ELSEVIER

Accident Analysis and Prevention 40 (2008) 697–703

ACCIDENT ANALYSIS & PREVENTION

www.elsevier.com/locate/aap

Risk perception of driving as a function of advanced training aimed at recognizing and handling risks in demanding driving situations

Tova Rosenbloom *, Amit Shahar, Avi Elharar, Offir Danino

The Phoenix Road Safety Studies, The Interdisciplinary Department of Social Sciences, Bar Ilan University, Ramat-Gan 52900, Israel

Received 17 May 2007; received in revised form 29 July 2007; accepted 8 September 2007

Abstract

The present study examined in 224 individuals whether an advanced driving training aimed at recognizing, avoiding and handling risks in demanding driving situations, affected perceived risk of driving situations (measured by a questionnaire). The training, which involved both experience and feedback on real performance, specifically intended to emphasize the dangers in loss of control of a vehicle. With that emphasis, it was hypothesized that perceived risk would increase after as compared to before the training. In addition, this study examined whether risk perception was dependent on gender or on age. A mixed ANOVA performed on mean scores on the questionnaire yielded significant main effects for training (before/after), gender, and age. Higher levels of perceived risk were reported after the training as compared to before it, by females than by males, and by older adult drivers than by younger adult drivers. An analysis of the data of a smaller sample showed that the increment in perceived risk was still present 2 months after the training, and that it did not decrease significantly as compared to immediately after the training. These results are discussed in relation to relevant methodological issues and future research.

Keywords: Skid training; Driving skills; Driver education; Risk perception; Gender differences

1. Introduction

Young novice drivers play a disproportionately large role in traffic crashes. In Israel, 18–24-year olds comprise about 17% of the driving population, but account for around 24% of crashes (Israeli Statistic Bureau, 2006). The situation in many overseas countries is similar (Mayhew et al., 2003). It seems mainly due to their limited experience to develop the complex, higher-order perceptual and cognitive skills required to safely interact with the traffic environment (Deery, 1999).

One of the factors involved in this process is risk perception defined as subjective experience of risk in potential traffic hazards (Elander et al., 1993). There are evidence that novice drivers are more likely than experienced drivers to adopt a riskier driving style (e.g., speeding, tailgating) and thus are more likely to find themselves in potentially risky situations (Mayhew and Simpson, 1995). At the same time, novice drivers are less likely to deal with those situations effectively due to lower levels of driving skill.

According to previous research (Horwarth, 1988; Brown and Groeger, 1988) there is an association between risk perception and risky behavior. Harre (2000) claims that the driver's road behavior (especially the young driver) is much influenced by his/her "risk state". Drivers who perceive low crash-risk in an objective high crash-risk will drive recklessly, while those who perceive high crash-risk in the same situation will drive cautiously and will do anything to avoid risks.

Therefore, novice drivers must develop their risk perception in order to reduce their involvement in dangerous road situations. One of the tools of improving novice drivers' safe driving is by advanced driving trainings aimed at handling risks in demanding driving situations. This research is aimed to assess the utility of such training for drivers in developing their risk perception.

The effectiveness of driver education programs in reducing traffic casualties has been the subject of research and debate of many studies (e.g., Carstensen, 2002; Christensen and Glad, 1996; Gander et al., 2005; Glad, 1988; Hirsch, 2003; Katila et al., 1996, 2004; Ker, 2005; Morrisey et al., 2006; Shope and Molnar, 2003). While there appears to be some general agreement in the literature concerning the effectiveness of some programs, such as some of the graduated driver's license (GDL) programs, which introduce stages for young drivers prior to the acceptance of

* Corresponding author. Tel.: +972 3 5741011; fax: +972 3 5741959.
E-mail address: rosenbt1@mail.biu.ac.il (T. Rosenbloom).

0001-4575/$ – see front matter © 2007 Elsevier Ltd. All rights reserved.
doi:10.1016/j.aap.2007.09.007

a full license (e.g., Morrisey et al.; Shope and Molnar), there is less consensus concerning other, particularly post-licensing advanced driving programs.

The studies by Shope and Molnar (2003) and Morrisey et al. (2006) have both assessed the effectiveness of GDL programs in the USA. Both studies, provided support for the effectiveness of GDL programs in reducing casualties among teen drivers, Shope and Molnar, using the data from GDL programs implemented between 1996 and 1999, and Morrisey et al., using those from GDL programs which were operative in the USA between 1992 and 2002.

