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How Drivers' Risk Perception Changes While Driving on Familiar and Unfamiliar Roads: A Comparison of Female and Male Drivers

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Abstract

Road safety is the result of the interaction between human, vehicle, and environment-related factors. Road familiarity, as a human- and environment-related factor in road safety, was investigated in the present study. More specifically, the main aim of the current study is to investigate the subjective risk evaluations of drivers on familiar and unfamiliar roads. A total sample of 479 drivers, 278 males and 201 females, participated in the present study, and filled out the demographic information questionnaire and Risk Perception Inventory. The results showed that drivers evaluated risk as higher when driving on an unfamiliar road as compared to driving in a familiar road. Moreover, females reported a higher risk perception level than males on both familiar and unfamiliar roads. As a result, familiarity with the road was evaluated as an essential factor in the risk evaluation of drivers. The results were discussed with regard to their implications for road safety in light of the relevant literature.

Keywords: risk perception, risky driving, road familiarity, route familiarity, road safety

Sürücülerin Risk Algısı Aşina Olunan ve Olunmayan Yollarda Araç Kullanırken Nasıl Değişir: Kadın ve Erkek Sürücülerin Karşılaştırması

Öz

Yol güvenliği, insan, araç ve çevre ile ilgili faktörler arasındaki etkileşimin bir sonucudur. Bu çalışmada, yol güvenliğinde çevre ile ilgili bir faktör olarak yol aşinalığı araştırılmıştır. Bu çalışmanın temel amacı, sürücülerin aşina oldukları ve olmadıkları yollardaki öznel risk algılarının incelenmesidir. Çalışmaya 279 erkek ve 201 kadın olmak üzere toplam 480 sürücü katılmıştır. Katılımcılar demografik bilgi formunu ve Risk Algısı Envanteri'ni doldurmuştur. Sonuçlar, sürücülerin aşina olmadıkları yollarda araç kullanmayı aşina oldukları yollara göre daha riskli algıladıklarını göstermiştir. Ayrıca, kadın sürücüler hem aşina oldukları hem de aşina olmadıkları yollarda erkek sürücülere göre daha yüksek risk algısı raporlamışlardır. Sonuç olarak, yola aşinalık, sürücülerin risk değerlendirmesinde önemli bir faktör olarak değerlendirilmiştir. Sonuçlar, ilgili literatür ışığında karayolu güvenliği üzerindeki etkileri ile tartışılmıştır.

Anahtar Kelimeler: risk algısı, riskli sürüş, yola aşinalık, rota aşinalığı, yol güvenliği

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How Drivers' Risk Perception Changes While Driving on Familiar and Unfamiliar Roads: A Comparison of Female and Male Drivers

Factors affecting road safety were categorized as human, vehicle, and environmental factors (Haddon, 1972). In the study of Sabey and Taylor (1980), human factors were stated as the single or a contributory factor for the ninety-five percent of accidents. As one aspect of the human factors, driver behaviors were affected by different driver-related factors or other factors such as environment (Hennessy, 2011; Özkan & Lajunen, 2011). The present study aims to investigate risk perception differences while driving on a familiar or unfamiliar road.

1.1. Road Familiarity

In recent years, familiarity with the road or route has been taking more attention, and the issue considers both human and environment-related factors (Colonna, Intini, Berloco, & Ranieri, 2016; Intini, Berloco, Colonna, Ranieri, & Ryeng, 2018; Martens, 2018; Yanko & Spalek, 2013). Martens (2018) defined road familiarity as driving on the same road multiple times.

Different studies demonstrated various effects of road familiarity on driver behaviors (e.g., Colonna et al., 2016; Intini et al., 2018; Yanko & Spalek, 2013). For instance, Yanko and Spalek (2013) found that driving on familiar roads affected different behaviors of drivers. In familiar roads, drivers drove more closely and showed higher reaction time to pedestrians and central and peripheral events (Yanko & Spalek, 2013). Therefore, it was suggested that driving on familiar roads might make drivers more dangerous (Yanko & Spalek, 2013; Intini et al., 2018).

