ASSESSMENT OF COMPUTER-BASED AND SELF-REPORTED HAZARD PERCEPTION SKILLS AMONG DRIVERS: THE ROLE OF PERSONALITY AND DRIVING SKILLS

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ABSTRACT

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The aim of the present study was to investigate the correlates and predictors of hazard perception skill among drivers. Specifically, it was examined whether novice and experienced drivers would differ from each other in terms of hazard perception skill. In addition, the role of personality factors and driving skills in predicting hazard perception among drivers was inspected. Drivers' hazard perception skills were assessed by using both a computer-based hazard perception latency test (Turkish Hazard Perception Test in Traffic) which consists 31 video clips recorded in real traffic, and a self-report measure (Self-Reported Hazard Perception Scale). Following the completion of hazard perception measures, Turkish drivers (N = 135; 90 males, 45 females) also responded to the measures of driving skills, big five personality factors, and sensation seeking. The results of the study indicated that both computer-based and self-reported hazard perception measures significantly differentiated novice and experienced drivers after controlling for the effects of age. Results of the regression analyses demonstrated that computer-based hazard perception skills were significantly predicted by perceptual motor skills subscale of the Driving Skill Inventory. Self-reported hazard perception skill was also strongly predicted by age and perceptual motor skills. The results further revealed that sensation seeking and big five traits did not

predict either the computer-based or the self-reported hazard perception skill among drivers. It was concluded that the effects of personality factors could be more observable in on-road assessment of hazard perception. However, the significant difference between novice and experienced drivers showed that hazard perception training should be included to the driver-training curriculum in Turkey as an intervention to promote young novice drivers safety. The findings of the present study were argued in the light of the literature and in relation to the implications for traffic safety in Turkey. Additionally, limitations of the study and suggestions for future researches were discussed.

Keywords: Hazard perception skill, young novice drivers, driving experience, driving skills, personality factors

ÖZ

SÜRÜCÜLERDE TEHLİKE ALGISI BECERİSİNİN BİLGİSAYAR-TABANLI VE ÖZBİLDİRİME DAYALI ÖLÇÜLMESİ: KİŞİLİK ÖZELLİKLERİ VE SÜRÜCÜLÜK BECERİLERİNİN ROLÜ

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Bu çalışmanın amacı sürücülerde tehlike algısı becerisini açıklamada ilişkisi bulunan ve yordayan değişkenleri incelemektir. Özellikle acemi ve deneyimli sürücülerin tehlike algısı becerisi bakımından ne derece farklılık gösterdiği araştırılmıştır. Ayrıca kişilik özellikleri ve sürücülük becerilerinin tehlike algısı becerisini açıklamadaki yordayıcı gücü incelenmiştir. Sürücülerin tehlike algısı becerisi gerçek trafik ortamında çekilmiş 31 video görüntüsünden oluşan bilgisayar tabanlı bir test (Türkiye Trafiğinde Tehlike Algısı Testi) ve özbildirime dayalı bir anket (Özbildirime Dayalı Tehlike Algısı Becerisi Ölçeği) kullanılarak ölçülmüştür. Türk sürücüler (N= 135; 90 erkek, 45 kadın) tehlike algısı ölçümlerinin tamamlanması sonrası sürücülük becerileri envanteri, beş faktörlü kişilik envanteri ve heyecan arama risk alma envanterini doldurmuşlardır. Araştırmanın sonuçlarına göre yaş etkisi kontrol edildikten sonra hem bilgisayar tabanlı hem de özbildirime dayalı tehlike algısı ölçümünde acemi ve deneyimli sürücülerin puanlarının anlamlı olarak farklılaştığı görülmüştür. Tehlike algısını yordayan değişkenleri belirlemek amacıyla yapılan regresyon analizinde bilgisayar tabanlı tehlike algısı becerisinin sürücülük becerisi envanterinin algısal motor beceriler altölçeği tarafından anlamlı olarak yordandığı bulunmuştur. Özbildirime dayalı tehlike algısı becerisi ise benzer olarak algısal motor beceriler

ve yaş tarafından yordanmıştır. Buna karşın beş-faktör kişilik özelliklerinin ve heyecan aramanın bilgisayar tabanlı ve özbildirime dayalı tehlike algısını yordamada anlamlı katkısı olmadığı görülmüştür. Bu bulguya istinaden kişilik özellikleri etkisinin sürücünün yoldaki performansının değerlendirildiği araç-içi ölçümler ile daha açık gözlenebileceği sonucuna varılmıştır. Bununla birlikte acemi ve deneyimli sürücülerin tehlike algısı becerilerindeki fark, tehlike algısı eğitiminin genç acemi sürücü güvenliğini sağlamak amacıyla ülkemizde sürücü eğitimi müfredatına dahil edilmesi gerektiğini göstermektedir. Araştırmanın bulguları literatüre dayalı olarak ve Türkiye'de trafik güvenliğine yönelik katkıları bakımından tartışılmıştır. Araştırmanın sınırlılıkları ve gelecek çalışmalara yönelik öneriler üzerinde de durulmuştur.

Anahtar Kelimeler: Tehlike algısı becerisi, genç ve deneyimsiz sürücüler, sürücülük deneyimi, sürücülük becerileri, kişilik özellikleri

To the Psychotechnical Assessment Systems Research Group

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INTRODUCTION

Hazard perception (HP) in traffic is defined as "the ability to recognize a situation on the road which is either dangerous or has the potential to develop into a dangerous situation in which some driver action will be required" (Transport Research Laboratory [TRL], 1996; pp. 28). Howarth, Mulvihill, and Symmons (2005) defined hazard perception as "the process whereby a road user notices the presence of a hazard (pp.xiii), which is "any permanent or transitory, stationary or moving object in the road environment that has the potential to increase the risk of a crash" (pp. 7). HP refers to the ability of reading the road and anticipating other road users' actions. Therefore, it is one of the most critical processes to avoid accidents. HP develops gradually with gaining experience in driving. However, in the initial phases of learning to drive, the novice driver may need to allocate all the cognitive and perceptual capacity to the task of controlling the car, and therefore unless the driving becomes an automated task the driver has no cognitive capacity left to effectively deal with road hazards (Deery, 1999). For this reason, the incompetence in hazard perception was regarded as one of the main reasons of high accident rates in young and novice drivers (Deery, 1999; Groeger, 2001).

In addition to the importance of perceptual processes in HP, cognitive and motivational processes affecting risk assessments are of vital importance (Evans and Macdonald, 2002). Howarth et al. (2005) labeled these processes as the modifying factors in hazard perception and they are influenced by stable or transient personality characteristics, as well as by situational variables such as driving while intoxicated (West, Wilding, French, Kemp, & Irving, 1993; Deery & Love, 1996). Personality factors have been investigated within the framework of individual differences approach in traffic research (Elander, West, & French, 1993) and they are regarded as the predictors of the preferred driving style. Investigation of road traffic accidents (the RTA) of young and novice drivers has

revealed that young and novice drivers' accident involvement could also be explained by their unsafe driving style, which was resulting from age-specific personality characteristics, such as high levels of sensation seeking and risk taking (Gabany, Plummer, & Grigg, 1997; Parker & Stradling, 2001). In terms of hazard perception, certain personality characteristics that are associated with risky driving may also contribute to assigning lower importance to hazardous situations. Therefore, when inexperience was accompanied by risk-elevating personality variables, hazard perception processes would be more deteriorated, leading to high accident involvement.

Hazard perception testing and training was given prior importance in several countries as a means for a safety intervention to reduce the number of accidents among young novice driver group (Sexton, 2001, Ferguson, 2003). While the majority of past research had a focus on measuring hazard perception latencies in novice drivers (Sagberg & Bjornskau, 2006, Sexton, 2001), other studies had a focus on measuring perceived risk associated with hazards (Ferrand & McKenna, 2001; Coulborn, 1978). However, there is no empirical research concerning the personality variables or driving skills which could affect hazard perception processes. A computer-based hazard perception test (Turkish Hazard Perception Test in Traffic, T-HPT) was developed in Turkey, as a part of a broader project that was funded by Technological Research Council of Turkey - Research and Development Support Program (TUBİTAK-TIDEB). The T-HPT consisting of real-life traffic scenes aimed to include the major road hazards that are representative of hazardous situations in Turkish traffic context.

The purpose of this thesis was threefold. First, it was investigated whether the T-HPT differentiate novice and experienced drivers in terms of hazard perception ability. Second, it was examined if main personality factors (i.e., Big Five) and self-reported driving skills are associated with hazard perception latency. Finally, potential moderator role of personality variables and driving skills in predicting hazard perception ability was investigated. In the following sections, first a background information will be given on the risk of young/novice driver in road safety. Second, a brief literature review will be presented on hazard perception

skills of novice drivers and main reasons for impaired HP from an individual differences approach. Finally, research on personality factors and driving skills related to HP will be introduced.

1.1. Novice Drivers and Traffic Safety

Young-novice drivers are the most risky group in road traffic accidents (RTA). They are consistently overrepresented in crash statistics, especially within the first few months after licensure (McCartt, Shabanova, & Leaf, 2003; Mayhew, Simpson, & Pak, 2003). In Sweden, accident involvement of young (18-19 year old) drivers was found to be five times more than older (35-50 year old) drivers (Engström, Gregersen, Hernetkoski, Keskinen & Nyberg, 2003). In Canada, 16-20 year old drivers were found to involve in RTA much more often than all other age groups (Chipman, MacGregor, Smiley, & Gosselin, 1993) and the first year of driving was reported as being critical in terms of engaging in at-fault accidents among all novices at all ages (Cooper, Pinili, & Chen, 1995).

Stradling and Meadows (2001) proposed that becoming a driver was consisted of three-phases. The first phase is the technical mastery phase, in which the novice driver learns how to control the car. The second phase is the road-reading phase and at this stage novice driver learns to anticipate the other road users' actions in the absence of a clear sign showing that a hazardous situation is developing. Gaining mastery in this phase has a special importance in terms of avoiding accidents. Finally the last phase is defined as the expressive phase, in which the driver develops a peculiar driving style as a reflection of attitudes and personality factors.

Gregersen and Bjurulf (1996) assert that since the skills related with controlling the car are gradually developing and a schema related with traffic is lacking, driving takes place as a highly rule-based task in the first-few months for the novice driver. Only after passing the technical mastery phase, other road users' behaviors are attended or realized. Therefore, the first months of learning how to drive is very critical in explaining the high rates of RTA of young novice drivers, since at this phase there is the absence of higher-order safety skills, such

as hazard and risk perception. Therefore, at the first glance accident likelihood of the novice drivers can be explained by inexperience in predicting how the traffic situations will develop.

In addition to inexperience factor, motivational and social factors that are tapping the expressive phase underlie the high accident rates of young novice drivers (Gregersen & Bjurulf, 1996; Laapotti, Keskinen, Hatakka, & Katila, 2001). These factors are generally refer to the goals related with driving and are either preconditioned by stable personality characteristics or rather transient age-related traits. The motivation to engage in a particular type of driving style reflects itself to behaviors. In that sense, young drivers may have a tendency to drive in more risky situations like nighttime driving or driving while intoxicated, as compared to older drivers (Williams, 2003; Arnett, 1990). They may have the tendency to perceive less risk in various driving circumstances (Trankle, Gelau, & Metker, 1990) or they may have the tendency to perceive their own skills as superior to other drivers' (Delhomme, 1991; Finn & Bragg, 1986).

Deery (1999) proposes that accident involvement of young novice drivers can be broadly investigated with reference to the effects of variables that are influenced by either age or experience. He categorizes driving skills and higher-order safety skills under experience-based factors, while he asserts that personality factors, driving style, attitudes and motivations should be categorized under age-related factors.

There exists an extensive research aiming to examine the possible effects of age and experience in adopting basic and higher-order safety skills as well as a safety oriented driving style among young/novice drivers. Although most of the novice drivers are young, there are also those who take their license first time later in their life, which makes the issue more complicated. To investigate this, in a study by Warren and Simpson (1979, cited in COMSIS, 1995), the accident frequencies of 30-years old experienced and 30 years of inexperienced drivers were compared by controlling the effect of age. Results of this study revealed that crash risk of 30-year old inexperienced drivers was 38% more than the experienced group. In a longitudinal study conducted on newly licensed drivers in

the USA, a significant decrease in accidents was reported within the 12 months of driving and this decrease was also observed when the same analysis was repeated by taking "exposure to the road" as the independent variable (McCartt, Shabanova, & Leaf, 2003). Considering that the analysis covered 12 months, the authors concluded that experience was more predictive of young/novice driver accident involvement as compared to age effect.

However, in another study by Warren and Simpson (1979, cited in COMSIS, 1995) that compared 20 year-old drivers, the crash risk of 20-year old inexperienced drivers was found to be only 8 % more than 20 year-old experienced drivers, pointing out to the fact that the decrease in age is associated with more crash. Similarly 18-20 year old inexperienced drivers were found to be more accident-involved as compared to 21-30 and 31-50 year old inexperienced drivers (Laapoti, Keskinen, Hattaka, & Katilla, 2001). These findings suggest that age and driving experience have also an interactive effect in accident proneness of young and novice drivers and the most risky group seems to be the combination of being both inexperienced and young.

1.1.1. Training of Novice Drivers in Western Countries

Gregersen (2001) reported that comparing the accident risk per 10 million km of learner drivers of age 16-17 and novice drivers with 2 years of experience with age 18-19 revealed that, novice drivers' accident involvement was 10.2 times more than learner drivers'. He further reported that by increasing the level of practice young drivers who gained more experience during the learner period were found to have 24-39% low accident rates during their first two years with a full license, as compared to those who did not benefit from lowered-age limit. However, it was also found that during learner period, professional instruction is linked with less accident involvement as compared to lay-instruction, which can be the result of professional training being more comprehensive in terms of the acquisition of higher-order skills like hazard perception. Considering the research findings showing the effectiveness of hazard perception training in Western countries, a special emphasis has been given to training of novice and learner

drivers.

In the USA and several European countries, legal actions were taken to prevent the accidents resulting from inexperience in driving skills, such as the development of graduated licensing programs (GDL) that require the candidate to pass through various phases before they obtain a full license. By GDL, candidates apply for a license at very young ages and the target of the system is to make them gain experience by taking less risk (Hedlunt, Shults, & Compton, 2003). This is assured by restricting the candidate in driving in certain circumstances, such as driving with peers, at night or driving while intoxicated (Foss, & Goodwin, 2003).

For example in Sweden, practicing age for driving was reduced to 16 by issuing the candidate driver a "learner permit" to drive under supervision of professional instructors and lay-instructors like family members (Gregersen, Nyberg, & Berg, 2003). Carstensen (2002) reported that the driver training curriculum has changed in 1986 in Denmark and an emphasis was put on teaching defensive driving and hazard perception as well as allowing the candidate to practice more about the issues that were theoretically given. A follow up study which covered 5,5 years and which was carried out with the drivers who received their licenses before or after the change revealed that those who were licensed with the new curriculum were involved in accidents less that those licensed with the old curriculum. The decrease was especially pronounced for the first year of driving.

There is also a focus on attitude and behavior change during the licensing period, with the implementation of voluntary or compulsory safe driving courses in Austria and Finland (Bartl, 1998). These courses target the novice drivers who did not obey the restrictions in GDL phases.

1.1.2. Young/Novice Driver Problem in Turkey

According to the Annual Traffic Statistics Reports, over 550.000 traffic accidents occurred in our roads in 2005. These accidents resulted in 3215 deaths and 123.985 injured road-users (Emniyet Genel Müdülüğü [EGM], 2005). Compared with 422.000 accidents in 2003, it can be said that there is a 36%

increase in accident rates and 30% increase in injury rates in 2005. These numbers are not covering the accidents that occur in roads which are under the responsibility of the Gendarme. In addition the people who had died after being hospitalized are not represented in these statitstics, since there is not a follow-up for accident victims in Turkey. Therefore, it is reasonable to speculate that there is an underestimation of the real number of traffic accidents in Turkey and the costs of traffic accidents are greater than they are pronouced by official reports as presented in the Traffic Safety Report prepared by Sweroad (2001).

In Turkey, there are almost 15 million driving license holders as compared to about 11 million vehicles. This means that there is a considerable portion of drivers who hold a license but not experiencing the driving. This is one of the reasons that being inexperienced is not always associated with young age in Turkey, creating a problem in calculating the role of driving experience and age in crash rates.