Carstensen (2002) sought to evaluate whether the modified driver education program in Denmark (changed in 1986) had any effect on car accidents. Although young drivers who had trained according to the new, as compared to the old training program were found less involved in some accident types, this decrease was limited to the first year of driving. Ker (2005) was interested in assessing the effectiveness of post-license driver education for preventing road traffic crashes. She performed a meta-analysis on 21 studies which used some form of such trainings (almost exclusively in the USA). The results did not provide a definite proof for the effectiveness of post-licensing training in preventing car accidents.

Although the present study did not assess the effectiveness of a driving training in preventing accidents, nor did it measure confidence and overconfidence directly, it examined how risk perception was affected by participating in an advanced driving training which aimed at increasing perceived risk of traffic situations. Since the training evaluated in the present study particularly focused on skid training, only studies concerning skid training (Christensen and Glad, 1996; Glad, 1988; Katila et al., 1996, 2004) are presented below.

Generally, while skid trainings may aim at educating drivers to drive more safely on slippery roads, on many occasions such attempts have been considered failures, possibly due to improper expectations of students from such courses (Katila et al., 1996). Thus, Katila et al. have compared the views of instructors and students in Denmark, Finland, Norway and Sweden on the goals of skid training courses. In all four countries, students who have completed a skid training course assessed maneuvering skills and anticipating skills in the courses as equally important, whereas instructors assessed anticipating skills to be more important than maneuvering skills. The authors suggested that the skid training may give students the wrong impression that maneuvering skills are more important than anticipating skills. Likewise, they suggest that maneuvering exercises also increase their self-confidence, leading to underestimation of the risks involved, resulting in unsafe driving.

Katila et al. (2004) introduced much of the research about skid training in Nordic countries. They point out that following the renewed driver training policy in Norway in 1979, which included a compulsory skid training course, the total number of accidents increased by 17% among novice male drivers and accidents in slippery road conditions increased by 23%, as compared to the control group with no skid training. They also mention that decreased safety has also been found regarding skid training for truck drivers (Christensen and Glad, 1996), possibly due to increased self-confidence among drivers (Glad, 1988).

Thus, in order to avoid the decreased safety that was found following the Norwegian skid training, the emphasis in such training in Finland has been shifted to anticipatory skills, as opposed to maneuvering skills (Katila et al., 2004). Specifically, the main goal in Finland was to teach drivers how to become more aware of the possible risks of slippery conditions, and generally to promote foreseeing risks; vehicle handling and maneuvering skills were considered to be of secondary importance.

The Katila et al. (2004) study specifically evaluated the effect of Finnish driver skid training on accidents in slippery road conditions. The study gathered information on driving exposure and accident rate during 6–18 months following licensing. Half of the drivers received and half had not received skid training. The results showed no effects of the training on slippery road accidents for either male or female drivers.

Although effects of the training on slippery road accidents were not obtained, the training affected self-confidence, as reflected by a self-assessment questionnaire about skills, worries and perceived risks regarding driving in slippery conditions. Specifically, although the Finnish driver skid training tried to avoid an increase in confidence, drivers who had passed the skid training showed higher levels of confidence in their skills and were less afraid to drive in slippery conditions than drivers who had not passed the training. Katila et al. (2004) point out that nevertheless, this increase in confidence did not lead to an increase in slippery road accidents. They further argued that high confidence in one's personal skills does not necessarily imply negative safety; the crucial factor is how skills are used.

In recent years, the Israel Ministry of Transportation has begun implementing a GDL program for novice drivers. Amongst several requirements presented, some of which have already been activated (e.g., following their initial permit to drive, novice drivers are legally prohibited to drive without an experienced escort driver during the first 3 months, and they are obligated to complete a 12-h knowledge-refreshing course after 3 years), the new regulations would condition the approval of a permanent license in the completion of an advanced driving course (which is expected to be activated in the near future). This course would include both theoretical education of, and practical training in, a number of different complex situations. Each training site would be designed to enable training in a number of special driving situations, such as skidding on water and on sand, bypassing, driving in a traffic circle, getting on and off road shoulders, entering a puddle, driving in a steep descent, and slalom driving.