In a study conducted by Rosenbloom, Perlman, and Shahar (2007), driver behaviors were observed in familiar and unfamiliar locations. Drivers showed more severe violations such as crossing at the red light, not stopping for a stop sign; more minor traffic violations such as not using seat belts and winkers; and dangerous driving behaviors such as crossing in yellow light, sudden stopping, and speeding in more familiar locations. Drivers tended to show more frequent traffic violations and dangerous behaviors in familiar locations. On the other hand, Intini, Berloco, Colonna, and Ranieri (2016) reported that people tended to underestimate risk regarding speed when becoming familiar with the road. Drivers who were familiar with the route also increased their speed compared to those driving in unfamiliar routes. On the other hand, drivers reduced their speed as familiarity with the road decreased (Colonna et al., 2016; Hu, Liu, & Zhu, 2019).

In addition to behavioral differences, road familiarity was also associated with drivers' perception in terms of noticing the traffic environment changes and was related to inattentional blindness in some studies (e.g., Martens & Fox, 2007; Yanko & Spalek, 2013). Yanko and Spalek (2013) suggested that driving on familiar roads might create an unrealistic sense of security and increase mind wandering resulting in inattentional blindness. In another experiment regarding change detection done by Martens and Fox (2007), it was concluded that after five days of repeated practice regarding traffic signs along a road, participants failed to detect the changes among traffic signs on the road after repeated encounters with the environment. Babić, Babić, and Šćukanec (2017) revealed that people who were unfamiliar with the road paid greater attention to the elements on the road; however, when they became familiar with the road, the perceived number of road signs was decreased.

Moreover, it was shown that drivers were less likely to notice the changes in the familiar environments (Charlton & Starkey, 2011; 2013; Martens & Fox, 2007). To illustrate, the number and the time spent for secondary task engagements increased on familiar roads (Wu & Xu, 2018). In another experiment regarding change detection done by Charlton and Starkey

(2013), it was found that as familiarity with the road increased, the number of the items (e.g., buildings, road signs) that attracted drivers' attention decreased; drivers became insensitive to the changes in the traffic environment such as changes on buildings or wording on a direction sign. It was also concluded that increased familiarity with the road resulted in insensitivity to changes in the elements of the traffic environment.

Besides the effects on driver behaviors and attention, road familiarity was also associated with accidents. Intini et al. (2018) suggested that drivers unfamiliar with the road were more frequently involved in head-on crashes more. In contrast, drivers familiar with the road experienced more rear-end or angle accidents. Lastly, Intini, Colonna, and Ryeng (2019) reviewed the literature and found that familiarity and unfamiliarity with the road have an effect on driving behaviors. On the other hand, gender and age are the factors associated with road familiarity and unfamiliarity. Regarding the age factor, it was found that older drivers familiar with the road demonstrated riskier driving behaviors compared to younger ones (Payyanadan, Sanchez, & Lee, 2019). Rosenbloom et al. (2007) conducted a study with female participants. They demonstrated more violations in traffic on familiar routes than unfamiliar routes.

Overall, road familiarity or route familiarity might be evaluated as a potential risk factor affecting drivers' attention and resulting in overconfidence, more distracted, and dangerous behaviors. Familiarity with the road appears to play a crucial role concerning road safety by affecting different aspects of drivers.

1.2. Risk Perception

Risk perception of the drivers is one factor that affects the behaviors of drivers and safety-related outcomes (Kanellaidis, Zervas, & Karagioules, 2000; Ram & Chand, 2016). Individuals perceive risks under different circumstances in different ways, and risk perception level is shaped by the information provided from dangerous situations in the traffic environment. Risk perception is also about an individual's ability to prevent potential accidents (Brown & Groeger, 1988). It is necessary to clarify what is meant by risk perception. According to a definition provided by Jonah (1986, p. 263), risk perception is "the perceived likelihood of an event occurring (e.g., an accident while driving) or the likelihood that the event will result in negative consequences (i.e., injury or death)." The study conducted by Lund and Rundmo (2009) revealed that traffic safety is influenced by the ability to evaluate risky situations in the traffic environment. Moreover, drivers with problems in perceiving risks in traffic had more traffic accidents.