The distribution of drivers' at-fault accidents, which are grouped by age, was given in Figure 1 for the year 2002 (EGM, 2002). It can be seen that at-fault accidents are lower in the first age-range (16-20). Then there is a rapid increase in at-fault accidents among 21-25 year-old drivers (which are typical active driving age period in Turkey), followed by a slight increase in number of accidents for 26-30 year-old driver group. After this age span, at-fault accidents are observed to be decreasing consistently as the age of the driver increases. In that sense, it can be said that older drivers are less accident-involved than younger drivers. However, to say more about the effects of age, we should compare the age-spans within the younger drivers separately. As can be seen in Figure 1, the youngest drivers' (16-20) accident involvement was lower as compared to the drivers who aged between 21-25 and 26-30. It is reasonable to speculate that the youngest drivers do not have access to a car since owning a car at young ages is not so common in Turkey due to low motorization rate as compared to more developed countries. Therefore the number of the youngest drivers in traffic can be said to be lower than the number of the drivers in other age spans. However, it is empricailly unknown whether the majority of the 16-20 old drivers were accident involved or

not. Moreover, these statistics does not reveal the number of the novice drivers in certain age spans either, indicating that other age categories can also be consisted of novice drivers. Due to these reasons, it is impossible to have a clear picture of the accident-risk of novice drivers in Turkey.

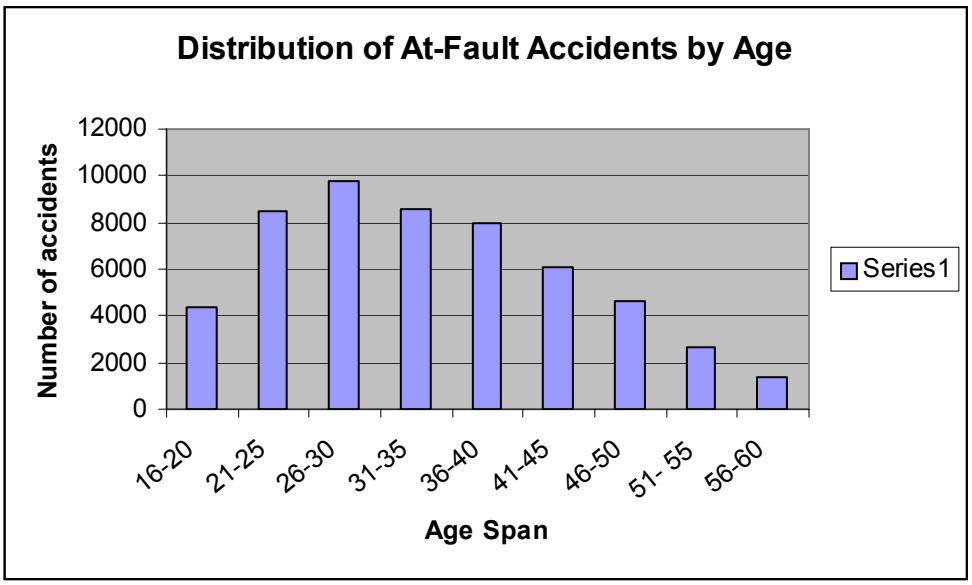

Figure 1. Age Distribution of Drivers who are Involved in At- Fault Accidents in 2002

1.1.2.1. Driver Training Programs in Turkey

Driver training is provided by private driver training centers, which are affiliated to and regulated by Ministry of Education in Turkey. The training program consists of both theoretical training and practice sessions. In classroom-based theory courses, first-aid, motor/ technical lessons and traffic courses constitute 12, 16 and 35 hours respectively (T.C. Milli Eğitim Bakanlığı, 2006). Following the completion of these theoretical learner drivers are given a written exam and learners who pass the exam successfully were given supervised driving/practice courses. These on-car driving courses last for 10-hour duration and at the end of the practice session, candidates take an on-road driving exam.

Compared to the graduated driving license courses in several EU countries

and several states in the USA and Australia (Wolmig & Wiberg, 2004; Carstensen, 2002; Gregersen, Nyberg, & Berg, 2003), duration (time) devoted to practice was much less and limited in Turkey that restricts candidates in gaining basic driving and HP experiences in the initial phase of driving. It seems that driver training programs in Turkey target to make the candidates experienced enough to pass the exam by giving an emphasis on "skills training" and thus underemphasizing the importance of hazard perception training and other safety training necessary for young drivers. Sümer, Özkan, and Lajunen (2006) reported that an emphasis on skills rather than safety may also lead the driver to overestimate the importance of driving skills and underestimate the significance of safety skills, which may increase the threshold for acceptable risk in traffic. Similarly, Gregersen (1996) reported that during the supervised practice, when an emphasis was put through driving skills to deal with skid roads, drivers showed a tendency to overestimate the importance of driving skills, as compared to drivers for whom skills were not emphasized. Therefore, the content and target of the driver training courses may also affect how the candidates perceive driving context and how they prioritize what is important to avoid an accident (Sümer et al., 2006).

Given that the motorization rate has been dramatically increasing by doubling the number of vehicles in every decade and there is a very high rate of young population who potentially will apply for a license increasing the young and novice driver population in a short term, improving the quality of novice driver training program will be more imperative for preventive traffic safety policies in Turkey.

1.2. Individual Differences Approach in Hazard Perception Research

It has been known that accident involvement is related to situational, environmental, and driver factors and over 90% of the accidents in Turkey were reported to be resulting from driver factor rather than other factors (EGM, 2002). Driver factor refers to what has been labeled as the individual differences in differential accident involvement (Elander, West, & French, 1991) and mainly it

focuses on individual factors that are correlated with crashes and unsafe driving. Elander et al. proposed that individual differences in driving could be broadly categorized under driving skills/driving ability and driving style/personality characteristics. The authors defined driving skill and driving style as the intrinsic factors to driving and they defined driving ability and personality characteristics as the extrinsic factors to driving. By driving skills, the authors referred to basic car handling skills, while with driving ability they referred to attentional and cognitive processes such as scanning strategies. Driving style was defined as the person's adapted way of driving with reference to having a safe or unsafe orientation and personality characteristics were claimed to be affecting the driving style extrinsically. In addition to the personality factors, the authors claimed that situational variables such as driving while intoxicated or demographic variables such as experience and age are also extrinsic factors to driving and they directly affect the intrinsic factors. Consistent with this framework, a contextual-mediated model was proposed by Sümer (2003) with defining driving skills and driving behaviors (tapping driving style) as proximal context variables and with defining demographical, situational, environmental, and personality factors as the distal context variables in predicting accident involvement. Sümer reported that there were direct effects of aberrant driving behaviors on accident risk. Psychological symptoms, sensation seeking, and aggression were found to be related to driving behaviors, which in turn were associated with crashes. Therefore, there are associations and causal relations between different individual differences factors that are intrinsic or extrinsic to driving and interactions between specific individual differences factors may lead to a variable type of drivers.

Adapting this framework, hazard perception, which was defined as the ability to read the road can be regarded as a proximal factor that directly influences the accident involvement, and thus HP ability is expected to be influenced by distal context including environmental conditions and personality factors.

1.3. Driving Abilities and Skills of Young/Novice Drivers

Drivers differ greatly in their driving skills and preferred driving styles

(Elander et al., 1993). Driving skills refers to psychomotor and cognitive processes that are acquired with experience. Within driving skills, Lajunen and Summala (1995) made a distinction between perceptual and motor skills and safety skills. In their conceptualization, the former refers to the basic skills concerning gaining mastery over controlling the car, and the latter refers to skills tapping accident avoidance. However while basic driving skills such as wheel-hand coordination or lane keeping are acquired more easily, safe driving skills and abilities such as attentional control, hazard and risk perception or situational awareness require time to develop (Deery, 1999; Groeger, 2001; Stradling & Meadows, 2001). In terms of the road-reading phase that requires higher-order skills, the most important and highly studied safety-based skill is the hazard perception which interferes with safe driving unless it becomes a habitual skill for the driver.

1.3.1. Hazard Perception as a Higher-Order Safety Skill

Hazard perception is the ability to anticipate the potential hazards on the road before they develop enough to lead an accident. Hazards can be either dynamic or static (road surface, weather conditions, environmental factors etc.). Dynamic hazards occur by the simultaneous movements of all other road users like other cars, pedestrians or cyclists. Therefore HP requires the driver's ability to predict other road users' behavior, in relation to the changing demands of the traffic such as road and weather conditions or the traffic flow.

While experienced drivers make a more holistic analysis of the hazardous situation, novice drivers tend to focus on narrowly to few characteristics since they do not have a fully developed schema of the traffic environment (Deery, 1999; Underwood, Chapman, Bowden, & Crundall, 2002). In addition, they were found to attend closer to the front of the vehicle, especially in the prevalence of more traffic stimuli (Falkmer & Gregersen, 2001) and they were ineffective at spotting distant hazards (Brown, 1982), fail to control and search the sides of the road (McKnight & McKnight, 2003), fixate on irrelevant objects in traffic environment by inefficient use of their eyes. Moreover, novice drivers tend to

perceive nonmoving/static hazards more dangerous as compared to dynamic hazards, while it was just the opposite for the experienced drivers (Soliday & Allane, 1974; cited in Drummond, 1989). This was explained by the fact that the information that is gathered is less informative for the learner driver and requires more time and greater cognitive capacity to be labeled as hazardous (Drummond, 1989; Vogel, Kircher, Alm, & Nilsson, 2003). Similarly in a follow up study covering one year of assessment on novice drivers, it was found that novice drivers' scanning abilities did not change significantly by time, indicating that visual search patterns develop gradually, and therefore gaining experience may take longer time (Chapman, Underwood, & Roberts, 2002). In that sense, it is reasonable to claim that hazard perception is a higher order safety skill which requires safety skills at the perceptual level as well as a safety orientation at the cognitive level.

1.3.2. A Model of Responding to Risks in Traffic

Hazard perception is not solely based on detecting the onset of a hazardous situation in traffic. It includes information processing on the basis of risk assessments as well. Howarth, Mulvihill, and Symmons (2005) define a hazard as any object on the road which is either stationary or moving and which poses a threat in terms of accident involvement. They proposed that differentiating between hazard and risk is important and they asserted "Hazards exclude characteristics of the rider or the vehicle, which are classed as modifying factors" (pp.7). They argued that modifying factors may refer to personality traits, driving style, experience and all other specific attributes of the driver, that affect perceived risk associated with a hazard.

Grayson and Groeger (2000) propose a model of responding to risks in traffic and they claim that the first stage is consisted of detection of a hazard. This basic level is related to the good use of scanning and searching abilities. Second drivers should assess the level of threat in that hazard, which is a subjective decision. As a result of this appraisal, at the third level drivers should think of the best way to avoid that hazard such as breaking or slowing down and then, finally driver

implements the decided action at the last stage.

Young and novice drivers may fail at the very first stage of this detection and responding process by not scanning the environment and not detecting the hazard earlier because of their inexperience. In addition, even if the hazard is detected, young drivers may fail to assess the actual risk that the hazard would bring due to age-specific modifying factors. Therefore, while it is important to assess the competencies of young/novice drivers in their abilities to detect a hazard early on, it is also very important to highlight the effects of modifying factors that predispose young/novice drivers to mislabel the hazardous situations as a result of perceiving less risk.

1.3.3. Measuring Hazard-Perception

Hazard perception ability has been assessed by using various methods, including real-life traffic videos, photographs or driving simulators. In addition, assessment methods differ in terms of a focus to either measuring simple reaction-time and scanning strategies or assessing the perceived risks associated with hazards (Sagberg & Bjornskau, 2006).

Past studies using different methods in assessing HP skills have consistently shown that novice drivers have poorer HP skills than the experienced drivers, especially on the HP latency (reaction time) measurements. In an earlier study, Colbourn (1978) asked and measured the HP skills of young drivers (age 18-24) on the basis of how risky they rate the traffic scenes that were captured in real-traffic environment. Although there were no significant differences between the risk assessment of experienced and inexperienced young drivers, more experienced young drivers showed a tendency to perceive less risk in the observed scenes. However, Colbourn cautiously interpreted these results since the video footage was of low quality due to technological constraints at that time. In another study, Colbourn (1978) asked older female drivers to rate the hazardousness potential of the photographs taken from traffic video scenes. However, he manipulated the task by asking the participants under what circumstances the driver in the pictures were driving, such as emergency drive or leisure drive. It

was found that when the purpose of the driving was labeled more stressful, participants' risk perceptions were more accurate than the less stressful situations, indicating that perceived risk in hazards was subject to context-driven factors as well.

In another study on the detection of hazards in a simulated traffic environment Quimby and Watts (1981, cited in Jonah, 1986) reported that young drivers under age 25 were late in their responses in spotting the hazardous situations as compared to 25-54 year old drivers. McKenna and Crick (1997) found that it takes much time for younger drivers to detect a hazard than older drivers. However, they also found that three-hour long classroom training on HP has significantly increased HP scores. As a means for assessing whether computer-based assessment of HP was reflecting the participants' actual hazard perception ability, participants HP scores that are obtained via real-life traffic scenes were compared with their scores of HP that are measured by experts during an on-road assessment (TRL, 1998). It was reported that computer-based HP scores were correlated with on-road assessment scores indicating that laboratory assessment of HP was a valid source of measurement. It was further reported that the effects of HP training was also significant. Novice drivers were found to detect more hazards and were found to react faster to those hazards in the post-test phase.

Sexton (2001) reported that there were significant mean differences between the HP scores of learner, novice, and experienced drivers with the experienced drivers scoring the best, followed by novice drivers. Learner drivers with less experience performed the poorest performance.

Some other studies, however, have yielded inconclusive results. For example, in a recent study using a video-based HP test in Norway, it was found that the reaction time between novice and experienced drivers did not differ for the majority of hazard clips (Sagberg & Bjornskau, 2006), although a tendency for experienced drivers' having lower reaction time was observed. The results did not change when the researchers added a secondary task manipulation to investigate whether novice drivers will suffer under the condition of more cognitive workload. The authors concluded that hazard perception skill should be measured

under conditions similar to driving since vehicle-handling can act as a powerful distracter for the novice driver within the first few months of driving.

In terms of hazard perception latency and risk assessments, Farrand and McKenna (2001) designed a study in which they asked the participants to rate the risks involved in hazardous driving scenes as well as to rate their perceived ability dealing with these hazards. The results indicated that there was no relationship between perceived risk and hazard perception latency. However, drivers who rated themselves more skillful were also found to perceive the scenes less risky. Since their study did not include different age and experience groups, it is not known whether the results would be different under age and experience manipulation.

Searching about whether anticipatory hazard perception training would lead to increments or decrements in risk evaluations, McKenna, Horswill, and Alexander (2006) demonstrated that drivers who received such training preferred lower speeds when they were confronted with hazards as compared to the untrained group. They argued that anticipatory skill training was a good means of improving hazard perception in novices, by means of affecting them behaviorally to take less risk while driving. Similarly Underwood et al. (2002) reported that a short multimedia-training product of visual search skills was found to be effective in improving novice drivers' scanning skills in a hazard perception task.

Another method used to assess the hazard detection time is the eye-tracker devices which simply record the gaze durations and fixations to the presented objects during driving (Underwood, Chapman, Brocklehurst, Underwood, & Crundall, 2003). This method provides an objective basis to track the scanning abilities of novice drivers. In a study by Crundall, Chapman, France, Underwood, and Phelps (2005) novice and experienced police drivers watched clips that were captured inside the policemen cars while they were following the lead - fleeing car. It was found that while there was no difference in terms of gazing durations on the lead car, police drivers were found to fixate to other hazardous objects like pedestrians or parked cars more than novice drivers did. Similarly, while dealing with a hazard perception task in the screen, experienced drivers were found to be

faster than learners in detecting the objects that were presented from the peripheries, although mean reaction time to hazards did not differ between experienced and learner drivers (Crundall, Underwood, & Chapman, 2002). Novice drivers were also found to be inflexible in adapting different scanning strategies on different types of roads while experienced drivers' scanning strategies were found to differ on the basis of the varying demands of different types of roads (Crundall & Underwood, 1998).