Although we agree with Katila et al. (2004) that it is an oversimplification to say that increased confidence in skills will inevitably lead to more accidents, the goal of designing a training which would avoid leading to overconfidence still seems worthy. Assuming that more awareness of the dangers of slippery conditions is more or less equivalent to higher levels of perceived risk in such conditions, Gerald Wilde's (1982, 1988) risk homeostasis theory RHT provides some basis for implementing

trainings that enhance the awareness to risks, and for favoring such trainings upon trainings that reduce risk perception. There is room for arguing that in accordance with the theory (RHT), a training which enhances perceived risks would respectively suppress risky behaviors, reducing accident risk and promoting safety driving.

The present study, then, sought to examine whether risk perception was affected by participating in an advanced driving training that specifically intended to emphasize the dangers in loss of control of a vehicle. The training involved both experience and feedback on real performance to the driver concerning the dangers in complex driving situations (such feedback of individual performance has been found efficient as a behavioral tool for positive behavior modification; Hutton et al., 2002). With resemblance to the courses in Finland, as described by Katila et al. (2004), although vehicle handling and emergency maneuvering skills during skidding were taught in the training that was assessed in this study, its emphasis was put on avoidance from entering such conditions and on awareness of the possible dangers involved in those conditions. With that emphasis, it was hypothesized that perceived risk would increase after as compared to before the training.

Based on previous findings of greater perceived risk in females than in males (Dejoy, 1992) and in older male than in younger male drivers (Finn and Bragg, 1986; Trankle et al., 1990), this study also examined whether risk perception before and after the course was dependent on gender and on age. It was expected that female- and older-drivers would show higher levels of perceived risk, as compared to male- and younger-drivers, respectively.

2. Methodology

2.1. Participants

There were 224 individuals, 85 females (mean = 24.73; S.D. = 12.97; range = 18–64) and 139 males (mean = 31.8; S.D. = 15.16; range = 18–63), who attended the course. Of them, 135, 69 males (mean = 18.19; S.D. = 0.39) and 66 females (mean = 18.18; S.D. = 0.39) were 12th grade students from high schools in the city Netanya (Israel). All of the remaining 89 participants, 70 males (mean = 45.21; S.D. = 9.57; range = 29–63) and 19 females (mean = 47.47; S.D. = 9.06; range = 23–64), were employees in the city hall of Netanya. Of them, 44, 38 males (mean = 46.08; S.D. = 10.33; range = 29–63) and 6 females (mean = 42; S.D. = 12.52; range = 23–58) were professional drivers (e.g., sanitation truck drivers), and 45, 32 males (mean = 44.19; S.D. = 8.64; range = 33–63), and 13 females (mean = 50; S.D. = 6; range = 41–64), were not. All of the participants had a driving license.

The two age groups of drivers are referred to below as younger and older participants. The younger participants (high school students) paid for the training 20% of its original price and completed it during school hours (which we assume was considered by them as a positive outcome), whereas the older participants had not paid at all but completed the training on their own free time (see Section 4.1).

2.2. Advanced driving training

The training was upheld in a specially designed enclosed area (skid-track). Its main objective was to increase both the level of knowledge and experience about the risks inherent in driving in slippery conditions. All of the participants attended a 4–5 h theoretical- and practical-course.

The theoretical part provided knowledge about safety equipment (e.g., anti-lock brakes [ABS], seat belts, tires) and behaviors (e.g., sitting posture, correct steering/squeezing the wheel, choice of speed). Additionally, the theoretical part identified conditions which can lead to loss of control over a vehicle, and it emphasized avoidance from entering such conditions and awareness of the possible dangers involved in those conditions including recognition that frequently is impossible preventing an accident once control over the vehicle has been lost.

The practical part included the training of principles of emergency maneuvering using previously studied scenarios of loss of control. These scenarios included skidding and sudden braking, driving with two wheels on road shoulders, and sudden braking in a turn to prevent skidding. These maneuvers were practiced on different surfaces, such as water and sand.

The training session included (a) watching the professional instructor in action and (b) sitting with three other trainees in a car driven by an instructor. Each of the exercises was practiced by each of the participants in turn while the instructor demonstrated the exercise and offered effective feedback to each. Each participant tried to physically experience the situation demonstrated. At the end of this phase, the instructor summarized the principles of controlling a vehicle to the group of trainees. It could be felt that a strong impression was left on these young trainees from taking part in this experience.