Risk perception level of drivers is affected by the different driver and environment-related factors (Rosenbloom, Shahar, Elharar, & Danino, 2008). To illustrate, the experience levels of drivers positively affect risk perception. Drivers with a higher level of experience also show a higher level of risk perception. Young drivers with lover experience levels underestimate the risk and overestimate their skills (Deery, 1999). In a study conducted by using a telephone survey method, it was indicated that female drivers' perceived level of risk is higher than male drivers' perceived risk level (Rhodes & Pivik, 2011). On the other hand, male drivers reported riskier behaviors such as driving faster than the speed limit, driving faster on curves, especially while they are sleepy, or driving after drinking. The study showed that perceived risk is a predictor for driver behaviors, and it is the stronger predictor for female drivers' behaviors than positive affect. Moreover, Rosenbloom et al. (2008) reported that females had higher perceived risk scores than males, and younger drivers had higher scores on risk perception than older drivers. The difference in perceived risk scores between males and females was higher than the difference between younger and older drivers. On the other hand,

it was shown that risk perception predicted risky driving behaviors of young drivers such as speeding and rule violations weakly (Ulleberg & Rundmo, 2003).

Another study, conducted by Havârneanu and Havârneanu (2012), reported that risk perception and four safe behaviors on the road were negatively correlated. Drivers with a higher level of risk perception tended to run through the red traffic lights, overtake illegally, violate speed limits, and park illegally less than drivers with a lower risk perception level. On the other hand, risk perception did not predict two deviant behaviors driving in the city without wearing seat belts and driving for a longer travel without the car's obligatory technical control. It was also indicated that drivers with a low level of subjective risk tend to violate the rules more in situations in which restrictions seem inadequate. Furthermore, Charlton and Starkey (2017) found a negative correlation between speeding and the perceived risk level. On the other hand, young drivers' risk perception level was associated negatively with ten risky driving behaviors such as tailgating, drunk driving, speeding (x2), using cell phones while driving (hands held and hands free), racing with another vehicle, using seatbelts, fatigue driving and unsafe overtaking. Perceived risk was the strongest predictor of risky behaviors while driving (Harbeck & Glendon, 2013). Overall, it could be emphasized that drivers perceiving various traffic situations as riskier behave in a safer manner (Ngueutsa & Kouabenan, 2017).

1.3. Aim of the Study

The widely studied issue of risk perception can be linked to the drivers' familiarity with the route. However, the influence of continuous exposure to a road or a traffic condition on how a driver perceives the risk in this condition has not been studied widely. There is no study examining the relationship between road familiarity and the self-reported risk perception of drivers to the authors' best knowledge. Concerning this, this study seeks to obtain data which will help address this research gap by investigating the subjective risk evaluations of drivers on familiar and unfamiliar roads.

2. Method

2.1. Participants

There were 479 participants (278 Male and 201 Female). The age range of drivers was between 19 and 55 years (M = 25.50, SD = 7.65). All the participants held a valid Turkish driving license for an average of 5.80 years (SD = 6.44). The previous year's kilometer driven was between 100 and 50000 km (M = 7038.6, SD = 9014.06). The lifetime kilometer was between 100 and 500000 (M = 45246.99, SD = 87439.34) (see Table 1).

2.2. Measurements

2.2.1. Demographic Information Form.

Participants were asked to indicate information on their age and gender in the demographic information form and give some necessary information about driving-related aspects like annual and lifetime kilometers and licensing year.

2.2.2. Risk Perception Inventory.

The Risk Perception Inventory is a self-reported scale developed by Rosenbloom and colleagues (2008) to measure risk perception concerning traffic environment. The scale included 34 items representing 34 driving situations (e.g., eating while driving; losing control while driving on a wet and slippery road). Participants have filled out the questionnaire twice. They were asked to indicate the degree of risk on a familiar road which they use regularly (at

least twice a week; e.g., between work, school and home) and in an unfamiliar road which they use for the first time (they have never been before; e.g., a new traffic environment) on a 5-point Likert scale (1= not risky at all; 5 = very risky). Cronbach's alpha internal consistency reliability coefficients of Risk Perception Inventory for familiar roads and unfamiliar roads were found .93 and .92, respectively.