1.3.4. Legislative Actions about Training and Testing Hazard Perception

In the review on the HP tests, Ferguson (2003) reported that a video-based hazard perception test has been used in the United Kingdom since 2002, and the licensing test includes a hazard perception part in Australia. Ferguson added that although there was no use of a computer-based hazard perception assessment, experts try to assess the candidate's HP ability during the on-road test in Canada and New Zealand. In Denmark, after the change in driver training curriculum in 1986 which included a focus on defensive driving and hazard perception training, significant decrease in number of accidents were reported, especially in those involving the multiple-vehicle crashes (Carstensen, 2002). However, there was no significant change in the number of single-vehicle crashes. These findings have critical implications at least by showing that hazard perception training would be most effective in reducing the rate of multiple vehicle crashes in which the anticipation of other road user's behavior is necessary to avoid accidents.

In conclusion, examination of the driving testing systems and driver training programs has suggested that hazard perception training and testing method have been utilized extensively for the young and novice drivers as a means for increasing traffic safety in Western countries.

1.4. Young Drivers' Driving Style

Driving style is generally defined as the established manner of driving (Elander et.al, 1993), which is also labeled as the expressive phase (Parker & Stradling, 2001). This was explained by the fact that after gaining mastery in

driving the driver develops a peculiar style, which is a reflection of his/her personality characteristics, motivations, attitudes, and beliefs. Several variables may interfere with choosing a safe or unsafe driving style during this process of establishing a preferred style. Age related characteristics such as high levels of sensation seeking and risk taking, peer pressure, impression management concerns or tendency to overestimate their driving skills may lead to the development of negative or unsafe attitudes and beliefs towards safety for young drivers (COMSIS et al.,1995; Deery, 1999; Arnett, Offer, & Fine, 1997).

1.4.1 Young/Novice Drivers' Violation Tendency

Within the framework of aberrant driving behaviors, Parker and Stradling (2001) differentiated between violations, errors and lapses with reference to their associations with accidents. The authors reported that while the consequences of errors and lapses were not so severe, violations were found to be a significant predictor of both active and passive accidents. They specified that young drivers were more likely to be high violators as compared to older drivers.

On-road assessments tested via observers or instrumented car revealed that young drivers drive faster (Grayson and Groeger, 2000; Boyce and Geller, 2002) and maintain an unsafe following distance with the lead car as compared to older drivers (Boyce and Geller, 2002). They were found to score higher in risk-taking behaviors as well as in past traffic convictions (Furnham & Saipe, 1993). In their research aiming at identifying the basic reasons for speeding among different groups of drivers, Gabany, Plummer, and Grigg (1997) found that thrill-seeking was one of the most pronounced reasons for speeding among young drivers. This indicates that young drivers do not consider possible consequences of violations realistically and they are focusing on immediate rewards rather than adverse consequences before engaging in violations (Parker, Manstead, Stradling, Reason, & Baxter, 1992).

Young drivers were also found to attribute low importance to traffic rules as compared to older drivers (Finn & Bragg, 1986; Yagil, 1998). Laapotti, Keskinen, and Rajalin (2003) reported that young drivers were found to have more negative

attitudes towards rules and safety-oriented behaviors and the tendency was most prevalent for male drivers as compared to females. Similarly in their study of assessing attitudes to driving, Stradling and Meadows (2001) reported that young drivers have a higher tendency to develop personal identity with the car and that they use the car more frequently as a source of enjoyment. They further reported that, in terms of attitudes toward driving safety, young drivers were found to score high on rule violations and they prefer higher speeds than older age group. No optimistic bias was found related to self-reported driving skill. That is, young drivers were not found to rate themselves as more skillful than other age groups. However, they report low levels of safety-orientation as compared to others.

Young drivers were also found to have less pressure from others for not violating and reported more compliance with the expected wishes of others, which imply that peer pressure may also affect young drivers in adopting a risky driving style (Elliot, Armitage, &Baughan, 2003; Preusser, Ferguson, & Williams, 1998; Parker et. al, 1992, Arnett, Offer, & Fine, 1997).

The tendency to violate the traffic rules is the most common pattern among young and novice drivers, which reflects itself in heightened accident rates. Of all types of accidents, single-vehicle crashes and loss-of-control accidents which occur mostly as a result of speeding, have a higher representation in young rather than older driver statistics (Engström et. al, 2003; Berg, Gregersen, & Laflamme, 2004; Laapotti & Keskinen, 1998; Gonzales, Dickinson, DiGuiseppi, & Lowenstein, 2005).

1.5. Personality Factors as Predictors of Driving Style

Driving style reflects the degree of safety orientation in drivers and both the trait and state characteristics of the driver have been shown to influence this orientation (Lester, 1991). A viable explanation for this is that personality factors reflect inner motivations and goals of the individual that guide the behaviors. In terms of driving context these motivations may lead to the adaptation of either safe or risky driving behaviors.

While a variety of personality variables such as sensation seeking,

aggression, impulsivity, internality, and externality were examined by researchers in terms of their relation to accidents, the strength of those relationships were claimed to be obscure (Gregersen, 2005; Sümer, Lajunen, & Özkan, 2005). However, it was also asserted that personality variables as being extrinsic factors to driving should be investigated by more appropriate statistical designs that aim to clarify the possible links between extrinsic and intrinsic variables (Elander et al, 1993; Sümer, 2002; Sümer, 2003; Rimmö & Aberg, 1999). Similarly in defining the processes of hazard perception, Howarth et al. (2005) refer to the extrinsic factors as modifying factors to risk assessment and they claimed that these factors are of vital importance due to their relation to perceived risk and targeted safety level. Therefore personality constructs, being either stable or transient, should be regarded as the organizers of motivations and cognitions, and they should be taken into account in explaining the underlying factors for driving behaviors.

1.5.1. Sensation Seeking

Sensation seeking is defined as a trait-like characteristic, which is dominated by a tendency towards new and different experiences and stimuli, despite of the risks involved (Zuckerman, 1990). Sensation seeking as proposed by Zuckerman, fits into an "approach – avoid" kind of evolutionary heritage. He argued that sensation seekers are the ones who have a strong need to explore the environment and take risks on the way to reproductive success. This tendency predispose high sensation seekers to be more tolerant during dangerous situations; the situations in which sensation avoiders would feel anxious. In addition to this psychophysiological perspective, Arnett (1994) proposed that social environment and individual differences other than genetics were also important in affecting the behaviors of sensation seekers and sensation avoiders. Sensation seeking was linked with various kinds of risky activities and behaviors such as gambling, smoking and dangerous sports. Considering the traffic environment is one of the most risky contexts, sensation seeking as a driver characteristic was also investigated by researchers under the concept of individual differences approach.

1.5.1.1. Sensation Seeking and Risk Taking

High sensation-seekers were found to evaluate the risks that are involved in several activities like health, traffic, and sports as lower while they tended to score higher in terms of engaging in such activities (Rosenbloom, 2003a). The results were just the opposite for low sensation-seekers and they were found to evaluate more risk in similar domains and reported that they did not take risks. Even in conditions in which the drivers were made to watch a traumatic movie concerning an accident to create mortality salience, high sensation seekers were found to report taking more risks as compared to low sensation seekers (Rosenbloom, 2003b). Franken, Gibson, and Rowland (1992) claimed that sensation seekers perceive the world as less threatening and perceive the risky activities as less dangerous, as a result of a will to overcome the cognitive dissonance which was created by their engaging in hazardous activities.

Similarly, Horvath and Zuckerman (1993) in their study on the risk appraisals and sensation-seeking in various risk types, such as crime risk, financial risk, minor violation risk and sports risk, found that people who scored high on sensation-seeking were low on risk appraisals and high on their experiences of those risky behaviors. This shows that when people having repeated experiences related to risky situations and if those experiences did not end up with a negative consequence, they tend to assess the possible risk associated with that behavior as lower. This is consistent with Fuller's (1984, cited in Jonah, 1997) conceptualization of threat avoidance. Fuller differentiates between two driving styles, which are anticipatory avoidance driving and delayed avoidance driving, and he claims that when confronted with a hazardous situation the driver's decision is influenced by similar prior experiences of that situation. The person may assess low risk and may choose a delayed avoidance driving if he/she did not have negative experiences before. Besides the anticipatory avoidance driving, this pattern was believed to reflect a high sensation-seeking tendency which is characterized by focusing on present rewards rather than possible negative consequences. Fuller (2001) explains this phenomenon with the terms "learned riskiness" (pp. 110), which points out to the fact that risks that are associated with

rewards turn out to be reinforced and learned behaviors, the reflection of which to traffic can be associated with violations such as speeding or driving while intoxicated. In that sense, the discrepancy between the perceived and the actual risk may lead drivers to adapt a risky driving style and this is mostly a characteristic of young drivers (DeJoy, 1992).

In terms of engaging in risky driving behaviors, Wilde (1994) introduced the concept "risk-homeostasis" indicating that every driver has a level of acceptable risk and during driving the driver tries to keep this risk on a targeted level, such as driving faster to compensate for the time he drove slower. Heino, Molen, and Wilde (1996a) argued that sensation-seekers engage in more risky driving since their threshold for target risk was higher.

Jonah, Thiessen, and Yeung (2001) found a strong indirect relationship between high-sensation-seeking and wearing seat-belts, speeding, and beliefs about the chance of getting caught by the police. In terms of behavioral adaptation, they asked the participants how they would drive if they were to use a car with ABS, to manipulate behavioral adaptation. It was found that high sensation-seekers were more likely to drive while intoxicated and speed on highways and wet roads as compared to low sensation-seekers, in the prevalence of a car with ABS. However Jonah et. al. concluded that their results did not give a full support for high-sensation-seekers getting more involved in behavioral adaptation, since they did not know how participants would behave in the absence of ABS.

1.5.1.2. Age and Sensation Seeking Associations

The perceptions regarding rewards of risk-taking are defined as "risk-utility" by Jonah (1986) as he claims that what is important for researchers is to clarify the importance of various utilities relative to each other for identifying the underlying motives. The rewards that are associated with peer group support can be said to be an important factor why young drivers are willing to take risks (Horvath & Zuckerman, 1993; Cooper et.al., 1995; Williams, 2003). This is why Grayson and Groeger (2000) points out that a hazard may mean a source of

excitement to a group of drivers, something to use as a means of satisfying certain needs, while it may mean a real danger to another group of drivers.

It was demonstrated that adolescents scored higher on sensation seeking as compared to adults and sensation seeking was found to be correlated with aggression as well, in the younger age group (Arnett, 1994; Arnett, 1996). Young, male and inexperienced drivers were found to score higher on thrill and adventure seeking and boredom susceptibility subscales of Zuckerman's Sensation-Seeking Scale, as they were found to have more traffic convictions (Furnham & Saipe, 1993).

Sensation seeking was correlated with drunk driving among young college students (Arnett, 1990), along with other driving behaviors like violating the speed limits or racing with other cars (Arnett, 1996). High sensation-seekers were found to drive more risky in a driving simulator when they believed that they consumed alcohol, as compared to high sensation seekers who did not consume any alcohol (McMillen, Smith, & Parker, 1989). The authors elaborated that sensation seekers have the tendency to take advantage of the situations aiming to justify their risky driving.

Jonah (1997) in his review of the literature reports that 36 of the 40 studies he reviewed reported a positive relationship between several types of risky driving behavior and sensation seeking. In terms of the relationship between risky driving, age, and sensation-seeking, Johnson and Raskin (1989, cited in Jonah, 1997) found that 18 year-old male drivers who scored high on sensation seeking were more likely to drive while intoxicated while this relationship was weaker for 21 year-old males. However, Jonah did not report a similar finding related with other studies he reviewed, indicating a weak support for young age being more related to high sensation seeking.

In a recent study, Stradling and Meadows (2001) reported that young drivers' sensation seeking score was higher than older drivers'. In their investigation related to the link between sensation seeking and experience, Heino, Molen, and Wilde (1996b), reported no interaction between the two variables, while they found that inexperienced sensation-seekers were more accident involved than

inexperienced sensation avoiders, indicating that sensation seeking would contribute to more accident involvements when accompanied by inexperience.

Sensation seeking as an extrinsic factor to driving should be regarded as a personality variable, which has an effect on crash involvement under the mediation of risky driver behaviors. By a large-scale investigation about personality traits and crash involvement among Norwegian drivers, sensation seeking was found to be the best predictor of risk-taking, which was reflected by driving faster and violating traffic rules, among all other variables like locus of control and normlessness (Iversen & Rundmo, 2002). Similarly sensation-seeking was found to predict risky-driving along with driving anger and impulsivity, as it was found to be related with lost-concentration, which was defined as a crash related condition (Dahlen, Ryan, Ragan, & Kuhlman, 2005). Violations were found to be predicted by thrill and adventure seeking and disinhibition subscales of Zuckerman's SSS (Trimpop & Kirkcaldy, 1997), while other aberrant driving behaviors like errors and mistakes were not predicted by sensation seeking as good as violations (Rimmö & Aberg, 1999). Similarly, Sümer (2003) reported that sensation seeking increased the violations that are associated with speeding, which were overtaking tendency of the driver and self-reported speed in city and intercity roads.

1.5.2. Big- Five Personality Factors

Trobst, Wiggins, Costa, Herbst, McCrae, and Masters (2000) explain that, "trait approaches focus on relatively enduring individual differences that predispose individuals to characteristic styles of action and experience" (pp. 1234). They further elaborate that this kind of approach is useful in specifying the individuals who are risk-prone. One of the approaches that are used to organize personality subtypes is the Five-Factor Model (FFM) and it is accepted as one of the most comprehensive personality classification (Digman, 1990; Costa & McCrae, 1995).

FFM consists of five domains, which are exclusive in terms of the constructs that they represent and these domains are extraversion, openness to experience,

agreeableness, neuroticism, and conscientiousness. Each of the dimensions refers to a set of six facets (Costa & McCrae, 1995; Goldberg, 1993). Extraversion refers to warmth, gregariousness, assertiveness, activity, excitement seeking and positive emotions. Neuroticism refers to anxiety, hostility, depression, self-consciousness, impulsiveness and vulnerability. Agreeableness refers to trust, straightforwardness, altruism, compliance, modesty and tender-mindedness. Openness to experience refers to fantasy, aesthetics, feelings, actions, ideas and values. Lastly conscientiousness refers to order, competence, dutifulness, achievement striving, self-discipline and deliberation (Costa & McCrae, 1995). As Clarke and Roberson (2005) pointed out five-factor model is a good means to assess the relationship between personality variables and specific behaviors, since it is tapping a variety of personality facets that are organizing behaviors.

Driving behavior was investigated with reference to many personality variables such as sensation seeking, aggression or impulsivity. These variables are generally represented under different domains in FFM. For example, sensation seeking can be said to be synonymous to the excitement-seeking facet under extraversion. Impulsivity was regarded as a facet under neuroticism and aggression can be related to agreeableness in terms of its relation to hostility. Therefore, while some facets under the domains captured attention in driver research, the study of big-five traits as a comprehensive assessment of personality is rather a new issue in traffic psychology.

Among the domains in FFM, a majority of the studies showed that conscientiousness was related to accidents and risky driving in an indirect way (Schewebel, Severson, Ball, & Rizzo, 2006; Arthur & Graziano, 1996; Sümer, Lajunen & Özkan, 2005). Schewebel et al. (2006) reported that conscientiousness was negatively correlated with errors, lapses and violations, and errors and lapses were found to be strongly associated with conscientiousness rather than sensation seeking or anger. Arthur and Graziano (1996) found that accident involvement increased as conscientiousness levels of drivers decreased. Sümer et al (2005), in their study of testing the direct and indirect relations of five-factor on accident involvement, found that conscientiousness had an indirect effect on aberrant

driver behaviors and aberrant driver behaviors were found to mediate the relationship between conscientiousness and accident involvement. These results are not surprising considering the facets of this dimension such as rule-based behaviors or being reliable and organized (Goldberg, 1993). It seems that conscientiousness acts as a buffer against rule and norm violations, which may find its reflection in traffic as being a safe driver.

Similar results were reported for agreeableness as well (Sümer et al., 2005; Clarke & Robertson, 2005). Due to that, low level of agreeableness was associated with accident involvement (Clarke & Robertson, 2005; Sümer et al., 2005), while the predictive power of agreeableness was not as high as conscientiousness in Sümer et al.'s study. A high level of agreeableness was defined as an antagonist construct to hostility (Budaev, 1999). Therefore, low levels of agreeableness can be linked to an aggressive driving style, although there is not any empirical evidence with regards to this assumption.