2.3. Risk perception questionnaire

The evaluation of risk perception in driving was obtained using a questionnaire especially designed for the study. The questionnaire consisted of 34 items that represent 34 driving situations (e.g., driving at a speed above 110 kmph in an inter-urban road; driving while having an important conversation on the phone without a speaker; eating while driving). Each item included a driving situation and a 1–5 scale on which the respondents were required to mark the degree of risk involved in that condition (1 = not risky at all; 5 = very risky). The questionnaire consisted of items with different degrees of relation to skidding (e.g., driving at a sharp turn on a wet road; driving in a steep descent with a high gear; driving with loud and exciting music in the background). The 34 items which composed the questionnaire are presented in Table 1.

All of the participants completed the questionnaire twice—once before the training (Cronbach's alpha = .91) and once after the training (Cronbach's alpha = .92). The majority of the younger participants completed the questionnaire several days before the training, in their schools, and immediately after it, at the training site, whereas the majority of the older participants filled the questionnaire immediately before the training, at the training site, and many of them filled it again several

Table 1
List of the 34 items which composed the Risk Perception Questionnaire, including item means, S.D.s and *t*-tests for the comparisons between before and after the training

	Item	Before training		After training		*t*-value
		Mean	S.D.	Mean	S.D.	
1	Driving on a wet road after rain (not first rain)	3.47	0.86	4.08	0.92	9.17
2	The degree of risk in driving with one hand on the wheel	3.17	1.1	3.73	1.05	6.63
3	Bypassing when you are hidden by a truck and have no good vision of the vehicle coming in front of you	4.63	0.67	4.54	0.72	−1.68*
4	Driving with loud and exciting music in the background	2.98	1.03	3.43	1.01	5.85
5	Driving at a speed above 110 kmph in an inter-urban road	3.55	1.12	4.1	0.9	7.22
6	Driving at a speed of 100 kmph in an inter-urban road	2.87	1.16	3.55	1.07	8.65
7	Driving at a speed of 90 kmph in an inter-urban road	2.34	1.16	2.99	1.22	7.38
8	Driving while having an important conversation on the phone with a speaker	3.02	1.07	3.44	1.08	5.12
9	Driving while having an important conversation on the phone without a speaker	4.4	0.81	4.51	0.78	1.76*
10	Driving after drinking two beer cans or two other alcoholic drinks	4.29	0.89	4.36	0.85	1.23*
11	Driving after drinking two beer cans or one other alcoholic drink	3.62	1.12	3.94	1.04	4.78
12	Driving at a sharp turn on a wet road	4	0.93	4.54	0.7	7.34
13	Driving at a sharp turn on a dry road	2.85	1.01	3.5	0.93	8.63
14	Driving on an urban road at a speed of 50 kmph (speed limit)	1.94	0.9	2.66	1.04	9.06
15	Driving on an urban road at a speed of 60 kmph (above speed limit)	2.88	1.09	3.45	1.04	7.21
16	Accelerating when approaching a flickering green light	3.45	1.09	3.66	0.99	2.66
17	Accelerating when approaching a yellow light	4.1	0.97	4.27	0.85	2.64
18	Handling a radio or a cellular phone during driving	3.72	0.99	3.98	0.94	3.99
19	Eating while driving	3.29	1.06	3.67	0.92	5.46
20	Driving a steep descent in a high gear	4.09	0.88	4.29	0.79	3.42
21	Losing control over the vehicle while driving on a wet and slippery road	4.23	0.92	4.56	0.68	4.69
22	Losing control over the vehicle while driving on a dry road	3.03	1.12	3.5	1.04	5.79
23	The degree of risk for you which can be attributed to other drivers' driving	3.68	1.02	3.9	0.96	3.17
24	The degree of risk which can be attributed to your driving on a wet road based on your level of knowledge and expertise	2.94	1.04	3.5	1.09	7.03
25	Driving a vehicle with too low air pressure on a dry road	3.56	0.97	3.75	0.93	2.84
26	Driving a vehicle with too high air pressure on a wet road	3.97	0.97	4.28	0.89	3.97
27	Backward driving (reverse) when there are blind sights	4.02	1.01	4.19	0.89	2.18
28	Backward driving (reverse) when there are no blind sights	2.47	1.09	2.86	1.12	5.04
29	Getting on and off lower road shoulders	3.19	1.15	3.71	1.03	6.27
30	Bypassing a slow vehicle from the right, when impossible to bypass from the left	3.61	1.11	3.91	1.05	4.1
31	Slalom driving between cars for purposes of shortening travel time	4.37	0.83	4.47	0.75	1.78*
32	Sudden braking, when doing so is necessary for avoiding an accident	3.98	0.88	4.18	0.85	2.84
33	Driving after a sleepless night	4.47	0.7	4.5	0.78	0.47*
34	Challenged-driving aimed at testing your driving abilities	4.1	1.09	4.14	1.15	0.55*