2.3. Procedure

After getting ethical approval from Middle East Technical University Human Subjects Ethics Committee (Protocol Number: 2017-SOS-126), the questionnaire package, including demographic information form and Risk Perception Inventory, was distributed using web-based data collection (Qualtrics) via social media channels. Snowball sampling was used to reach participants. Participants were expected to complete the Risk Perception Inventory twice; one for a familiar road and one for the unfamiliar road. Drivers were asked to complete the same questionnaire twice, one for the route they are familiar with and one for a new, unfamiliar route. As suggested by Martens (2018), the familiar route is defined as the same route drivers usually drive.

3. Results

3.1. Bivariate Correlations

Bivariate correlation analysis was conducted to examine the relationship between age, gender, annual and lifetime kilometers, mean risk perception for familiar routes, and mean risk perception for unfamiliar routes. As presented in Table 1, significant correlations were found between study variables. Age was positively related to annual kilometer (r = .253**, p < .01), lifetime kilometer (r = .638**, p < .01), risk perception for familiar routes (r = .235**, p < .01) and risk perception for unfamiliar routes (r = .231**, p < .01). Gender was positively related to annual kilometer (r = .199**, p < .01), lifetime kilometer (r = .153**, p < .01) and negatively related to risk perception for familiar routes (r = -.168**, p < .01) and risk perception for unfamiliar routes (r = -.143**, p < .01). Annual kilometer was positively related to lifetime kilometer (r = .531**, p < .01). Lifetime kilometer was positively related with mean of risk perception for familiar routes (r = .106*, p < .05) and unfamiliar routes (r = .095*, p < .05). Risk perception for familiar routes was positively related to risk perception for unfamiliar routes (r = .834**, p < .01). However, no significant correlation was detected among annual kilometers and mean of risk perception for unfamiliar routes and among lifetime kilometer and mean of risk perception for unfamiliar routes.

Table 1. ***Descriptives and Bivariate Correlations***

	1	2	3	4	5	6
1. Age	1					
2. Gender (1: Female; 2: Male)	.043	1				
3. Annual Kilometer	.253**	.199**	1			
4. Lifetime Kilometer	.638**	.153**	.531**	1		
5. RP for Familiar	.235**	-.168**	-.064	.106*	1	
6. RP for Unfamiliar	.231**	-.143**	-.080	.095*	.834**	1
M	25.50	1,58	7038.59	45246.98	3.54	3.92
SD	7.64	.49	9014.06	87439.34	.58	.54
Min.	19.00	1	100.00	100.00	1	1
Max.	55.00	2	50000.00	500000.00	4.82	5

*. *Correlation is significant at the 0.05 level (2-tailed).*

**. *Correlation is significant at the 0.01 level (2-tailed).*

3.2. The Effect of Gender and Road Familiarity on Risk Perception

A mixed design factorial ANCOVA was conducted to determine the effects of gender and familiarity with the road on the perceived level of risk after controlling the effects of age and lifetime kilometers. The results showed that the main effect of gender on perceived level of risk was significant ($F(1, 470) = 14.74$, $p < .001$, $\eta_p^{2=} .030$). Female participants rated the risk in familiar routes higher ($M = 3.66$, $SD = .51$, $M_{Adj} = 3.66$, $SE = .04$) than male participants ($M = 3.46$, $SD = .61$, $M_{Adj} = 3.45$, $SE = .03$). Also, female participants rated the risk in unfamiliar routes higher ($M = 4.01$, $SD = .48$, $M_{Adj} = 4.01$, $SE = .04$) than male participants ($M = 3.85$, $SD = .56$, $M_{Adj} = 3.85$, $SE = .03$). Main effect of road familiarity on perceived level of risk was significant ($F(1, 470) = 42.76$, $p < .001$, $\eta_p^{2\,=} .083$). Participants' risk perception was significantly lower on familiar roads ($M = 3.54$, $SD = .58$, $M_{Adj} = 3.56$, $SE = .03$) as compared to the unfamiliar roads ($M = 3.92$, $SD = .54$, $M_{Adj} = 3.93$, $SE = .02$) after controlling for age and lifetime kilometer. The interaction effect of gender and road familiarity on perceived level of risk was not significant ($F(1, 470) = 2.21$, $p = .137$, $\eta_p^{2\,=} .005$).