Openness to experience was also found to have a positive relationship with accident involvement (Sümer et al., 2005). Dollinger, Leong and Ulinci (1996) conducted a factor analysis with a set of words tapping different constructs and they found that openness to experience was positively correlated with maturity, imagination, and broadmindedness and negatively correlated with responsibility, self-control and conformity. In terms of driving behavior, high scores on openness to experience can be correlated with irresponsible acts on the road, as well as rule-violations resulting from not confirming with the highway codes. Openness to experience seems to share a common characteristic with sensation seeking as well (Aluja, Garcia, & Garcia, 2003). Therefore, openness to experience can work as a modifying variable that impairs risk perception when a hazard is present.

In terms of extraversion, the results were inconclusive. In their study of extraversion and neuroticism, measured by Eysenck's inventory (1959, cited in Pestonjee & Singh, 1980), Pestonjee and Singh (1980) reported that introverts were more accident involved as compared to extraverts. They elaborated on the issue by telling that extraverts had higher tolerance for stimulation, which is helpful in dealing with the complex traffic environment. On the contrary to this,

Lajunen (2001), in his research covering more than thirty different countries, found that extraversion was positively related to accidents, and the countries that were representative of high extraversion, were also the ones with high accident rates. This finding was also replicated by Clarke and Robertson (2005), who found that extraversion was a good predictor of traffic accidents, while it was not related to occupational accidents, signaling that extraversion can be related to risk-elevating behaviors in traffic context. Similarly Sümer et al. (2005) reported that extraversion was found to have a positive relation with aberrant driving behaviors, while its effect on accident involvement via the mediation of driving behaviors was weak.

Neuroticism was also reported to be associated with accident involvement (Pestonjee & Singh, 1980) and violations (Sümer et al, 2005). Given that neuroticism was correlated with stress (Matthews, Dorn, & Glendon, 1992; Penley & Tomaka, 2002), it was hypothesized that neuroticism may increase accident involvement in the presence of highly stressful circumstances (Clarke & Robertson, 2005). Penley and Tomaka (2002), in examining the relations between big-five traits and coping with stressful events reported that neuroticism was related to defensive coping strategies. In traffic context these strategies may lead to a more hostile attitude towards other road users or simply may result in violations.

Empirical evidence with regards to the predictive power of big-five traits in accident involvement is relatively narrow, but suggesting that conscientiousness is the most consistent variable in predicting safe behaviors. Given that hazard perception is the leading cause of accidents among young novice drivers, it should be investigated which personality domains moderate/mediate the relationship between perceived risk and hazard perception

In terms of the given links between big-five traits and accident involvement, it can be expected to find a positive relationship between high conscientiousness and hazard perception ability. High conscientiousness, which is defined by rule-governed behaviors, may lead the driver to be more perceptive about other drivers' rule-incongruent behaviors in traffic and this may enhance hazard

detection time. In addition, given that extraversion and openness to experience can be related to sensation seeking, these traits may also contribute to taking more risks while driving, which will impair perceived risks associated with hazards. In terms of its relation to driving stress and anxiety, high neuroticism can be expected to interfere with hazard detection time. Finally low levels of agreeableness may create a basis for hostile attitudes in driving context and drivers with low agreeableness may themselves contribute to the development of hazardous situations by driving aggressively and putting themselves into risky situations.

1.5.3. Overestimation of Driving Skills

It has been known that individuals have the tendency to engage in self-enhancement biases while making self-evaluations, in order to verify their beliefs about certain aspects of the self. Taylor and Brown (1994) asserted that majority of the people have illusionary beliefs about themselves with regards to three domains "a) …view themselves in unrealistically positive terms b) they believe they have greater control over environmental events than is actually the case, and c) they hold views of future that are more rosy than base-rate data can justify" (pp. 21). The authors claimed that optimism bias and illusion of control were good for psychological well-being and they act as a buffer to cope with threats to self-esteem. They also asserted that optimism bias, which was described as holding positive views about future, was mostly pronounced among non-clinical samples with high self-esteem, while depressed individuals in clinical samples were found to make a more realistic assessment. (see Taylor & Brown, 1988, for a review).

Given that the driving context is one of the most risky environments, optimism bias or illusion of control may not be a good ground to make driving-related self-assessments. It is more important for a driver to make realistic self-evaluations on the basis of driving skills and abilities, in order to be aware of his limits in handling the hazardous situations. An elevated positive belief about the self in the driving domain may predispose the driver to perceive that he/she could handle every challenging situation in traffic. Therefore the overconfidence in

one's driving may lead to the adaptation of a risky driving style and may act as a modifying variable in attributing lower amounts of risks to road hazards.

A common method to investigate drivers' self-enhancement bias in traffic is to measure self-reported driving skill. In several studies, it was reported that there exists the tendency among all kinds of drivers to overestimate their driving skills when they were comparing themselves with the average driver (McCormick, Walkey, & Green, 1986; McKenna, Stanier, & Lewis, 1991) or a tendency to underestimate the other drivers' driving skills as compared to their skills (Delhomme, 1991; Walton & Bathurst, 1998).

McKenna et al. (1991) and Waylen, Horswill, Alexander, and McKenna (2004) reported that there was a positive correlation between experience and one's view of driving safety and driving skill. Lajunen and Summala (1995) found that experienced drivers (with an annual mileage of 5000km/year and above) were found to be skill-oriented rather than safety-oriented. They argued that gaining mastery over the car and being experienced create controllability and this may decrease the perceived risk while driving. This is critical considering the findings showing that the combination of the perceptions of high driving skill and low safety skill results in the highest level of accident involvement (Sümer & Özkan, 2002; Sümer, Özkan, & Lajunen, 2006). In their study with experienced drivers, Sümer and Özkan (2002) found that drivers, who scored high on self-reported driving skill, but low on safety skills, were more accident-involved than other combinations of driving and safety skills groups. This group of drivers was also found to be speeding and overtaking other drivers more and has more traffic convictions (Sümer et al, 2006). The authors elaborated on the issue that when driving skills were not accompanied by safety skills the driver may develop overconfidence about their driving skills, and this could be especially a problematic pattern for young drivers.

A comparison of young male and female drivers in terms of perceived driving ability and perceived accident risk revealed that, male drivers tend to assess their driving skills in a more positive light than females did (DeJoy, 1992). Similarly young-male drivers were found to underestimate their accident likelihood, while

this tendency was not observed for older drivers (Finn and Bragg, 1986).

To examine the relationship between age, perceived driving ability and perceived risk, Matthews and Moran (1986) asked their young participants to assess themselves in 'vehicle-handling skills', 'driving reflexes' and 'driving judgment'. The results provided support to the argument that there is an indirect relationship between perceived driving skill and perceived risk. Moreover it was revealed that young drivers have a tendency to perceive themselves as more skillful than their peers in vehicle-handling and driving judgment categories, and to perceive themselves more skillful than older drivers in driving reflexes category. Young drivers were also found to indicate their risk of involving a crash as lower than the risks of their peers. Matthews and Moran (1986) argued that young drivers' tendency to perceive themselves as skillful as older drivers, points out a misjudgment rather than a fact. As a support for this argument, Harrison (2004) in a follow-up on learner drivers found that although learner drivers' experience of driving in different and complex circumstances (such as at nights or in intercity roads) was very low, the positive perceptions about their driving skills increased rapidly within a short time.

Judgments about driving skills or perceived risk are susceptible to experiential driving knowledge (Rothengatter, 2002; Groeger & Grande, 1996; Groeger & Brown, 1989). Groeger and Grande (1996) provided statistical evidence concerning this point and they reported that drivers who had an accident-free driving record had the tendency to perceive their driving abilities in a more positive light. This indicates that drivers tend to think of themselves as very good drivers if they had not been involved in accidents. This generalization seems to be used by young and novice drivers as well, although they do not have a history in driving that is long-enough to make inferences. However, having overconfidence in driving skills which would create an elevated threshold for tolerable risk, can be said to create a potential basis for mislabeling the hazards when it was combined with inexperience and low levels of safety skills.

1.6. Aims and Hypotheses of the Thesis

Recent literature on hazard perception mainly focuses on the effects of experience with regards to the acquisition of reading the road ability in young novice drivers. Reading the road is related to scanning and searching strategies on the way to develop certain expectations about the consequences of other drivers' actions (Stradling & Meadows, 2001). In addition, perceived risk was given as one of the best predictors of hazard perception since it would interfere with deciding about whether the situation is really hazardous or not (Howarth et al., 2005). In that sense, it can be expected that young and novice drivers would fail to detect hazards as faster as experienced drivers since they do not have a well-structured schema for traffic which would guide them in where to attend. Moreover, certain personality traits, driving style and driving skills, which are shown to modify the relationship between risk assessments and hazard perception processes, may interfere with perceived risk in young novice drivers. However, it is also reasonable to claim that these modifying factors may also predispose the more experienced drivers to perceive less risk in certain hazards.

Perceived risk in hazards was measured by self-report ratings given for hazardous traffic scenes (Coulborn, 1978; Farrand & Mckenna, 2001) and no study tested the effects of personality factors and certain driving skills in predicting hazard perception ability. Therefore, the aim of this thesis is to investigate the link between personality factors, driving skills, and experience in predicting hazard perception ability.

The main hypotheses of the study were:

1) Experienced drivers would score higher in computer-based assessment of hazard perception as compared to novice drivers.
2) There would not be any difference between novice and experienced drivers in self-reported hazard perception ability.

   Considering the past research on self-enhancement bias and overestimation of driving skills, it was assumed that novice drivers would also have overconfidence about their hazard perception skills, which would lead them assess themselves as good as experienced drivers.

3) High sensation seeking would be associated with lower scores in computer-based hazard perception test among drivers.
4) Low levels of conscientiousness would be indicative of low hazard perception scores among drivers.

   Given that among the Big-Five traits, conscientiousness is the most consistent predictor of risky behaviors including accidents and violations, it was assumed that it would also predict hazard perception ability. However, explanatory effects of other traits, extraversion, openness to experience, agreeableness and neuroticism, will also be examined.
5) Low levels of safety skills and high levels of perceptual motor skills would predict lower levels of hazard perception ability among drivers.

CHAPTER 2

METHOD

2.1. Participants

The data were initially consisted of 142 drivers across different age spans (range 18 – 62) and with varying degrees of driving experience (range 0 – 32 years of active driving). After controlling for the accuracy of the data file, three of the young and learner drivers were excluded from further analysis since they indicated that they had driven a car before registering a driver-training course. In addition, four of the participants were also excluded from further analysis since they had missing values in most of the hazard clips indicating that they did not understand the task quite well. Data were examined for univariate and multivariate outliers and six univariate outliers on specific variables were deleted and replaced with the mean values.

Analyses were conducted with the remaining 135 participants (90 males and 45 females). Participants had a mean age of 27.18 years (SD = 6.74) and had a mean driving experience of 5.56 years (SD = 6.89). The majority of the sample was consisted of high school graduates (53.3%) and university graduates (40.7%). The remaining were secondary school and primary school graduates (5.2%). While the majority of the sample indicated that they were actively driving a car, 26.7% of the participants indicated that they were not actively driving. Driving under various conditions was high in city roads (M= 4.33, SD= 1.64), and low in intercity roads (M= 2.81, SD= 1.53) (see Table 1).

Table 1. Sample Characteristics

Variable	M	SD	Range	N	%
Sex					
Male				90	66.7
Female				45	33.3
Education Level					
primary school				2	1.5

Table 1 (continued)

Variable	M	SD	Range	N	%
Secondary school				5	3.7
high school				72	53.3
university or a higher degree				55	40.7
Age	27.18	6.74	19-48		
19 -25				58	43.0
26 and above				74	54.8
Driving under various conditions					
in winter	3.46	1.82	1-6		
in heavy traffic	3.85	1.77	1-6		
in highways	2.90	1.50	1-6		
in main roads	3.93	1.62	1-6		
in city roads	4.35	1.64	1-6		
in intercity roads	2.82	1.54	1-6		
at night	3.36	1.66	1-6		
in every situation	3.83	1.79	1-6		

2.2. Materials

Materials included the Turkish Hazard Perception Test in Traffic (T-HPT, see Appendix A), Self-Reported Hazard Perception (SRHP, see Appendix B), Turkish Sensation Seeking and Risk-Taking Questionnaire (see Appendix C), Driving Skills Inventory (DSI, see Appendix D), short form of Big-Five Inventory (BFI, see Appendix E), and Demographic Information Form (see Appendix F).

2.2.1. Turkish Hazard Perception Test in Traffic (T-HPT)

Considering the need for assessing the hazard perception skills of Turkish drivers, a computer-based hazard perception test, which was consisted of traffic videos including the actual road hazards peculiar to Turkish traffic environment, was developed. The T-HPT was developed as a part of a broader project that was supported by Meteksan Sistem A.Ş. and the Technological Research Council of

Turkey - Research & Development Support Program (TUBİTAK TIDEB– Project No.3040185).

Examination of the HP tests developed in the UK, the USA and Australia revealed that generally scenario-based traffic scenes have been used to generate the hazards. However scenario-based techniques do not seem to reflect actual traffic conditions because neither the traffic flow nor the environmental stimuli were mirroring the complexity of actual traffic setting. Therefore it was decided to use the video clips recorded in real traffic setting in Turkey.

A handy camera was mounted inside the car and installed on the windshield by using a special stabilizing apparatus that holds the camera still during the movements of the car. An expert was used to record the traffic scenes and the entire recording was done from the driver's point of view. The purpose was to obtain clips, which would create the impression that the participant was using the car in the scenes. A total of 45 - hour-long traffic scenes were recorded by the video footage and 15 hours consisted of intercity roads while the remaining was recorded in city roads. Those cities were Ankara, İstanbul, Isparta, Adana, Mersin, Gaziantep, Şanlıurfa, Van and Kırşehir.

At the first step, the video footage was watched by the assistant researchers and the parts that contained road hazards were identified on the basis of the definition of hazards given before. At the end of the process clips that were varying between 20 seconds to 60 seconds in length were created. During the labeling process the following criteria which was similar to Sexton's (2001) study were used:

1) Scenes with developing hazards (interaction with other road-users) and which requires good scanning skills would be selected.
2) Stable/static hazards would be selected only if they require good scanning skills. For example a parked/non-moving car would not be labeled as hazardous, but it would be labeled as a hazard if it is signaling to right or left.

3) Immediate hazards which do not facilitate an assessment on the basis of reaction times would be eliminated.

4) Overlapping hazards in which there would be ambiguity about the reaction given by the participant would not be selected.

At the end of the selection process, a total of 266 traffic clips with varying road hazards were obtained. All the clips were classified under broad categories by using the Annual Traffic Statistics about the causes of accidents in Turkey (EGM, 2002-2003-2004); such as hazards occurring in junctions, overtaking hazards, close following hazards, and pedestrian hazards.

Following the selection of potential hazard clips, a panel consisting of six raters working in the R&D project watched all the clips and rated each clip by using 10 point scales (1= very bad hazard; 10= very good hazard) considering the criteria given above. Mean points were calculated for each clip and the clips with a mean of above 7 were accepted to be included in the test. First, a pilot study was done with 11 real life scenes. The primary concern was to receive feedback from the participants about the instructions regarding how to detect a hazard and to see if hazards presented in video clips could be detected by drivers. The pilot study revealed that instructions were not clear enough to explain what a hazard means in traffic. Therefore, the instructions and trail phases were revised. Ergonomic design of the response button and the some aspects of the software were also revised considering the findings of the pilot study.

The final version of the T-HPT was consisted of 31 real-life traffic scenes. Three of the clips did not contain any hazards serving for the control items. Two of the clips included two hazards, which were not overlapping in the occurring time. The characteristics of the hazards are presented in Table 2. As can be seen in Table 2, 11 of the hazards were developing from the joining lane. These hazards were consisted of violation of the right to pass, such as a car pulling in front of the car. Four of the hazards occurred in the opposite lane and these hazards were consisted of the faulty overtaking of the car in the opposite lane. The remaining hazards occurred in the driver's own lane and they contained pedestrians or bicyclist/motorcyclist jumping to the road as well as other cars. The hazards that

were caused by other vehicles in one's own lane were mostly consisted of other drivers' sudden breaking or faulty lane changing.

