzeyden ziyade Hata sıklığına daha fazla neden olmaktadır. Ek olarak, mevcut çalışmanın sonuçları, Eleştirilme Korkusunun yüksek düzeyinin, Eleştirilme Korkusunun düşük düzeyine kıyasla, Kasıtsız Sapmalar ve Yanılgılar sıklığına daha fazla neden olduğunu göstermiştir. Ayrıca, Eleştirilme Korkusunun düşük düzeyi, Olumlu Sürücü Davranışlarının sıklığına orta ve yüksek düzeye göre daha fazla neden olmaktadır. Eleştirilme korkusu, kaygı düzeyinin yükselmesine, performansı iyileştirmek yerine kötüleşmesine neden olabilir (Rosenbloom ve ark., 2007). Dolayısıyla eleştirilme korkusu arttıkça Hata, Kasıtsız Sapmalar ve Yanılgılar gibi sapkın sürücü davranışlarının sıklığı artarken olumlu sürücülerin sıklığı azalmaktadır. Sosyal psikolojide bu durumu açıklamak için kullanılan teorilerden biri de Sosyal Kolaylaştırma Teorisidir (Zajonc, 1965). Bu teori, birinin varlığının, yani gözlemlenmesinin veya izlenmesinin, insanların davranışlarında bir değişikliğe neden olduğunu savunur. Ayrıca teori, görev tanıdık ve kolaysa, birinin varlığının performansı artırdığını, görev karmaşık ve zorsa performansı kötüleştirdiğini belirtmiştir (Cottrell, 1972). Trafik durumunun motor beceriler, dikkat, trafik kuralları bilgisi, yol tutuşu gibi çok boyutlu beceriler gerektirdiği için araba sürmenin karmaşık bir görev olduğunu düşünmek ve eleştirilme korkusuyla başkalarının varlığı düşük performansa neden olabilir.

Son MANCOVA Analizleri, Sürüş Dışı Görevlerde Yolcu Yardımı düzeyleri ile sürücü davranışları arasındaki ilişkiyi araştırmak için gerçekleştirilmiştir. Bulgular, yolcu kim olursa olsun, yüksek düzeye kıyasla, düşük düzeyde Sürüş Dışı Görevlerde Yolcu Yardımının daha yüksek sıklıkta Saldırgan İhlallere neden olduğunu göstermiştir. Bunun nedeni, yolcu sürücüyü sürüş dışı görevlerde yardımcı olduğunda, sürücünün bu faaliyetlerle uğraşmayarak stres düzeyini azaltabilmesi olabilir. Böylece

stres düzeyi düştükçe daha az saldırgan sürücü davranışları ve saldırgan ihlaller ortaya çıkıyor. Literatürde birçok çalışma, trafik sıkışıklığı gibi sinir bozucu durumların trafikteki saldırgan davranışlarla güçlü bir şekilde ilişkili olduğunu göstermiştir (Shinar, 1998). Bu bilgiler ışığında, yolcuya sürüş dışı görevlerde yardımcı olmak, sürücüler için sinir bozucu seviyeyi düşük tutabilir.

Yapılan beş MANCOVA analizinde yolcu tiplerine göre sürücü davranışlarında veya sürücü-yolcu etkileşimi ile yolcu tipi arasındaki etkileşime göre herhangi bir farklılaşma gözlemlenmemiştir. Bunun nedeni, bu çalışmada kullanılan yolcu tiplerinin (arkadaşlar, anne-babalar, kardeşler ve eş/partnerler) büyük çoğunluğunun sürücü ile yakınlık ilişkisi içinde olan yolcu tipleri olması olabilir. Dolayısıyla sürücü davranışlarında yolcu tiplerine göre bir farklılaşma olmayabilir. Yolcu olarak yabancı olsaydı belki yolcu tipinin sürücü davranışında farklılıklara neden olup olmadığı farklı sonuçlarla gözlemlenebilirdi. Örneğin, eleştirilme korkusu genellikle akran baskısı olarak görülürken (Weston ve Hellier, 2018), bir yabancı tarafından eleştirilme düşüncesi daha az kaygıya neden olabilir. Öte yandan, sorumluluk duygusu olan yolcu tanıdık ise daha yüksek olduğu bulunmuştur (Fleiter, Lennon ve Watson, 2010). Bu farklılıklardan dolayı yolcu tipinin etkisi gözlemlenmemiş olabilir. Ancak benzer güzergâhlarda seyahat eden veya otostop yapan yabancılarla araç paylaşımını sağlayan uygulamalar ülkemizde yaygın olmadığı için sürücülerin en sık seyahat ettiği yolcu olarak yabancı bulmak zordur. Bir yabancı yolcu olarak seyahat etse bile en sık seyahat edilen yolcu türü olması beklenmemektedir.