4. Discussion

Behaviors of people on the roads and traffic accidents due to those behaviors are affected by various human, environmental, and vehicle-related factors (Colonna, 2002). One of those factors affecting drivers' behaviors was identified as drivers' perceived risk (Wang, Hensher, & Ton, 2002). The current study aimed to get detailed information about this relationship and examined the differences in self-reported risk perception on familiar and unfamiliar road conditions.

The results showed that when drivers are on a familiar road, the perceived risk level is low compared to an unfamiliar road condition. This finding was in line with the previous findings. For instance, Lund and Rundmo (2009) suggested that the more drivers repeat behaviors on the same road, the more they experience the same risk factors various times. This situation led to a decrease in the perception of risk factors in the familiar road because drivers were exposed to risk factors repeatedly. The findings regarding the association between gender and risk perception scores are in line with those of previous studies (Rhodes & Pivik, 2011; Rosenbloom et al., 2008). In the current study, females rated the risk higher than males for both familiar and unfamiliar roads. In comparison to the male participants, females have a higher level of perceived risk in general. These findings can provide insight into behavioral and cognitive differences in males and females. In the present study, age significantly correlated with lifetime kilometers and risk perception for both familiar and unfamiliar roads. This finding is consistent with some research in this area, showing that adults' perceived risk increases with the experience level and age (Deery, 1999; Machin & Sankey, 2008; Rhodes & Pivik, 2011).

Concerning the implications of the findings, familiarity with roads might result in a significant degree of decrease in risk perception. As a result, becoming familiar with a road may place drivers at risk on the roads used more frequently. Martens and Fox (2007) found that drivers failed to notice changes such as traffic signs after being familiar with the road. Familiarity with a road can make driving more dangerous. Findings have implications for the education of drivers regarding the perception of risk on familiar roads. Some studies showed that the perceived level of risk affected their safe behaviors on the road positively (Deery, 1999). It could also be suggested that drivers who underestimate the risks on the familiar roads behave accordingly. Increasing awareness of the drivers in terms of the potential risks in the familiar traffic environments may lead to more safe behaviors on the roads. Moreover, a policy can be implicated in terms of probabilities of the risks on the roads. In this way, drivers

can gain intuition to estimate the risks in the traffic environment, and this intuition may affect the driver's behaviors on a positive side whether they are on a familiar road or an unfamiliar road.

There are some limitations that should be considered while interpreting the results of the current study. First of all, the data gathered from the present study was based on self-reported information. It comes with some disadvantages. Participants may be unable to assess themselves completely accurately, so respondents might give answers in a socially desirable way. That is, the questionnaire might be answered in a certain way that seems favorable to others. Desirable behaviors might be overreported, and undesirable behaviors that seem to them might be underreported. Another limitation of the current study was the use of cross-sectional data. Participants completed measurements for both familiar and unfamiliar roads at the same time. Future studies with a different methodology, such as driving simulators or road-road assessments, may replicate the results of the current study. Additionally, the majority of the sample includes younger people. Studies reported that younger individuals underestimate the risk on the road (Deery, 1999). In the current study, younger individuals reported a lower level of risk perception both on familiar and unfamiliar routes. The findings of the study should be interpreted carefully because of the characteristics of the population of the current study. It can be problematic to generalize the findings of the study to other age groups.

Overall, the results of the current study showed that female drivers had reported higher levels of risk perception regardless of being or not being familiar with the road, and the risk perception level of drivers was high when they were driving on an unfamiliar road. As discussed by Rosenbloom et al. (2007), drivers made more violations while driving on a familiar road. In line with the findings of the current study, underestimating the risk on familiar roads might result in showing more dangerous behaviors (Intini et al., 2018). In the present study, the relationship between road familiarity and risk perception was investigated. To the authors' best knowledge, the differences between self-reported risk perception on familiar and unfamiliar roads were investigated for the first time in the literature. The results showed that drivers' risk perception level was high when driving on unfamiliar roads than familiar roads. Moreover, female drivers perceived risks on the road higher than males.

Ethics Committee Approval Statement

Ethics committee approval of the present study was obtained from Middle East Technical University Human Subjects Ethics Committee (Date 09.08.2021 and Protocol Number: 2017-SOS-126).

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