The participants could give five responses at most for each clip in the test. The number of responses and reaction times for each response were recorded separately in the system's database for every single item and response.

Total scores obtained from the test were calculated on the basis of response times. The, reaction time responses for each item were recorded in terms of frames which were tapping a specific point in the clip in the database of the computer-based T-HPT. First, the onset and offset of each hazard were defined in advance by the research group, by means of a program called Frame-Reader which was a tool specifically developed for the purpose of making precise analysis of the onset and offsets of hazards (Birdal, 2006, personal communication). The onset of a hazard was the point in which the developing hazard was becoming visible on the screen. The offset of a hazard was the point in which the hazard has already been developed and has already became too visible. Therefore for every item, hazard response windows were created and the scoring of each response was done with reference to where it was positioned in the hazard response areas.

An indication of good hazard perception ability is to respond to the hazard as early as possible. Therefore, a hazard response area of for each item was divided into 10 equal ranges and if a response was given within the first range (that is the closest range to the onset point), the participant was given 10 points for that item. If the response was given at the last range (that is the closest range to the offset of the hazard), the participant was given 1 point. If no response was given within the hazard response window, participant was given –1 point, as a punishment for not perceiving the hazard on time. Scores obtained from all the items were summed, and thus, the total score for computer-based the T-HPT was calculated.

Table 2 Characteristics of Hazards

Joining Path		11
Opposite Lane		4
Own Lane	Cyclist/Motorcyclist	4
	Pedestrian	3
	Cars	7
	Animals	1
Total		30

2.2.2. Self-Reported Hazard Perception Scale (SRHP):

A short scale consisted of six items was developed to assess the self-reported assessment of hazard perception. Specific situations in which a typical novice drive could face in traffic were considered in developing the items for the SRHP (e.g., "There are times that I find it hard where to attend in traffic"). Participants were asked to indicate how often they experience the situations that were given in the items by using 6-point Likert type scales (1= never, 6= always). Higher means represented better self-reported hazard perception ability (Appendix B).

A principle component analysis was run on these items to test the factor structure of the scale. Single factor was clearly emerged indicating that six items were tapping the same factor. Factor loadings were high (ranged between .80 and .61). The total variance explained by the factor was 51%. In addition, reliability analysis revealed that item-total correlations ranged between .45 and .67 and Cronbach's alpha for the scale was satisfactory (α = .80).

2.2.3. Turkish Sensation-Seeking and Risk Taking Questionnaire:

The questionnaire was developed by Ayvaşık, Sümer, Er, and Hünler (2004) for the purpose of generating a sensation-seeking scale that was specific to traffic situation and includes items representing characteristic typical to Turkish drivers. Among a pool of 52 items, the researchers reported that they reached a 3-factor-structure scale that was consisted of 33 items. These factors were General Sensation-Seeking with 18 items (e.g., "I have a tendency of taking risks"),

Sensation Seeking in Traffic with 7 items (e.g., "If I had the opportunity, I would like to change my car frequently") and Risk Taking in Traffic with 8 items (e.g., "I like to take risks while driving"). Participants responded to the items by using a 6-point Likert type scale (1= Does not describe me at all, 6= Describes me very much). Higher means indicated a high degree of sensation seeking or risk taking (Appendix C).

Ayvaşık et al. reported that in the factor analysis, general sensation seeking explained 35%, sensation-seeking explained 6% and the risk taking in traffic explained 7% of the total variance. The scale was reported to have a total alpha reliability of .94. The reliability coefficients for the subscales were also high; .90 for general sensation seeking subscale, .82 for sensation seeking in traffic and .91 for risk taking in traffic subscale.

All of the subscales were negatively correlated with age, and general sensation seeking and risk taking in traffic were also negatively correlated with experience that was measured by the annual km driven. The subscales were positively correlated with overtaking tendency and number of tickets. Risk taking in traffic subscale was found to be correlated with number of accidents moderately. The subscales were found to be correlated with speeding convictions as well. General sensation seeking and risk taking in traffic were also correlated with convictions of driving while intoxicated. As compared to other subscales, risk taking in traffic subscale showed the highest correlations with number of accidents, number of tickets, overtaking tendency, speeding convictions and convictions of driving while intoxicated. Therefore, it can be claimed that Turkish Sensation-Seeking and Risk Taking Questionnaire is a reliable instrument of measure with good predictive power.

2.2.4. Driving Skills Inventory (DSI)

DSI was developed by Lajunen and Summala (1995) to measure drivers' self-assessments related with their skills and competency in driving as well as safety related motivations. The scale was adapted to Turkish by Sümer and Özkan (2002) and the factor analysis results revealed that 21 items were loading on the

two intended factors. Fifteen items taped the perceptual-motor skills dimension and six items represented the safety skills dimension. Sümer and Özkan reported that internal consistencies of the subscales were moderate to high; .84 for perceptual-motor skills subscale and .78 for safety skills subscale.

In a recent investigation of the link between driving skills and safety skills, Sümer, Lajunen, and Özkan (2006) applied the DSI to more that 800 drivers in Turkey and reported a new factor distribution. Sümer et al. reported that the adapted version of DSI was consisted of 19 items. Perceptual-motor skills factors included 12 items (e.g. Reverse parking into a narrow gap), while safety-skills factor included 7 items (e.g. Avoiding unnecessary risks). The total variance that was explained with the factors was 46%. Internal consistency coefficient was .89 for perceptual-motor skills subscale and .80 for safety skills subscale. In the latest version of the inventory, a five-point Likert type scale was used as compared to the previous studies in which the measurement scale was 4-point Likert scale.

In this thesis the latest version of the DSI which was shown to be a reliable measure among the Turkish sample was used. Participants were asked to assess their competency in terms of perceptual-motor and safety skills by indicating the degree of their strengths and weaknesses along the items (1= very weak, 5= very strong). Higher means indicate a high degree of self-reported skill (Appendix D).

2.2.5. The Big – Five Inventory (BFI)

The Big-Five Inventory was developed by John, Donahue, and Kentle (1991; cited in Benet-Martinez & John, 1998) for the purpose of constructing a short and brief measure of big-five traits, namely extraversion, neuroticism, openness to experience, agreeableness and conscientiousness. The inventory consists of 44 items and these items are adjectives or pair of adjectives that are tapping the facets under personality traits. Extraversion and neuroticism included 8 items each, agreeableness and conscientiousness included 9 items each, and openness to experience included 10 items. The short-version of BFI was translated into Spanish as well, and showed the same five-factor structure (Benet-Martinez & John, 1998). It was reported that the short-version of BFI was a good measure of

assessment to be used in other cultures, and in studies where there was no need to make a detailed investigation of the specific facets under the dimensions (Benet-Martinez & John, 1998).

Sümer (unpublished data) adapted and translated the BFI to Turkish as a part of a broader international project. In the Big-Five Inventory, participants were asked to indicate to what degree the given definitions were reflecting their characteristics by using a 5-point Likert type scales (1= I do not agree, 5= I strongly agree, see Appendix E). Acceptable levels of alpha reliabilities were reported for the Turkish version of the inventory, ranging between .66 and .77 (Sümer et al., 2005).

2.2.6. Demographic Information Form

The demographics form was mostly consisted of driving-related information. First, drivers were asked to indicate their age, sex, occupation and education level, as well as their driving status (learner driver, amateur driver and professional driver). Secondly, they indicated the number of years with driving, annual km driven, number of accidents for the last five years and number of traffic offences for the last three years. In addition, they were asked to report their speed in city and intercity roads when the road and weather conditions were normal. Lastly they were asked to indicate their overtaking tendency as compared to other drivers. In this latter measurement, drivers were asked to choose between one of the forced-choice options (Other drivers overtake me more than I overtake them, I overtake other drivers more than they overtake me, Equal).

In addition, participants filled in a short-scale asking the frequency of their driving under various conditions. They were asked to indicate the frequencies on a 6-point Likert type scale (1= never, 6= always) and the conditions which were given were as follows: winter time, in heavy traffic, in highways, in major city roads, in city roads, in intercity roads, at night and usually in all conditions. A high mean represented a higher frequency of driving in a particular situation (see Appendix F).

2.3. Procedure

In order to obtain data from young and novice drivers several driver-training courses in Ankara were contacted and three of the courses accepted to support the research by means of targeting learner and newly-licensed drivers to the study.

Participants were approached via phone calls and informed about the study. In addition to the driver-training courses, written announcements were put in several places in Middle East Technical University, calling for novice drivers to participate in the study. Learner and novice drivers –from either the driving courses or from METU - who accepted to participate in the study were paied 20YTL for their participation. Experienced drivers were approached by e-mailing the purpose of the study to the employees of Meteksan Sistem A.Ş. in Ankara. Although the rate of participation was quite low, Ankara Umum Servis Odası also accepted to participate in the study. All of the participants were assured about anonymity of their identity and confidentiality of their personal information.

Participants were first registered to the computer by entering the personal and driving related information. Following registration they completed the self-reported hazard perception scale on the computer. Then, they were given a 5-minutes long multimedia instruction on the screen related with the hazard perception test. They were also given a practice clip to habituate to the user-interface and response button of the test. After they completed the T-HPT in the computer they were given the other questionnaires in paper and pencil test format. It took one hour for the participants to complete the computer based test and other instruments.

CHAPTER 3

RESULTS

In the data analysis, sequential regression analyses were used in predicting HP ability. One-Way ANOVA and ANCOVA were employed in comparing group means, and bivariate correlations were calculated for testing the degree of associations among the variables.

3.1. Descriptive Statistics

As presented in Table 3, descriptive statistics for 135 participants were examined before the main analyses. Mean number of accidents reported was .58 (SD = .93). Of the participants, 63.7% did not report any accidents, 22.2% reported only one accident and the remaining reported two or more accidents in the last five years. Participants' mean traffic offences was .37 (SD = .69). While 77.9% of the participants did not report any traffic offences in the last three years, 22.1% reported to be convicted from one or more traffic offences, mostly as a result of speeding. Participants reported an average speed of 63.04 km in city roads and they reported an average speed of 99.39 km in intercity roads. In terms of overtaking tendency, the majority of the participants (39.3%) indicated that other drivers overtake them more often than they overtake other drivers.

Within the scope of this study, it was important to categorize drivers under novice and experienced categories. During the categorization process, self-reported annual km driven and active years in driving were taken into account since they reveal much about the intensity of exposure to the road. Of the participants, 40% indicated that they were actively driving for 5 years or above, 14.8 % indicated driving actively for two to four years, and 18.5% indicated that they were actively driving for less than one year. Twenty six percent of the participants indicated that they were not actively driving. This last group of drivers was mostly consisted of learner drivers or novice drivers who do not owe a

car. In terms of annual km driven, 11.9 % reported that they never drive a car, 7.4 % reported an annual km of 1000 – 5000 and 10.4% reported an annual km of 5000 - 10000. Of the participants, 14.1% reported to drive 10.000 to 20.000 km on the average and 6.7 % reported to drive 20000 -50000 km on the average. The remaining participants reported that they drive above 50000 km during the year.

Participants who were actively driving one year or less and whose annual km driven was 1000 km at most were grouped under novices. Also, participants who had just passed the on-road driving test and had the right to obtain a driver license were grouped under novices. Participants, who were actively driving more than four years or whose annual km driven was 20000 km or above were grouped within the experienced drivers group. By adapting a conservative type of grouping described above, some of the participants who did not meet these criteria were not categorized under any of the groups. Therefore novice driver group consisted of 52 participants and experienced driver group was consisted of 43 participants. During the analyses in which experience was regarded as one of the predictor variables, only the novice and experienced drivers' data were used. However in conducting other analyses in which there was not a differentiation on the basis of experience the complete data set consisting 135 drivers was used.

Table 3 Descriptive Statistics for the Main Demographic Variables

Variable	M	SD	Range	N	%
Number of Accidents	.58	.93	0-4		
0				86	63.7
1				30	22.2
2 and above				19	14.1
Number of Traffic Offences	.37	.69	0-3		
0				97	71.9
1 and above				38	28.2
Speed					
city roads	63.04	15.07	0-100		
Intercity rods	99.39	21.89	0-150		

Table 3 (continued)

Variable	M	SD	Range	N	%
Overtaking Tendency					
others overtake more				53	39.3
Equal				49	36.3
overtake others more				33	24.4
Years with Active Driving	5.56	6.88	0-35		
0				36	26.7
1				25	18.5
2-4				20	14.8
5 and above				54	40.0
Annual Km Driven					
Not Driving				16	11.9
Up to 1000 km				49	36.3
1000-5000 km				10	7.4
5000-10000 km				14	10.4
10000-20000 km				19	14.1
20000-50000 km				9	6.7
50000-100000 km				12	8.9

The relationships among demographic variables were tested using Pearson correlations. Results revealed that age was positively correlated with the number of accidents (r = .36, p< .01) and number of traffic offences (r = .31, p< .01). As expected, age was also positively correlated with driving under various conditions (r = .47, p< .01) and years with active driving (r = .74, p< .01). Number of accidents was moderately correlated to speed within city roads (r = .21, p< .05), and number of traffic offences was positively correlated with speed within intercity roads (r = .58, p< .01). A more detailed description related with the correlations among variables was given in Table 4.

Table 4 Correlations between Driving Related Demographic Variables

	Age	Years with Active Driving	Driving under Various Conditions	Speed / City	Speed / Intercity
Age					
Years with Active Driving	.74**				
Driving under Various Conditions	.47**	.23**			
Speed (km)					
City Roads	.08	.15	.30**		
Intercity Roads	.11	.19*	.34**	.58**	
Number of Accidents	.35**	.23**	.31**	.21*	.13
Number of Traffic Offences	.31**	.23**	.40**	.15	.21*

* p<.05, **p<.01

3.2. Descriptive Analysis of the Main Variables in the Study

Means, standard deviations, and ranges for the main variables were given in Table 5. As can be seen, participants reported moderate levels of sensation seeking (M = 2.90), and considerably high levels of driving skills (M = 3.73). Self-reported hazard perception (SR-HP) skill was moderately high (M = 4.18). Investigation of the mean scores for the subscales of sensation seeking revealed that the highest mean was obtained for sensation-seeking in traffic subscale (M = 3.63), while the lowest mean was observed for risk taking in traffic subscale (M = 2.30). Considering the dimensions of the Big-Five Inventory, it was observed that the mean for Neuroticism (M = 2.63) was lowest and the mean for Conscientiousness was the highest (M = 3.90) in this sample.

Table 5 Means, Standard Deviations and Ranges for the Main Variables

	Mean	SD	Observed Range
I. Personality Factors			
Sensation-Seeking	2.90	0.78	1.27 – 5.12
General Sensation Seeking	2.92	0.8	1.22 - 5.00
Sensation Seeking in Traffic	3.63	1.04	1.14 – 6.00
Risk Taking in Traffic	2.30	0.98	1.00 – 5.13
Big Five			

Table 5 (continued)

	Mean	SD	Observed Range
Extraversion	3.47	0.7	2.25 – 4.75
Agreeableness	3.77	0.5	2.56 – 4.78
Conscientiousness	3.90	0.66	2.00 – 5.00
Neuroticism	2.63	0.7	1.38 – 4.50
Openness to Experience	3.74	0.54	2.20 – 4.90
II. Driving Skills	3.73	0.50	2.58 – 4.84
Perceptual/Motor Skills	3.68	0.63	2.08 – 4.92
Safety Skills	3.83	0.55	2.00 – 5.00
III. Self-Reported HP	4.18	0.88	1.50 – 6.00
IV. Computer-Based HP	133.44	30.46	43.00 – 193.00

3.3. Correlations among the Main Variables

The relationships among the main variables were tested through Pairwise Correlation (See Table 6). Results of the analysis revealed that computer-based hazard perception score was positively correlated with driving under various conditions (r = .19, p < .05), indicating that the more the drivers reported high frequencies of driving in various situations (eg. in heavy traffic, at night, etc.), the higher the scores obtained from the computer-based hazard perception (CB-HP) test. SR-HP was positively correlated with age (r = .35, p < .01), driving experience (r = .56, p < .01) and driving under various conditions (r = .51, p < .01). In addition, the SR-HP was also positively correlated with perceptual motor skills (r = .71, p < .01) and safety skills (r = .22, p < .05) which indicated that drivers who perceived their driving skills as superior had the tendency to report high levels of SR-HP. Lastly, SR-HP was negatively correlated with general sensation seeking (r = -.26, p < .01), neuroticism (r = -.18, p < .05) and openness to experience (r = -.22, p < .05). The negative correlations between SR-HP and neuroticism indicated that, drivers who have high levels of anxiety and stress are not good at predicting other road users' behaviors.