Asterisks represent non-significant *t*-values, all other *t*-values were significant at .05.

days after it, at their working environment (see Section 4.1). Twenty-eight individuals among the younger participants (16 males and 12 females) filled the questionnaire again (third time) 2 months after the training (Cronbach's alpha = .93). Finally, the participants were not given any details regarding the purpose of the questionnaire or about the study, and although they were informed that at the end of the research no personal information would be kept, the questionnaire was not anonymous (see Section 4.1).

3. Results

In order to check if risk perception differed as a function of the different conditions, repeated measure ANOVAs were performed on the ratings of risks. Particularly due to the large differences in groups' sizes, Levene's test for homogeneity of variances was performed on the perceived risk data, separately before and after the training. There were no apparent differences between group variances (Fs < .20; ps > .20). Because the group of the older drivers consisted of both professional and non-professional drivers, besides to running an ANOVA on the complete sample, a 2 (×2) ANOVA (Professionalism (×Training)) was also performed on mean perceived risk scores on the questionnaire. Neither the main effect of Professionalism nor the interaction was significant (Fs < .20; ps > .20).

A mixed 2 × 2 (×2) ANOVA (gender × age (×training)) was performed on mean scores on the questionnaire. The main effects of training (before/after the training), gender and age [Fs(1,

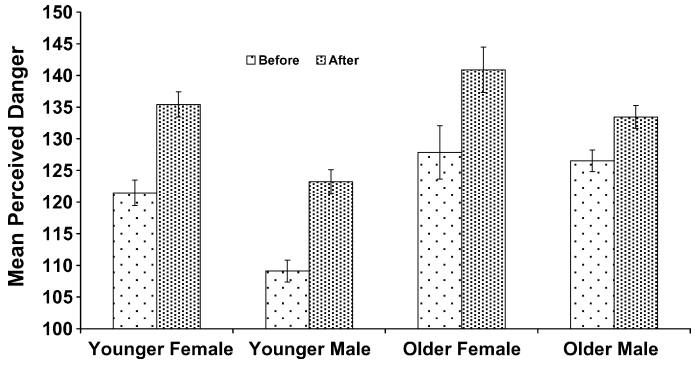

Fig. 1. Mean perceived risk scores as a function of age (younger and older), gender (female and male), and training (before and after). Error bars represent standard error of means.

220) = 124.4, 14.89 and 20.96, respectively] were all highly significant ($ps < .001$).

There were higher scores of risk perception after the training (mean = 131.51; S.D. = 16.7) as compared to before the training (mean = 119.77; S.D. = 16.95), females (mean = 129.76; S.D. = 15.32) scored higher than males (mean = 123.12; S.D. = 14.71), and older drivers (mean = 130.92; S.D. = 13.12) scored higher than younger drivers (mean = 122.16; S.D. = 15.62). Gender accounted for approximately 6% ($h_p^2 = .063$), age for approximately 9% ($h_p^2 = .087$) and training accounted for 36% ($h_p^2 = .36$) of the overall variance.

The interactions between Age and Gender and between Age and Training approached levels of significance [Fs(1, 220) = 3.34 and 3.56; ps = .07 and .06, respectively]. Fig. 1 displays mean scores of perceived risk as a function of age (younger and older), gender (female and male), and training (before and after). As can be seen in Fig. 1, the pattern of the interaction between Age and Gender showed that the difference in perceived risk between males and females tended to be larger among younger than among older participants. Tukey HSD test showed that in fact the mean scores of perceived risk were smaller among younger-males (116.16) as compared to all of the other conditions (128.43, 129.99 and 134.37, for younger-females, older-males and older-females, respectively; $ps < .001$), but no significant differences between any of the other conditions were indicated ($ps > .20$).