Çalışmanın Etkileri ve Gelecek Çalışmalara İlişkin Öneriler

Bu çalışmada, bulgulara dayalı kritik çıkarımlar yapılabilir. Sürücü-yolcu etkileşimi için yeni bir ölçek geliştirmenin teorik yaklaşımı yönünden, bu çalışma farklı adımlarında hem nitel hem de nicel veri toplama yöntemlerinin birleşimini kullandığı için benzersizdir. Ayrıca, ölçek karmaşık ve çok yönlü sürücü-yolcu etkileşimi kavramını ölçmek için yeni bir yol sağladı. Sürücü-yolcu etkileşimi ile ihlaller, hatalar, kasıtsız sapmalar ve yanılgılar ve olumlu sürücü davranışları gibi çeşitli sürücü davranışları arasındaki ilişkiyi incelemek için kullanılmıştır.

Uygulamalı bir bakış açısıyla, mevcut çalışmanın sonuçları hem yolcu varlığının sürücü davranışları üzerindeki olumlu etkilerini artırmak hem de yolcu

varlığının sürücü davranışları üzerindeki olumsuz etkilerini azaltmak için bir güvenlik kampanyası hazırlamak amacıyla kullanılabilir. Örneğin, bu çalışmanın sonuçlarından biri, yüksek düzeyde sorumluluk duygusunun, olumlu sürücü davranışlarının sıklığını artırdığıdır. Bu bilgiler ışığında kamu spotları hazırlamak sürücülerde araçtaki yolcuların güvenliğinin kendi sorumluluğunda olduğu algısını oluşturmalarını sağlayarak olumlu sürücü davranışlarını artıracak ve trafik güvenliğine olumlu katkı sağlayacaktır. Diğer bir bulgu da yolcunun proaktif katkısının düşük düzeyde olmasının daha saldırgan ihlallere neden olduğudur. Aynı şekilde bu bilgiler ışığında yolcular için de bir güvenlik kampanyası hazırlanabilir. Örnek verecek olursak, sürücülerin yolcuların kendi can güvenliğinin tehlikede olduğu vurgulanarak ihlal yapmaması veya trafik ortamına dâhil olarak yolda oluşabilecek tehlikelerin farkında olması için güvenlik kampanyaları düzenlenebilir ve sürücüyü bu tehlikelere karşı uyarabilir.

Yolculara yönelik eğitim programları geliştirilebilir. Örneğin, yolcunun hangi davranışların dikkat dağınıklığına veya zihinsel aşırı yüklenmeye neden olduğunun farkına varması, hata, kasıtsız sapmalar ve yanlışlar sıklığını azaltabilir. Ayrıca yolculara yönelik eğitim programlarında sürüş dışı görevlerde yardımcı olmanın ve sadece araçta olmaktan çok yardımcı pilot olarak sürüşün bir parçası olmanın öneminden bahsedilebilir. Ayrıca, eleştirilme korkusunun sürücü davranışları üzerindeki etkisini azaltmak için sürücülere psikolojik destek sağlanabilir.

DPIQ'nun kullanışlılığını artırmak için, uygulamasını tek bir örnek ve milliyetin ötesine genişletmek avantajlı olacaktır. Bu, istatistiksel, teorik ve pratik gücünü artıracaktır. Örneğin, ölçeğin kültürler arası uygulanabilirliğini görmek için farklı kültürlerden veri toplanabilir. Taksi, otobüs ve minibüs şoförleri gibi inanılmaz derecede profesyonel sürücüler olan diğer sürücü grupları için de yolcu varlığının sürücü davranışları üzerindeki etkisini incelerken DPIQ'nun kullanılması önerilmektedir. Profesyonel sürücülerin tanımadıkları yolculara karşı sorumluluk duygusu, yolcuların sadece ulaşım için bindikleri ve aşına olmadıkları sürücülere proaktif bir katkı sağlayıp sağlamadıkları veya sürüş dışı görevlerde yolcu yardımının katkı sağlayıp sağlamadığı gibi değişkenlerin incelenmesinin literatüre katkı sağlayacağı düşünülmektedir.

APPENDIX M

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TEZİN ADI / TITLE OF THE THESIS (İngilizce / English): How the Interaction between Driver and Passenger Is Related to Driver Behaviors? A Study Based On the Newly Developed Driver-Passenger Interaction Questionnaire

TEZİN TÜRÜ / DEGREE: **Yüksek Lisans / Master** ☐ **Doktora /**
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