As expected, safety skills subscale of the DSI was negatively correlated with general sensation seeking (r = -.21, p < .05), risk taking in traffic (r = -.38, p <

.01) and sensation seeking in traffic (r = -.25, p < .01) indicating that as the sensation seeking increases the safety orientation gets more deteriorated in drivers. As could be expected, safety skills subscale was positively correlated with conscientiousness (r = .31, p < .01).

Investigation of the correlations among personality factors reveled that extraversion was positively correlated with sensation seeking in traffic (r = .19, p < .05), and openness to experience was positively correlated with general sensation seeking (r = .38, p < .01). On the contrary, conscientiousness was negatively correlated with general sensation seeking, risk taking in traffic and sensation seeking in traffic (r = -.29, p < .01, r = -.34, p < .01, r = -.27, p < .01 respectively). Generally these associations pointed out that conscientiousness and sensation seeking were antagonist to each other in predicting risky driving tendency.

Consistent with the literature general sensation seeking, risk taking in traffic and sensation seeking in traffic were all negatively correlated with age (r = -.39, p < .01, r = -.37, p < .01, and r = -.38, p < .01 respectively). Moreover openness to experience was also negatively correlated with age (r = -.18, p < .05) while conscientiousness and agreeableness were positively correlated with age (r = .31, p < .01 and r = .20, p < .05 respectively). These relationships indicated that younger drivers were more likely to take risks while driving and they were more likely to exhibit rule-incongruent behaviors as well as hostile attitudes in road.

Lastly correlations with regards to driving experience revealed that experience was highly and positively correlated with perceptual motor skills (r = .54, p < .01) and safety skills (r = .25, p < .01). Experience was negatively correlated with the subscales of general sensation seeking and openness to experience. These findings showed that experienced drivers rated themselves as more skillful and less likely to take risks while driving (see Table 6).

Table 6 Correlation Matrix for the Main Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Hazard Perception																
1. Computer-Based HP-Score																
2. Self-Reported HP Score	.02															
Demographic Variables																
3. Age	-.06	.35**														
4. Gender (1= Male, 2= Female)	-.06	-.27**	-.07													
5. Driving Experience (active years in driving)	-.11	.56**	.74**	-.30**												
6. Driving under Various Conditions	.19*	.51**	.47**	-.26**	.57**											
Driving Skills																
7. Perceptual Motor Skills	.14	.71**	.38**	-.32**	.54**	.61**										
8. Safety Skills	-.08	.22*	.24**	.03	.25**	.01	.29**									
Sensation Seeking/ Risk Taking																
9. General Sensation Seeking	.13	-.26	-.39**	.19*	-.45**	-.20*	-.21*	-.21*								
10. Risk Taking in Traffic	.03	-.05	-.37**	-.08	-.24**	.01	.01	-.38**	.64**							
11. Sensation Seeking in Traffic	.08	-.08	-.38**	.04	-.35**	-.15	-.03	-.25**	.56**	.67**						
Big-Five Inventory																
12. Extraversion	.02	.04	-.07	.17	-.01	.02	.11	-.08	.10	.09	.19*					
13. Agreeableness	.17	.18*	.20*	-.01	.17	.17	.25**	.15	-.11	-.15	-.05	.02				
14.Conscientiousness	.00	.28**	.31**	-.04	.31**	.20*	.28**	.31**	-.29**	-.34**	-.27**	.09	.35**			
15.Neuriticism	-.07	-.18*	-.08	.31**	-.21*	-.25**	-.24**	-.17	.14	.17	.16	.05	-.34**	-.36**		
16. Openness to Experience	.10	-.22*	-.18*	.16	-.30**	-.03	-.06	.05	.38**	.16	.14	.11	.09	.03	.11	
Mean	133.44	4.18	27.18		5.56	3.48	3.68	3.83	2.92	2.29	3.62	3.47	3.77	3.90	2.63	3.74
Standard Deviation	30.46	.88	6.74		6.88	1.45	0.63	0.55	0.80	0.98	1.04	0.57	0.50	0.66	0.70	0.54
Observed Range	43.00 193.00	1.50 6.00	19.00 48.00		0 35	0.75 6.00	2.08 4.92	2.00 5.00	1.22 5.00	1.00 5.13	1.14 6.00	2.25 4.75	2.56 4.78	2.00 5.00	1.38 4.50	2.20 4.90

*p < .05; ** p < .01

3.4. Testing Group Differences on Computer-Based and Self-Reported Hazard Perception Tests

In order to examine if there was a group difference on the CB-HP test and the SR-HP, two separate ANCOVA analyses controlling for age were conducted. These analyses were also important in terms of assessing the predictive power of computer-based test since a good hazard perception test was assumed to differentiate between novice and experienced drivers (Sexton, 2001).

The results of the ANCOVA analysis on the CB-HP test revealed that there was a significant effect of experience on hazard perception scores (F (1,92) = 15.88, p< .001). Experienced drivers were found to score significantly higher (M = 151.97, SD = 5.48) than novice drivers (M = 117.85, SD = 4.81) and experience was found to explain a high proportion of the variance in hazard perception scores (Eta^2 = .15). Therefore, hypothesis 1 was supported indicating that experienced drivers performed better than novices in detecting the hazards on time.

ANCOVA analysis on the SR-HP also revealed a significant effect of experience (F (1, 91) = 25.58, p< .001) after controlled for age. It was found that experience had an effect size of .22 in explaining the variance on the SR-HP. When the mean scores were compared, it was seen that experienced drivers reported a higher ability of hazard perception (M = 4.78, SD = .14) as compared to novice drivers (M = 3.65, SD = .13) indicating that novice drivers did not overestimate their hazard perception skills.

3.5. Predicting Hazard Perception Scores from Personality Factors and Driving Skills

Three separate hierarchical regression analyses were conducted on the scores of the CB-HP and the SR-HP to test whether sensation seeking, big five traits and driving skills predict hazard perception ability. Because of the small sample size and high correlations among the subscales of the same questionnaire, hazard perception skills were predicted separately by the personality, sensations seeking, and driving skills variables (See Tabachnick & Fidell, 2001)

Data were examined for normality, linearity, multicollinearity, and singularity before the main analyses. Tabachnick and Fidell (2001) proposed that if a set of

IVs were related to each other with a correlation of .90 or above, this was the indicator of multicollinearity. Although the correlations between the subscales of sensation seeking were generally quite high, they were not as high as Tabachnick and Fidell pointed out. Moreover, examination of the tolerance values also revealed that data met the assumption of multicollinearity and singularity. Multivariate outliers were examined by using $p < .01$ criterion for Mahalonobis distance and no outliers were detected.

In all the equations, age and gender of the driver were entered at the first step to control for their effects and the set of personality, sensation seeking or driving skills variables were entered in the second step. Analyses using the three sensation seeking subscales as the predictors showed that there was a suppressor effect among the variables. Tabachnick and Fidell (2001) reported that a suppressor variable is observed when "(1) the absolute value of the simple correlation between IV and DV is substantially smaller than the beta weight for the IV, or (2) the simple correlation and beta weight have opposite signs" (p. 149). In the current analysis, the beta weight for general sensation seeking was doubling the absolute value of the simple correlation, and risk taking and sensation seeking in traffic subscales had beta weights and correlation coefficients with opposite signs. Therefore it was decided to use the mean score of the sensation seeking/risk taking questionnaire instead of using the mean scores of subscales separately. The results of the hierarchical regression analysis revealed that demographic variables at the first step did not predict the CB-HP ($F_{change}(2, 122) = .84$, ns.). Similarly, sensation seeking at the second step did not predict the outcome variable either ($F_{change}(2, 121) = .73$, ns.).

In the second regression analysis, personality traits measured by the Big-Five Inventory entered into the equation at the second step. It was found that neither the demographic variables in the first step ($F_{change}(2, 120) = .93$, ns.), nor the big five traits in the second step ($F_{change}(5, 115) = .84$, ns.) predicted the CB-HP scores.

The third regression analysis included perceptual motor skills and safety skills in the second step and their interaction term in the third step. Since this analyses included testing a moderated (interaction) effect, the procedure that was

developed by Aiken and West (1991) was followed. This method simply required the centering of the variables to avoid problems of multicollinearity. The interaction term was obtained by multiplying the two centered variables. The results revealed that demographic variables did not predict the outcome variable (F_{change} (2, 120) = .98, ns.). The inclusion of the subscales of DSI did not lead to a significant increment in predicting the CB-HP as well (F_{change} (2, 118) = .2.42, ns.). However, investigation of the variables at this step revealed that perceptual motor skills had unique contributions in predicting the CB-HP (β = 0.23, $p < .05$). This indicated that perceptual motor skills positively predicted 4% of the variance in CB-HP scores. The interaction term at the third step did not predict the CB-HP scores of the drivers, meaning that Hypothesis 5, in which it was claimed that high levels of perceptual motor and low levels of safety skills would be associated with low scores on CB-HP was not supported (see Table 7).

Table 7 Hierarchical Regression Analyses on Computer-Based Hazard Perception Scores Using Driving Skills

	Computer-Based Hazard Perception		
	Beta	R^2 change	F change
I. Demographic Variables		.02	.98
Age	-.04		
Gender (1,male; 2,female)	-.12		
II. Driving Skills		.04	2.42
Perceptual Motor Skills	.23*		
Safety Skills	-.07		
III. Interaction of Driving Skills	-.11	.00	1.14
Total R^2		.06	

* $p < .05$

The same regression analyses explained above were repeated in predicting self-reported hazard perception ability (SR-HP). Similarly age and gender were entered in the first step to control for their effects. First, the analysis was run with sensation seeking as the predictor variable in the second step. As can be seen from Table 8, age and gender were significantly predicting the outcome variable in the first step (F_{change} (2, 120) = 13.71, $p < .001$). Age positively predicted the SR-HP

(β = 0.36, p < .001), while gender negatively predicted the SR-HP (β = -0.21, p < .05), indicating that women reported lower levels of SR-HP than men. Age and gender were found to be uniquely explaining 19% of the explained variance in the SR-HP. The inclusion of the sensation seeking in the second step did not lead to an increment in the explained variance (F_{change} (1, 119) = .18, ns.).

Table 8 Hierarchical Regression Analyses on Self-Reported Hazard Perception Using Sensation Seeking

	Self-Reported Hazard Perception		
	Beta	R² change	F change
I. Demographic Variables		.19	13.71***
Age	.36***		
Gender (1,male; 2,female)	-.21*		
II. Sensation-Seeking		.00	.18
Sensation seeking/risk taking	.04		
Total R^2		.19	

* p < .05; ** p < .01 *** p < .01

The regression equation in which big-five traits were entered in the equation at the second step revealed that demographic variables explained 23% of the variance on the SR-HP (F_{change} (2, 118) = 17.31, p < .001). However the variables in the second step did not lead to any increments in the explained variance above the effects of demographic variables. None of the personality traits was uniquely contributing to the explained variance as well (see Table 9).

Table 9 Hierarchical Regression Analyses on Self-Reported Hazard Perception Using Big-Five Traits

	Self-Reported Hazard Perception		
	Beta	R² change	F change
I. Demographic Variables		.23	17.31***
Age	.39***		
Gender (1,male; 2,female)	-.23**		
II. Big-Five Personality Traits		.27	1.28
Extraversion	.10		

Table 9 (continued)

	Beta	R² change	F change
Agreeableness	.08		
Conscientiousness	.12		
Neuroticism	.00		
Openness to Experience	-.11		
Total R^2		.27	

* $p < .05$; ** $p < .01$ *** $p < .01$

Finally, a regression analysis was run by the inclusion of the subscales of the DSI in the second step and their interaction term in the last step. As can be seen in Table 10, the contributions of the variables in the first and second steps were significant. Demographic variables in the first step explained 19% of the variance on the SR-HP (F_{change} (2, 118) = 13.93, $p < .001$). The inclusion of the subscales of the DSI in the second step lead to a significant increase in the explained variance ($R^2_{change} = .34$, F_{change} (2, 116) = 42.35, $p < .001$). At this step the only variable with unique contribution was perceptual and motor skills, explaining 34% of the variance ($\beta = 0.66$, $p < .01$).

Table 10 Hierarchical Regression Analyses on Self-Reported Hazard Perception Using Driving Skills

	Self-Reported Hazard Perception		
	Beta	R² change	F change
I. Demographic Variables		.19	13.93***
Age	.36***		
Gender (1,male; 2,female)	-.22*		
II. Driving Skills		.34	42.36***
Perceptual Motor Skills	.66***		
Safety Skills	.02		
III. Interaction of Driving Skills	.00	.00	.00
Total R^2		.53	

* $p < .05$; ** $p < .01$ *** $p < .001$

CHAPTER 4

DISCUSSION

The findings of the current study will be discussed in this chapter with reference to the previous findings in the literature. The main issues that were examined in the current study were the correlates and predictors of hazard perception ability in novice and experienced drivers. Some limitations and suggestions for future researches will be presented, followed by the investigation of the main findings.

4.1. Computer-Based Assessment of Hazard Perception Ability

The current study aimed to measure response latencies of novice and experienced drivers by employing the computer-based assessment of hazard perception, which was consisted of real-life traffic scenes. Consistent with previous studies (Sexton, 2001; TRL, 1998; McKenna & Crick, 1997), current study demonstrated that novice drivers differ from the experiences ones with their less developed hazard perceptions skills. In addition to this, the CB-HP was positively correlated with driving under various conditions. Driving under various conditions was measured via a short self-report in which drivers indicated the degree of their driving in certain situations such as in heavy traffic, in intercity roads, at nights etc. In that sense other than the driving experience variable that was an outcome of active years in driving and annual km driven, driving under various conditions was directly related to drivers' experiential knowledge in driving under different traffic settings. Thus, it is reasonable to claim that driving under various conditions was also reflecting the complexity of the driving-related schema.

As Underwood et al. (2002) mentioned it seems that experiential driving knowledge serves to the development of a well-structured schema related to driving. In hazard perception, this schema allows the driver to analyze the situation more holistically and guides the driver in where to attend. In addition,

experienced drivers have the ability to develop anticipations regarding which situations have the potential to turn out a hazard. This is generally associated with what was called as situational awareness (Whelan, Senserrick, Groeger, Triggs, & Hosking, 2004). Situational awareness refers to the prediction of the future actions of the other stimuli and it requires the good use of perceptual and attentional processes. Whelan et al. (1994) measured situational awareness by using real-life clips and asking their subjects to figure out the positions of the cars in the clips 5 seconds after the clip was paused. The authors reported that novice drivers' situational awareness was more likely to deteriorate under distraction as compared to experienced drivers, indicating that increases in cognitive workload interferes with critical attentional processes in novices. Therefore, it appears that both the lack of effective management of attentional resources and the competencies on where to attend and what to expect from other drivers lead to hazard perception latencies in novices. Measurement of situational awareness should be examined together with the hazard perception ability to better assess the differences between experienced and novice drivers. However, it is also possible that hazard perception skills can be trained during pre-licensing period. For example Regan, Deery, and Trigss (1998a) reported that novice drivers who received a training of mediated instruction to deal with hazards, were found to rate the risks in hazards higher as compared to the control group. In another study Regan et al. (1998b) reported that a simulator-based training of variable priority during driving lead to increases in novice drivers attentional control skills. Similarly, McKenna et al. (2006) reported that a hazard perception training focusing on anticipation ability lead to increments in perceived risk and hazard perception ability.

In Turkey, driver-training curriculum has a focus on traffic rules and safety perspective was generally underemphasized. For example, following the completion of driver-training, learner drivers all know that they should lower their speed after seeing the zebra crossing sign. However they do not learn why they should attribute risks to the zebra-crossing sign. Similarly during on-road driving lessons the candidates are taught about basic maneuvering skills, such as parking, fluent use of the gears or wheel-control. Although these skills are among the ones

that a novice driver needs to possess, a more comprehensive driver-training method that also focuses on higher-order skills should be employed in Turkey.