As also can be seen in Fig. 1, the pattern of the Age × Training interaction seems to show that the effect of the training on mean perceived risk (i.e., the size of the difference between mean perceived risk before and after the course) tended to be larger in younger (115.13 and 129.19) as compared to in older (126.81 and 135.03) participants. Tukey test yielded for the two comparisons highly significant differences ($ps < .001$).

Finally, a separate (×3) ANOVA (×training) was performed on the questionnaire scores using the data of the smaller sample (28 students) who filled the questionnaire again 2 months after the training. The three within-subject levels used were the scores before the training, immediately after, and 2 months after the training. Tukey test for the significant effect [Fs(2, 52) = 11.28; $ps < .001$] showed significant differences between mean scores before the training (114.32), and mean scores both immediately after (129.57), and 2 months after (126.32) the training ($ps < .001$ and .005, respectively), but not between mean scores immediately after, and 2 months after the training ($ps > .20$).

4. Discussion

Primarily, the results of this study, specifically the significant main effect of training supports its main prediction that perceived risk would increase after, as compared to before the training. Moreover, the analysis of the data of the smaller sample showed that the increment in perceived risk was still present 2 months after the training, and that it did not decrease significantly as compared to immediately after the training. These results are indeed consistent with the emphasis of the training that was evaluated in this study (see Section 2.2), strongly suggesting that the training succeeded bolding the dangers and the difficulties of preventing an accident once control over the vehicle has been lost.

As can be seen in Table 1, except for items 3, 9, 10, 31, 33, 34 in the questionnaire, all of the items were ranked with significantly higher means after, as compared to before training. A close inspection at the means of the non-significant items suggests that the absence of apparent differences (before versus after training) resulted from a ceiling effect—these items (e.g., "Bypassing when you are hidden by a truck and have no good vision of the vehicle coming in front of you"; "Driving after drinking two beer cans or two other alcoholic drinks") seem to present high risk-perceived activities, already prior to the training. Importantly, these behaviors are followed by high penalties by the police.

Apparently, the trainees generalized from items that were more seriously dealt with in the training (i.e., items described driving on wet surfaces [1,12, 21, 24], sharp turns [12,13], speeding [5,14, 15] and getting on and off lower road shoulders [29]), to the rest of the items. Generally, the training process, which included the conceptualization of the special experience made by the trainers, seems to have led to a better understanding and internalization of the specific safety values (Gillespie, 2006). More specifically, the exercises performed on the training site were aimed to demonstrate to the participants that it is nearly impossible to elude the emergency conditions they experienced. McDonald (1985) and Harre (2000) suggest that the feeling of mastering the basic skills involved in driving is a crucial component in risky behavior of young drivers. Relatedly, reckless driving of adolescents is a source of pleasure as long as things are under their complete control (Rosenbloom, 2003). The increased risk awareness of the participants in the present study, likely resulted from the emphasis put on the thin line between control and loss of control in hazardous road conditions. This thin line, we suggest, should be emphasized in standard training processes of novice drivers, as well as in advanced trainings.

Before interpreting the effects of age and gender, there is room to go into some details about the similarities and differences between the training evaluated in the present study, and those evaluated by former studies (Christensen and Glad, 1996; Glad, 1988; Katila et al., 1996, 2004). Thus, while the

idea of training anticipation skills and teaching or demonstrating the possible dangers are still common with both the Nordic trainings and the training evaluated here, quite differently the main target in the Nordic skid training is to train drivers to handle and anticipate the problems by not loosing control of the car caused by driving too fast on slippery roads and also to handle car on snow and icy road situations.

Yagil (1998) who examined attitudes towards traffic laws and traffic violations as a function of age and of gender, also found that perceived risk determined the tendency to commit traffic violations more among women than among men, suggesting that perceived risk contribute to cautious driving more among female- than among male-drivers. As applied to our data and to driving trainings in general, one meaning of this finding may be that the achievement of enhancing perceived risk is more likely to promote cautious driving among female drivers than among male drivers.

The results of this study also supported its predictions, that perceived risk would be greater in females than in males and in older than in younger drivers. These patterns are in general acceptance with previous findings regarding the effects of gender (Dejoy, 1992) and of age (Finn and Bragg, 1986; Trankle et al., 1990) on perceived risks of traffic and driving situations, albeit in these studies greater perceived risk was found in older male- than in younger male-drivers (Finn and Bragg, 1986; Trankle et al., 1990), but not in females (Trankle et al., 1990). Those specific patterns were in fact suggested also in this study, by the pattern of the interaction between age and gender, which showed (see Fig. 1) that perceived risk differences between the age groups tended to be larger in males than in females.