4.2. The Effectiveness of Computer-Based Assessment of Hazard Perception

The significant difference between the scores of novice and experienced drivers indicated that the computer-based test (T-HPT) could be used to assess hazard perception skill among drivers. The finding may partially serve as an indicator for the reliability of the test.

In the previous studies of hazard perception, a number of methods have been employed that lead to differential results. Each method seems to have advantages and disadvantages. For example Whelan et al. (2004) conducted a qualitative research and they used photographs of traffic scenes to identify which situations were labeled as more hazardous by novice and experienced drivers. The authors found that hazards occurring in the joining lane were frequently pronounced as hazardous by novice drivers while they tended to ignore the hazards occurring in one's own lane. Generally, Whelan et al.'s study can be regarded as a good method to identify the type of hazards that are underestimated by novices. However it is not tapping whether there would be differences in terms of anticipation skills or detection time since these differences can be more apparent under the use of video clips. In the studies in which video clips of traffic scenes were used, the main focus was to track reaction time latencies. However researchers adapted different types of scoring methods to assess reaction times. For example Sexton (2001) employed the method of giving the highest score to the early reaction times to hazards and giving zero point to the clips that were not responded by participants. Their method differentiated learner, novice and experienced drivers' hazard perception scores. Sagberg and Bjornskau (2006) indicated that they assigned the lowest score to missing items in which the participant did not give a response in the predefined response window. The authors reported that there was not any significant difference between novice and experienced drivers in terms of hazard perception. In the current study, the hazard response window was divided into 10 equal parts and participants were given the highest score when they reacted inside the first range. In addition, when the

participant did not respond to a hazard within the hazard response window, he/she was given "-1" point as a punishment. The scoring employed in this study lead to a differentiation between novice and experienced drivers' scores. McKenna (2002) stated that computer-based tests are objective means of assessments in driving research. However, the ambiguous results in the literature points out that more research is needed to be able to identify the best method of scoring for computer-based hazard perception tests.

Lastly, although being not significant, there was a negative correlation between age and the CB-HP test in the present research. Since the responses were given via a hand button, it is possible that older drivers were late at reacting to the hazards that they identified. However, older drivers were also the ones with higher levels of driving experience. Therefore, the use of response buttons may act as a performance-inhibiting variable for older experienced drivers in computer-based tests.

4.3. Other Predictors of Computer-Based Assessment of Hazard Perception

Another objective of the study was to investigate the effects of sensation-seeking, big-five traits and driving skills in predicting hazard perception skills of drivers. While previous researchers studied perceived risk in relation to hazard perception (Farrand & McKenna, 2001; Renge, 1998), the possible effects of personality factors have not been investigated so far. In that sense it was a question of interest whether personality factors and driving skills would enhance or impair hazard perception. It was found that the only variable that was uniquely contributing to the prediction of the CB-HP score was perceptual and motor skills. Neither sensation seeking nor the big-five traits had any effects in the prediction of the CB-HP scores, suggesting that hazard perception latencies are not linked with personality or levels of sensation seeking. This finding underscores that, as suggested by certain researchers (Whalen et al., 2004; TRL, 1998), hazard perception is a sole factor of driving experience and developed maneuvering abilities.

Sensation seeking was expected to negatively predict the CB-HP scores since it was assumed that a tendency for driving riskier would lead to decrements in

perceived risk in hazards. There is an extensive research pointing to the high correlations between sensation seeking and risky driving (Heino, et al., 1996a; Jonah, 1997) indicating that sensation seekers experience low levels of subjective risks while driving. However there are also other studies on sensation seeking which examined its relation with attentional processes. As it was postulated by Martin (1985) and Ball and Zuckerman (1992) high sensation-seekers were found to be good at novel tasks which require focused attention. This was explained with the fact that sensation-seekers had a higher need for arousal and they were actively searching for that arousal while working on certain tasks. A similar finding was reported by Er, Özkan, Sümer, Ayvaşık, and Alptekin (2002; cited in Er, 2002), and it was specified that there were moderately high and positive correlations between selective attention and sensation seeking. In addition to the link between selective attention and sensation seeking, Zuckerman (1990) from an evolutionary perspective stated that sensation-seekers were likely to give a more orienting response to novel stimuli, and their activity level does not deteriorate much under stressful conditions, allowing them to be able to focus on the stimuli better. On the contrary, he stated that low sensation seekers were found to give defensive responses under stressful conditions such as increases in heart rate, and heart-rate acceleration would lead to increases in reaction time which is not an adaptive response for dealing with dangers. Martin (1985) postulated that for sensation-seekers, who have the tendency to engage in risky activities, attending to the task-relevant stimuli is more important since those stimuli can be life-threatening if sensation-seekers do not detect them early on. In that sense Martin (1985) underscored that perceiving the dangers as early as possible is an adaptive strategy for sensation-seekers since even a low level of danger may be threatening when combined with their risky behaviors. For example perceiving a pedestrian earlier who is jumping on the street is more critical if the driver's speed is high than low. Therefore it can also be claimed that sensation seeking may also enhance hazard perception under high-risk conditions due to its relation with selective attention. Although the findings of the current study did not support this assumption as well, it would be interesting if the associations between sensation-seeking and attention could be investigated via the use of instrumental vehicles

which could reveal whether high sensation seekers are more perceptive of high-risk hazards. Furthermore, the association between HP and sensations seeking may be significant among only experienced drivers given that previous studies usually examined the effects of sensation seeking among experienced drivers. This could not be tested in this study because of the narrow sample size of the experienced drivers.

It was also hypothesized that among the big-five traits, low levels of conscientiousness would predict lower scores of hazard perception in drivers. In previous studies, conscientiousness appeared as an important personality factor in driving with regards to its being associated with aberrant driving behaviors and accident involvement (Sümer et al., 2006; Clarke & Robertson, 2006; Arthur & Graziano, 1996). In line with previous studies, conscientiousness was positively correlated with safety skills in the current study, indicating that drivers whose behaviors are regulated by rule-compliance tend to exhibit a safety orientation as well. Since conscientiousness was related to compliance with norms and rules, drivers who scored high in conscientiousness were expected to be more perceptive about rule-incongruent behaviors of other road-uses. However, conscientiousness did not show the expected effect.

A possible explanation for the personality factors being unrelated to hazard perception ability might be related to the method of assessment that was employed. It seems that the effects of personality variables are hard to observe in computer-based tasks. In computer-based assessments, the driver is only an observer who has to detect the onset of hazards. In that sense, scanning and searching strategies are better predictors of hazard perception in computer-based or simulator-based assessments. However when the driver is on the wheel, he has full control over the driving task, and he is the agent whose actions, motivations and perception are important to deal with hazardous situations to avoid an accident. Therefore, perceived risk in hazardous clips may not be tapping the actual risk that the driver would experience if he were to drive in that situation. On-road assessment can provide more insight related to personality factors and perceived risk in relation to hazard perception processes.

Moreover, as Elander et al (1993) proposed, mediated models may reveal more about the links between personality factors and outcome variables. In the present study, there was not any assessment of perceived risk in direct ways. That is, it was assumed that personality factors would act as moderating variables in risk perceptions that are associated with hazards. Similar to the studies of Farrand and McKenna (2001) and Renge (1998), if the drivers were also asked about their perceived levels of risks in hazardous clips, then it would be possible to track the moderating effects of personality variables.

The driving skills that were the focus of attention in the present study were represented by perceptual motor skills and safety skills. Hazard perception was regarded as a higher-order safety skill, since it was a critical ability for avoiding accidents. Therefore computer-based hazard perception score was expected to be correlated with safety skills. However no such relationship was observed. The regression analysis in which the main and interaction effects of the driving skills were investigated revealed that perceptual motor skills predicted the CB-HP scores. The items of the perceptual motor skills subscale were reflecting the skills of situational awareness (eg. Predicting traffic situations ahead), anticipation (eg. Adjusting your speed depending on the changing road conditions), hazard perception (eg. Perceiving hazards in traffic) as well as maneuvering skills (eg. Overtaking). Therefore, perceptual motor skills subscale was tapping the higher-order driving skills as well. In that sense the current finding was not surprising and pointed out that drivers with good perceptual motor skills were also competent in scanning the environment and detecting the hazardous signs earlier. In addition to its relevance with the detection of hazards, perceptual motor skills are also important in exhibiting the best motor response to deal with hazards, such as breaking or maintaining wheel control (Grayson & Groeger, 2001). Moreover, it can be claimed that perceptual-motor skills are also subjected to the effects of driving experience. More specifically, Parker and Stradling (2001) proposed that among the phases of learning to drive, technical mastery phase is tapping the acquisition of driving skills. The authors postulated that the second phase is the reading the road phase and this stage is related to hazard perception. This means that the drivers who are competent in terms of the skills related to reading the

road, are also competent in technical mastery skills as a result of the piling up of driving experience. In that sense the positive effect of perceptual motor skills in predicting hazard perception ability can be related to drivers being more experienced in both technical mastery and reading the road phases.

It was proposed that elevated levels of perceived driving ability lead to assessing low risks in hazards (Farrand & McKenna, 2001). Similarly Sümer et al. (2006) suggested that a higher dependence on perceptual motor skills would lead to taking more risks on the road if they are not accompanied with safety skills. With reference to these findings, it was assumed that drivers who scored high on perceptual motor skills and who scored low on safety skills would also exhibit a poor performance in the CB-HP test. However, the interaction term was not significant in predicting the CB-HP scores. Similar to personality factors, it seems that the effects of safety skills on hazard perception could be demonstrated if on-road assessment of hazard perception was done. Since low safety skills was associated with risky driver behaviors (Sümer et al., 2006), when the driver is on the wheel the absence of safety skills could also contribute to the development of hazardous situations.

Bjornskau and Sagberg (2005) reported that novice drivers tend to report fewer driving errors and mistakes as they gain experience and this was as a result of increments in driving skills. However they were found to take more risks while driving as they gain experience. The authors further reported that novice drivers' skills related to active interaction with other road users, which was tapping the anticipation ability, were not fully developed at that period. The authors claimed that this could be the main reason of accident involvement among novice drivers. Therefore although the present findings did not show any effects of safety skills it seems that hazard perception training should also cover the adaptation of safety skills to overcome the negative effects of risky driving in novices. These skills may also buffer the risk that is associated with poor anticipation ability in novices.

4.4. Self-Reported Assessment of Hazard Perception Ability

Current study also investigated hazard perception ability by means of a brief self-report scale. Self-reports in driver research were taken with skepticism due to

the interference of social desirability effects (Lajunen, Corry, Summala, & Hartley, 1997). McKenna (2002) stated that there are certain conditions, which evoke concerns related to impression management such as under job selection. He claimed that objective and subjective measures has their own shortcomings, and one of the advantages of self-reports is their being one of the major ways to study attitudes, intentions and to discover inner thoughts and feelings about the self.

In this study, it was aimed to measure how the novice and experienced drivers perceive their hazard perception abilities, and whether their self-reports corresponded to their performance measured by the computer-based test. The results revealed that experienced drivers' reports of their hazard perception ability were significantly higher than novices. Therefore novice and experienced drivers' SR-HP scores were in accordance with their CB-HP scores.

The items of the self-report that was developed for this study were tapping higher-order skills, which are closely connected to hazard perception such as anticipation, road reading, situational awareness or scanning strategies. Therefore, while the previous studies reported that young drivers were likely to have overconfidence related to driving skills (Finn and Bragg, 1986; DeJoy, 1992) it seems that they do not show a similar tendency when asked about higher-order skills, at least in the initial phases of driving. Novice drivers in the current study can be said to have insight related to their competencies in certain skills, and this is a support for Groeger and Grande's (1996) assumption indicating that overconfidence increases with driving experience and an accident-free history of driving.

In the current study, it was observed that the SR-HP was not correlated with the CB-HP scores. Farrand and McKenna (2001) reported a similar finding in their study, in which they asked their participants to rate the level of risk and their perceived ability of dealing with the hazards. They found out that participants' hazard perception latencies were not correlated with either self-reported skill or perceived risk. The authors postulated that while answering the questionnaires, every single driver recalls the most relevant event that they experienced related to the item. For example, the item "It is hard for me to predict other road users behavior" can be constructed differently by drivers, depending on their existing

experience related to the situation that was described in the item. McKenna (2002), by referring to the previous findings, claimed that objective and subjective measures of hazard perception might not be assessing the same general construct as intended. In the present study the objective measure was identical to Farrand and McKenna's, while the subjective measure was different since a specific hazard perception scale was used. In that sense although the two independent assessment of hazard perception skills were uncorrelated, they were both significantly predicted by experience, indicating that to some extent the SR-HP scale was tapping the actual performance in the CB-HP test.

As opposed to the CB-HP test, the SR-HP scale was positively correlated with many of the variables in the study such as conscientiousness, agreeableness, and safety skills. Partially this can be explained by the common method variance and participants' concerns about impression management.

The SR-HP ability was positively correlated with safety and perceptual motor skills, indicating that drivers' self-assessments related to various kinds of driving skills were positively associated with each other. More specifically, the correlations between the SR-HP and perceptual motor skills was quite high and this can be related to their reflecting similar processes such as anticipation or attentional control. Age positively predicted the SR-HP which means that older drivers rated their hazard perception ability as higher. On the contrary, gender negatively predicted the SR-HP indicating that females scored lower on the SR-HP as compared to males. This is consistent with the findings of Farrand and McKenna (2001) who reported that females perceive more risks in hazards and they rate their own ability to handle the hazardous situations lower than the males do. The authors proposed that generally females have lower levels of driving experience as compared to males and this may lead them to think of themselves as being inadequate in dealing with hazards. Farrand and McKenna (2001) further reported that there was not any difference between hazard perception latencies of males and females, implying that self-reports of females were not tapping their actual performance in the hazard perception test. In the current study, no analysis was conducted on the basis of gender since the number of males and females were not equal and number of males was doubling the number of females. However it

is a question if interest whether the same result would be obtained if the sample sizes were adequate enough to make comparisons.

Among the personality factors and driving skills only perceptual motor skills had a unique contribution in explaining the SR-HP. It is likely that drivers who are confident about their perceptual motor skills are also confident about managing the challenging situations in traffic. This is another support for Farrand and McKenna (2001) who reported that drivers' positive perceptions about their driving skills lead them to attribute low risks to the hazards since they were trusting in their abilities. However the authors noted that there was not any relationship between perceived driving ability and hazard perception scores obtained from the computer-based test. In the current study, perceptual-motor skills were also the single variable that was predicting the CB-HP scores, indicating that skillful drivers were indeed good at detecting the hazards.

4.5. Conclusions

4.5.1. Strengths of the Thesis and Implications for Traffic Safety in Turkey

The current study was generally focused on the predictors and correlates of hazard perception among drivers. One of the major contributions of the current study was that a newly developed computer-based hazard perception test which reflects the common road hazards in Turkey was used in this study first time and this system seems to be very beneficial for future traffic researchers. In line with the existing research, experience appeared as a significant determinant of hazard perception. Drivers who indicated a higher rate of active driving and a higher rate of annual km driven exhibited better abilities of hazard perception. This means that there is a critical time in which drivers would be under more risk in terms of accident involvement and this is the novice-period in general.

As an intervention for increasing the amount of experience and improving hazard perception abilities in novice drivers, several European countries have adapted the use of Graduated Driver Licensing Programs (Carstensen, 2002; Gregersen, 2001) and it was found that lengthening the time for accompanied driving during the pre-licensing period was a beneficial means of reducing accident involvement in novices (Sagberg & Gregersen, 2005; Gregersen, Berg,

Engström, Nolen, Nyberg, & Rimmö, 2000). Learner drivers who gain experience under supervised driving were found to be less accident involved then the provisional drivers who are permitted to drive by their own under certain restrictions (Mayhew, 2003; Williams, 2003; Lam, 2003). More importantly Gregersen et al. (2000) reported that benefits of a lengthened learner period was also pronounced for the following two years with a full license, indicating that increasing the length of the training had long-term effects as well.

Given the content of the current driver-training curriculum in Turkey in which the learner drivers are given only 10 hours of on-road driving lessons, it seems that pre-licensing period is not comprehensive enough to learn about higher-order skills. As the present findings implied, novice drivers' hazard perception abilities are not developed as much as experienced drivers' and on-road driver training should be enhanced in length to compensate for poor hazard perception abilities of novice drivers.

In addition to the experience factor, current study examined the links between personality factors and hazard perception ability. However, there was not a powerful relationship between these variables and hazard perception indicating that HP ability is relatively independent of personality differences. However, potential effects of modifying variables should be investigated via on-road observation methods. In fact, the pronounced effects of experience would be even larger if the drivers were to be investigated on-road. In the computer-based assessment, the driver has the chance to allocate all of his perceptual and cognitive capacity to the task on the PC. In a normal drive, there are more external stimuli that create a large mental workload in the driver. In addition to the external stimuli, the driver has to handle in-car controls such as keeping the car in lane or adjusting the driving due to road conditions. Therefore, under the presence of more cognitive workload, hazard perception of the novices can be expected to be deteriorated much more (Sagberg and Bjornskau, 2006).

Another implication of the current study was the relationship between perceptual motor skills and hazard perception. In the present study, perceptual motor skills appeared as the only predictor of both the CB-HP scores and the SR-HP scores and safety skills was not found to be relevant in predicting hazard

perception. Perceptual motor skills were regarded to play an important role in early detection of hazards as well as in managing the hazardous situations by the implementation of necessary actions. This finding also implied that when the novice drivers are incompetent in both perceptual motor and hazard perception skills, their accident likelihood might increase.

In conclusion, the present findings lend support to the significance of driving experience in hazard perception processes. In addition, the findings also pointed out that on-road observation can be the ideal method of assessment, especially in terms of tracking the effects of modifying factors in hazard perception. Still, when there is a focus on hazard perception latencies, the CB-HP can be regarded as a good measure to investigate novice and experienced drivers.

4.5.2. Limitations of the Study

The study had also certain limitations that should be taken into consideration when interpreting the findings. First of all, it would be more informative to investigate the predictors of hazard perception for novice and experienced drivers separately. However the sample size was not large enough to make such an analysis.

In addition, it has been known that both age and driving experience contribute to accident involvement of young novice drivers (Deery, 1999). In the current study the mean age of drivers was relatively low, but the age range was larger indicating that there were younger, middle-aged and older drivers in the sample. Therefore the effect of age was controlled in all the analyses. However a more comprehensive design could be based on creating heterogeneous groups that were representative of different age and driving experience categories. For example assessing the hazard perception skills of younger novice vs. older novice drivers or younger novice vs. younger experienced drivers would reveal more about the effects of age and experience on hazard perception.

Secondly, the study aimed to measure the moderating effects of personality factors on perceived risk in hazards. However, perceived risk was not measured by any means. In the beginning of the study, it was thought to employ Farrand and McKenna's (2001) procedure, which was simply pausing the hazard clips

when a hazard was detected and asking about the level of risk. However, the battery of tests was taking 1-hour to complete and the addition of such a measurement would increase that time. It was thought that if the length of the test increases further, this might bore the participants and might lead them to respond randomly to finish the battery as soon as possible. However, to track the moderating effects of personality factors and driving skills, future studies should measure perceived risk as well.

Thirdly af Wahlberg (2003) pointed out that to assure methodological strength the measurements should at least possess test-retest reliability. In fact the CB-HP test's success to differentiate between experienced and novice drivers partially served as a reliability indicator. Still, on-road assessments should be done to find out whether the performance on the test was tapping the actual performance on the road. In addition, with a larger sample an item analysis should be conducted to find out the hazards with high discriminating power. By means of a qualitative research which will clarify the hazards that are undermined by novice drivers, it may be possible to develop multimedia training products of hazard perception for Turkish drivers.

Finally, since the majority of novice drivers consisted of learner drivers or drivers with no active driving only four of the novice drivers reported that they had been involved in an accident. On the contrary, experienced drivers were found to report more accidents and this was thought to be resulting from exposure to the road. Therefore, an analysis examining the power of computer-based HP test in predicting accident rate could not be conducted. The relationship between accidents and hazard perception skill should also be tested in a longitudinal design in future studies to better understand the importance of hazard perception in novice drivers' safety. For that reason follow-up studies can be conducted to track month-by-month changes in accident involvement of young novice drivers and future studies may focus on demonstrating the characteristics of road accidents that were occurring as a result of low hazard perception skills.

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APPENDICES

APPENDIX A

Turkish Hazard Perception Test in Traffic (T-HPT)

(Türk Trafikte Tehlike Algısı Testi)

Sample Screenshots from the Video-Based T-HPT

Sample 1 Bicyclist Emerging from Right

Sample 2 Faulty Overtaking

APPENDIX B

Self-Reported Hazard Perception Ability Scale

(Özbildirime Dayalı Tehlike Algısı Becerisi Ölçeği)

Aşağıda sürücülerin araç kullanırken karşılaştıkları bazı durumlar yer almaktadır. Sizden istenen araç kullanırken trafikte nasıl davrandığınızı düşünerek aşağıdaki soruları yanıtlamanızdır. Lütfen bu soruları kendi davranışlarınızı dikkate alarak ve sizi yansıtacak şekilde her bir ifade için uygun seçeneği işaretleyerek doldurunuz.

		Hiçbir zaman	**Nadiren**	**Bazen**	**Sık sık**	**Oldukça Sık**	**Her zaman**
1-	Diğer araçların hareketlerini önceden kestirmek benim için güçtür.						
2-	Hangi yolda ne tür tehlikeler olduğunu önceden tahmin edebilirim.						
3-	Daha önce geçmediğim yollardaki tehlikeleri fark etmekte zorlanırım.						
4-	Trafikte tehlike yaratacak araçları çok iyi tanırım.						
5-	Yolun akışından nelerle karşılaşabileceğimi kestirebilirim.						
6-	Akan trafikte dikkatimi nereye yoğunlaştıracağımı bilemediğim zamanlar olur.						

APPENDIX C

Turkish Sensation Seeking and Risk Taking Questionnaire

(Türk Sürücü Heyecan Arama ve Risk Alma Ölçeği)

Aşağıda bir takım ifadeler yer almaktadır. Bu ifadelerin sizi ne kadar tarif ettiğini/tanımladığını her bir ifade için uygun seçeneği işaretleyerek belirtiniz.

		Hiç tarif etmiyor	Tarif etmiyor	Pek tarif etmiyor	Biraz tarif ediyor	Tarif ediyor	Çok tarif ediyor
1.	Yeni çıkan mamulleri denemekten hoşlanırım						
2.	Hayatımı değiştirebilecek ani kararlar alırım						
3.	Trafikte yarışmaktan hoşlanırım						
4.	Hiç bilinmeyen yerleri ilk keşfeden ben olmak isterdim						
5.	Tehlikeli araç kullanmanın yarattığı heyecandan hoşlanırım						
6.	Yüksek yerlere, ağaçlara tırmanmaktan hoşlanırım						
7.	Hızlı araç kullanmaktan hoşlanırım						
8.	Sık sık farklı markaların ürünlerini denerim						
9.	Macera ve sürprizlerle dolu tatilleri severim						
10.	Arabanın gücünü ve hızını artırmak için aksamlarını değiştiririm						
11.	Ara sıra içip dağıtmaktan hoşlanırım						
12.	Heyecanlı işlere bayılırım						
13.	Arkadaş olmak için ilginç/enteresan insanlar ararım						
14.	Motosiklete binmekten hoşlanırım						
15.	Trafikte makas atmak hoşuma gider						
16.	Çılgınlık yapmaktan hoşlanırım						
17.	Sık sık cep telefonu değiştiririm						
18.	Çılgın, “hafif kaçık” insanlardan hoşlanırım						
19.	Sık sık seyahat etmeyi gerektiren bir işte çalışmak isterdim						
20.	Buz gibi dondurucu suya girmekten/atlamaktan hoşlanırım						
21.	Macera ve aksiyon filmleri seyretmekten hoşlanırım						

		Hiç tarif etmiyor	Tarif etmiyor	Pek tarif etmiyor	Biraz tarif ediyor	Tarif ediyor	Çok tarif ediyor
22.	Risk alma eğilimim vardır						
23.	Tehlikenin sınırından dönmek bana heyecan verir						
24.	Dışarı çıktığımda yüksek sesle müzik çalan yerlere gitmekten hoşlanırım						
25.	Sık sık evimin/odamın şeklini değiştiririm						
26.	Kuralları çiğnemekten keyif alırım						
27.	Esrar gibi keyif verici maddeleri sırf merak ettiğim için denediğim olmuştur						
28.	Araç kullanırken risk almaktan hoşlanırım						
29.	Canım sıkıldığında veya boş kaldığımda arabayla dolaşmaktan hoşlanırım						
30.	Beygir gücü yüksek araç kullanmaktan hoşlanırım						
31.	Araba yarışlarına meraklıyımdır.						
32.	İmkanım olsaydı sık sık arabamı değiştirmek isterdim						
33.	Sıkıntılı olduğumda araç kullanarak rahatlarım						

APPENDIX D

Driving Skills Inventory

(Sürücü Becerileri Envanteri)

Araç kullanırken güçlü ve zayıf yönleriniz nelerdir?
Doğal olarak hepimizin güçlü ve zayıf yönleri vardır. Lütfen sizin sürücü olarak güçlü ve zayıf yönlerinizin neler olduğunu her bir madde için aşağıdaki uygun seçeneği işaretleyerek belirtiniz.

		Çok zayıf	Zayıf	Ne zayıf Ne güçlü	Güçlü	Çok güçlü
1.	Seri araç kullanma					
2.	Trafikte tehlikeleri görme					
3.	Sabırsızlanmadan yavaş bir aracın arkasından sürme					
4.	Kaygan yolda araç kullanma					
5.	İlerideki trafik durumlarını önceden kestirme					
6.	Belirli trafik ortamlarında nasıl hareket edileceğini bilme					
7.	Yoğun trafikte sürekli şerit değiştirme					
8.	Hızlı karar alma					
9.	Sinir bozucu durumlarda sakin davranma					
10.	Aracı kontrol etme					
11.	Yeterli takip mesafesi bırakma					
12.	Koşullara göre hızı ayarlama					
13.	Geriye kaçırmadan aracı yokuşta kaldırma					
14.	Sollama					
15.	Gerektiğinde kazadan kaçınmak için yol hakkından vazgeçme					
16.	Hız sınırlarına uyma					
17.	Gereksiz risklerden kaçınma					
18.	Diğer sürücülerin hatalarını telafi edebilme					
19.	Trafik ışıklarına dikkatle uyma					
20.	Dar bir yere geri geri park edebilme					

APPENDIX E

Big-Five Inventory

(Beş-Faktör Kişilik Envanteri)

Aşağıda sizi kısmen tanımlayan (ya da pek tanımlamayan) bir takım özellikler sunulmaktadır. Lütfen aşağıda verilen özelliklerin sizi ne oranda yansıttığını ya da yansıtmadığını belirtmek için sizi en iyi tanımlayan rakamı her bir özelliğin yanına yazınız.

Hiç katılmıyorum	**Biraz katılmıyorum**	**Ne katılıyorum/Ne katılmıyorum**	**Biraz katılıyorum**	**Tamamen katılıyorum**
1	2	3	4	5

Kendimi ..... biri olarak görüyorum.

_____ 1. Konuşkan
_____ 2. Başkalarının hatalarını arama eğiliminde olan
_____ 3. İşini tam yapan
_____ 4. Bunalımlı, melankolik
_____ 5. Orjinal, yeni görüşler ortaya koyan
_____ 6. Ketum/vakur
_____ 7. Yardımsever ve başkaları için çırpınan
_____ 8. Biraz umursamaz
_____ 11. Enerji dolu
_____ 12. Başkalarıyla sürekli didişen
_____ 13. Güvenilir bir çalışan (eleman)
_____ 14. Gergin olabilen
_____ 15. Hünerli, derin düşünen
_____ 16. Heyecan yaratabilen
_____ 17. Affedici bir yapıya sahip
_____ 18. Dağınık olma eğiliminde olan
_____ 19. Çok endişelenen
_____ 20. Hayal gücü yüksek
_____ 21. Sakin yaradılışlı
_____ 22. Genellikle başkalarına güvenen
_____ 23. Tembel olma eğiliminde olan
_____ 24. Duygusal olarak dengeli, kolayca keyfi kaçmayan
_____ 25. Keşfeden, icat eden
_____ 26. Atılgan bir kişiliğe sahip
_____ 27. Soğuk ve mesafeli olabilen

_____ 28. Görevi tamamlayıncaya kadar sebat edebilen
_____ 29. Dakikası dakikasına uymayan
_____ 30. Sanata ve estetik değerlere önem veren
_____ 31. Bazen utangaç, çekingen olan
_____ 32. Herkese karşı saygılı ve nazik olan
_____ 33. İşleri verimli yapan
_____ 34. Gergin ortamlarda sakin kalabilen
_____ 35. Rutin işleri yapmayı tercih eden
_____ 36. Sosyal, girişken
_____ 37. Bazen başkalarına kaba davranabilen
_____ 38. Planlar yapan ve bunları takip eden
_____ 39. Kolayca sinirlenen
_____ 40. Düşünmeyi seven, fikirler geliştirebilen
_____ 41. Sanata ilgisi çok az olan
_____ 42. Başkalarıyla işbirliği yapmayı seven
_____ 43. Kolaylıkla dikkati dağılan
_____ 44. Sanat, müzik ve edebiyatta çok bilgili

Lütfen kontrol ediniz. Tüm maddelerin yanını doldurdunuz mu?

APPENDIX F

Demographic Information Form

(Demografik Bilgi Formu)

1) Cinsiyetiniz: ( ) Kadın ( ) Erkek

2) Yaşınız: _____

3) Mesleğiniz: _____

4) Son Bitirilen Okul: _____

5) Sürücü Belgesinin:

Alındığı Yer (İl) : _____
Alındığı Yer (İlçe) : _____
Alındığı Tarih : _____
No : _____
Türü :_____

6) Kaç yıldır aktif olarak araç kullanıyorsunuz?_____

7) Yılda sürülen yol (Uygun seçeneği işaretleyiniz):

___ Hiç kullanmıyorum
___ 0-1000 km arası
___ 1000 – 5000 km arası
___ 5000 – 10000 km arası
___ 10000 – 20000 km arası
___ 20000 – 50000 km arası
___ 50000 – 100000 km arası
___ 100000 – 200000 km arası
___ 200000 km ve üzeri

8) Son 5 yılda başınızdan geçen her türlü trafik kazası sayısı: _____

9) Son 3 yılda aldığınız cezaların sayısını ilgili kutulara yazınız.

Aşırı Hız : ___
Hız : ___
Hatalı Sollama : ___
Alkol : ___
Kırmızı Işıkta Geçme : ___
Park Cezası : ___
Emniyet Kemeri : ___
Trafik İşaretlerine Uymama : ___
Diğer : ___

10) Hava ve yol koşulları uygun olduğunda **şehiriçi yollarda** yaklaşık ortalama kaç km hızla gidersiniz? _____ km

11) Hava ve yol koşulları uygun olduğunda **şehirlerarası yollarda** yaklaşık ortalama kaç km hızla gidersiniz? _____ km

12) Normal bir seyahatinizde kendinizi diğer sürücülerle kıyasladığınızda yaptığınız sollamaların sayısı sollandığınıza oranla nedir?

___ Yaptığım sollamaların sayısı sollandığımdan azdır.
___ Yaptığım sollamaların sayısı sollanmalarıma hemen hemen eşittir.
___ Yaptığım sollamaların sayısı sollanmalarımdan fazladır.

Ne kadar sıklıkla aşağıda belirtilen durumlarda araç kullandığınızı ilgili rakamı işaretleyerek belirtiniz.

	Hiçbir zaman	**Nadiren**	**Bazen**	**Sık Sık**	**Oldukça sık**	**Her zaman**
Kış aylarında	1	2	3	4	5	6
Yoğun araç trafiğinde	1	2	3	4	5	6
Otobanda	1	2	3	4	5	6
Diğer ana yollarda	1	2	3	4	5	6
Şehiriçi yollarda	1	2	3	4	5	6
Şehirdışı yollarda	1	2	3	4	5	6
Gece	1	2	3	4	5	6
Genellikle her durumda	1	2	3	4	5	6