The patterns of this interaction (Age × Gender) is also consistent with Yagil's (1998) finding, that gender differences in the evaluation of traffic laws were larger among younger drivers than among older drivers. Likewise, the pattern of the Age × Gender interaction in this study showed that the gender differences in perceived risk, tended to be larger in younger as compared to older participants.

4.1. Methodological considerations and future research

Primarily, different factors may each and all have contributed to response set biases and differences in theses biases among groups. These factors include the anonymity of the questionnaire, and the differences between the younger and older participants, in the timings of administrations of the questionnaire (see Section 2.3), and in the price and circumstances of the training (see Section 2.1). Nevertheless, although the possibility that theses data reflect the different tendencies to satisfy the experimenters cannot be ruled out, this possibility, that the participants intentionally provided higher risk estimates following the training also indicates that the messages regarding the risks in skidding were clear. Moreover, the general consistency of the age effects in this study with previous reports of a positive relation between perceived risk and age (Finn and Bragg, 1986; Trankle et al., 1990; Yagil, 1998) strongly suggest that these age related effects indeed reflect true group differences and not side-effects of mild differences in experimental treatments.

Secondly, the present study cannot fully differentiate between the effects of age and of driving experience on perceived risk, since the older-aged group was also more experienced than the younger-aged group. Although the non-significant effects of Professionalism and the interaction in the Professionalism × Training ANOVA, suggests that the difference in perceived risk that was found between the age groups is related more to the age-difference than to the difference in driving experience, the Professionalism sub classification in this study was performed mainly for purposes of variable (driving experience) control, but there is no database to provide history of driving.

In future, assessing risk perception in an experiment that also assesses the effectiveness of the training in reducing, risk taking behaviors, near accidents and car accidents, would allow advancing the study of the relations between risk perception, expertise and safety driving. While generally, including as far as driving is concerned, people tend to overestimate themselves relative to others (Dunning, 2005; Dunning et al., 2004), there are also differences in levels of confidence that are group- and domain-specific (e.g., male drivers have higher thoughts of their own skills as compared to female drivers; Farrand and Mckenna, 2001), assessment of perception of own driving skill would be necessary to account for compensation of higher risk levels. Such assessment (of the perception of own driving skills) is strongly related to the problem of overconfidence, which is cardinal in this type of driving courses. Together with the assessment of the effectiveness of the training in reducing, risk taking behaviors, near accidents and car accidents, assessment of the perception of own driving skills would therefore provide a direct measure of confidence.

Finally, in order to overcome possible faults which might be associated with the questionnaire used in the present study to evaluate perceived risk, a method which has been successfully used in the past by Finn and Bragg (1986) can be adopted. In their study, the risk of accident involvement was estimated using three different methods, including general questions about accident involvement, driving situations illustrated in still photographs, and videotaped driving situations.

In sum, the present study found an increment in perceived risk associated with driving following an advanced driving training, showing that a training which enhances perceived risks can be designed. Theoretical basis for favoring driving trainings that enhance perceived risks upon trainings that do not enhance or that reduce subjective estimates of risks can be provided by risk homeostasis theory (Wilde, 1982, 1988). In addition, perceived risk in this study positively correlated with age, and was also a function of gender, with higher levels (of perceived risk) in women than in men. The general patterns of the data are consistent with the conception that young male drivers do not perceive driving as being as risky as female- and as older- (male- and female-) drivers perceive it (Dejoy, 1992; Finn and Bragg, 1986; Trankle et al., 1990).

Acknowledgements

The authors are grateful for the valuable comments of two anonymous reviewers on an earlier draft of this manuscript.

References

Brown, I.D., Groeger, J.A., 1988. Risk perception and decision taking during the transition between novice and experienced driver status. Ergonomics 31, 585–597.

Carstensen, G., 2002. The effect on accident risk of a change in driver education in Denmark. Accid. Anal. Prev. 34, 111–121.

Christensen, P., Glad, A., 1996. Mandatory course of driving on slippery roads for drivers of heavy vehicles. The effects on accidents. TÖI Report 334 (in Norwegian).

Deery, H.A., 1999. Hazard and risk perception among young novice drivers. J. Safety Res. 30, 225–236.

Dejoy, D.M., 1992. An examination of gender differences in traffic accident risk perception. Accid. Anal. Prev. 24, 237–246.

Dunning, D., 2005. Self-insight: Roadblocks and Detours on the Path to Knowing Thyself. Psychology Press, New York.

Dunning, D., Heath, C., Suls, J.M., 2004. Flawed self-assessment: implications for health, education, and business. Psychol. Sci. 5, 69–106 (public interest).

Elander, J., West, R., French, D., 1993. Behavioral correlates of individual differences in road-traffic crash risk: an examination of methods and findings. Psychol. Bull. 113, 279–294.

Farrand, P., Mckenna, F.P., 2001. Risk perception in novice drivers: the relationship between questionnaire measures and response latency. Transp. Res. Part F 4, 201–212.

Finn, P., Bragg, B.W.E., 1986. Perception of the risk of an accident by young and older drivers. Accid. Anal. Prev. 18, 289–298.

Gander, P.H., Marshal, N.S., Bolder, W., Girling, I., 2005. An evaluation of driver training as a fatigue countermeasure. Transp. Res. Part F 8, 47–58.

Gillespie, A., 2006. Games and the development of perspective taking. Hum. Dev. 49, 87–92.

Glad, A., 1988. Fase 2 i føreropplæringen. Effekt på ulykkes risikoen. Rapport 0015. Transportökonomisk institutt, Oslo (in Norwegian).

Harre, N., 2000. Risk evaluation, driving, and adolescents: a typology. Dev. Rev. 20, 206–226 .

Hirsch, P., 2003. Adolescent driver risk taking and driver education: evidence of a mobility bias in public policymaking. J. Safety Res. 34, 89–98.

Horwarth, I., 1988. The relationship between objective risk, subjective risk and behavior. Ergonomics 31, 527–535.

Hutton, K.A., Sibley, C.G., Harper, D.N., Hunt, M., 2002. Modifying driver behavior with passenger feedback. Transp. Res. Part F 5, 257–269.

Israeli Statistic Bureau, 2006. http://www1.cbs.gov.il/reader/cw_usr_view_Folder?ID=141.

Katila, A., Keskinen, E., Hatakka, M., 1996. Conflicting goals of skid training. Accid. Anal. Prev. 28, 785–789.

Katila, A., Keskinen, E., Hatakka, M., Laapotti, S., 2004. Does increased confidence among novice drivers imply a decrease in safety? The effects of skid training on slippery road accidents. Accid. Anal. Prev. 36, 543–550.

Ker, K., 2005. Post-licence driver education for the prevention of road traffic crashes. Accid. Anal. Prev. 37, 305–313.

Mayhew, D.R., Simpson, H.M., 1995. The role of driving experience: implications for training and licensing of new drivers. Occasional report, Insurance Bureau of Canada.

Mayhew, R.D., Simpson, H.M., Pak, A., 2003. Changes in collision rates among novice drivers during the first months of driving. Accid. Anal. Prev. 35, 683–691.

McDonald, W.A., 1985. Human factors and road crashes—a review of their relationship. Report: CR39. Federal Dept. of Transport, Melbourne.

Morrisey, M.A., Grabowski, D.C., Dee, T.S., Campbell, C., 2006. The strength of graduated drivers license programs and fatalities among teen drivers and passengers. Accid. Anal. Prev. 38, 135–141.

Rosenbloom, T., 2003. Risk evaluation and risky behavior of high and low sensation seekers. Soc. Behav. Pers. 31, 375–386.

Shope, J.T., Molnar, L.J., 2003. Graduated driver licensing in the United States: evaluation results from the early programs. J. Safety Res. 34, 63–69.

Trankle, U., Gelau, C., Metker, T., 1990. Risk perception and age-specific accidents of young drivers. Accid. Anal. Prev. 22, 119–125.

Wilde, G.J.S., 1982. Critical issues in risk homeostasis theory. Risk Anal. 2, 249–258.

Wilde, G.J.S., 1988. Risk homeostasis theory and traffic accidents: propositions, deductions and discussion of dissension in recent reactions. Ergonomics 31, 441–468.

Yagil, D., 1998. Gender and age differences in attitudes toward traffic laws and traffic violations. Transp. Res. Part F 1, 123–135.