

## THE RELATIONSHIP BETWEEN HAZARD PERCEPTION, RISK ASSESSMENT AND DIFFERENT DRIVING STYLES: LITHUANIAN SAMPLE

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### Abstract

Scientists agree that not only personality traits and emotions, but also cognitive characteristics have a great influence on developing individual driving style. Usually, the analysis of driving style includes cognitive skills related to memory and attention, unreasonably not taking into account perceptual skills. Cognitive factors as hazard anticipation and risk assessment are crucially important for risky actions while driving and traffic accidents. However, there is a lack of studies on how road hazard perception skills and risk assessment could influence individual driving style, especially for professional and non-professional drivers. So, this study aims to evaluate the relation between different driving styles, road-related hazard perception and risk assessment among professional and non-professional drivers in Lithuania.

One hundred twenty-three drivers (mean age 37.04 years) participated in online study. Eighty-nine participants were non-professional, 34 – professional drivers (the main job function is directly related to driving). The mean of driving experience was 16.2 years. Seventy-four percent of all participants drive on daily basis. Different driving styles were measured with Multidimensional Driving Style Inventory (Taubman-Ben-Ari et al., 2004). Forty-four self-reported items evaluated patient - careful, angry - hostile, anxious and reckless-careless driving styles. Hazard perception skills was tested by 12 short video clips in Lithuanian hazard prediction test (Endriulaitiene et al., in press). Risk assessment was measured by self-reported 34 – item scale (Rosenbloom et.al., 2008).

Professional drivers reported more risky, specifically angry-hostile and reckless-careless, driving style than non-professional drivers. There was no difference in anxious and careful-patient driving styles. Also, professional and non-professional drivers reported having similar road-related hazard perception skills and quite similar risk assessment. Correlational analysis showed that low risk assessment significantly related to more angry/hostile driving style in non-professional driver group. High risk assessment significantly correlated to more reckless/careless driving style driving style, while better hazard perception skills significantly related to aggressive/hostile driving style in professional drivers' group.

**Keywords:** *Driving styles, road hazard perception skills, risk assessment, professional drivers, non-professional drivers.*

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### 1. Introduction

Due to high number of people injured and killed in road accidents every year, road safety still remains one of the priority areas in the world. In recent years, the main focus of research is mainly on young and novice drivers. However, professional drivers' unsafe behavior on the road is equally dangerous and harmful at individual, organizational and societal levels. Recent research revealed that on average 7600 drivers die in road accidents at work per year (International Labor Organization, 2018). Seventy percent of these accidents are associated with employees' risky behavior on the road (e.g., speeding or dangerous maneuvers) (Xia, et al., 2020). Thus, the analysis of psychological antecedents of the driving peculiarities in professional as well as non-professional drivers' group is equally important for traffic psychology research.

Scientists agree that driving (behavior on the road) must be seen as a dynamic phenomenon, changing on a continuum from safe to extremely risky, dangerous driving. Some scientists suggest a multicomponent assessment by focusing on driving style (Freuli et.al., 2020; Useche et.al., 2020; Taubman - Ben-Ari, Skvirsky, 2016). Driving style is described as the sets of individual traits that characterize the way people usually drive, including dimensions related to their driving performance, such as attention and caution, average speed, emotions and behaviors while driving, in addition to attitudes, beliefs and values held towards road safety (Useche et.al., 2020; Taubman-Ben-Ari & Skvirsky, 2016). There is a four-dimensional model of driving styles provided by Taubman-Ben-Ari and Skvirsky (2016):

(1) *reckless and careless* driving style refers to deliberate violations of safe driving norms and the seeking of sensations and thrills while driving; (2) *anxious* driving style reflects feelings of alertness and tension, as well as ineffective engagement in relaxing activities during driving; (3) *angry and hostile* driving style refers to expressions of irritation, rage, and hostility while driving, along with a tendency to act aggressively on the road; (4) *patient and careful* driving style reflects well-adjusted driving behaviors, such as planning ahead, paying full attention to the road, displaying patience, courtesy, and calm behind the wheel, and obeying the traffic rules. It was found that reckless/careless, anxious and angry/hostile driving styles are consistently associated with traffic crashes (Useche et.al., 2020). It should be emphasized that comparison analysis of driving styles analysis in different driver groups is still rare. It remains unclear whether professional and non-professional drivers possess different driving styles and if so, are these differences depend on driving competences or other psychological factors, especially cognitive ones.

The researchers agree that safe behavior on the road depends on the driver's experience, competence and an ability to prioritize traffic information, distinguish real and potential hazards from other information, and respond to the situations on the road adequately. Thus, cognitive abilities are important for safe driving style. Researchers confirm that driving experience and successful management of difficult driving situations improve driving competence and an ability to detect, assess and react to potential hazards arising in traffic (Crundall, Kroll, 2018). Studies have shown that trained professional drivers recognize and identify more road hazards and do this faster than non-professional drivers (Crundall, Kroll, 2018). However, good road hazard anticipation skills do not necessarily enhance risk assessment (subjective assessment of behavior/situation riskiness hereinafter called as risk assessment) or even more – motivation to drive in safe style. Evidence suggests that professional drivers take risks on the road not because they do not see the danger on the road or are unaware of how to respond to it, but because they trust their competence, have over-confidence in their driving skills and do not consider the situation as personally dangerous for them (Crundall, Kroll, 2018). So, it is clear that non-professional drivers should have poorer hazard perception skills and low risk assessment. However, still it remains unclear how hazard perception abilities and risk assessment are directly related to different driving styles even regardless of driving competencies. Thus, the aim of this study is to assess the relation between different driving styles, road-related hazard perception skills and risk assessment among professional and non-professional drivers in Lithuania.

## 2. Method

### 2.1. Participants

One hundred twenty-three drivers (72.4% non-professional, 27.6% professional drivers) participated in online study on voluntary basis. Participants of the study were invited via social media (mostly Facebook). Those participants, who read informed consent and agreed to the terms of the study, were repeatedly informed about data protection and confidentiality issues, only after that the questionnaire was provided. The main inclusion criterion was solely the possession of a valid driver license for non-professional drivers. All participants were asked if they're main job function is directly related to driving. Those, who chose "no" were assigned to non-professional driver, group, those who chose "yes" were treated as professional drivers. The characteristics of the sample are provided in Table 1.

Table 1. Sociodemographic characteristics of the sample.

Variable	Non-professional drivers	Professional drivers	Total sample
Size	89	34	123
Males	29	21	50
Females	60	13	73
Age in years			
Mean	37.10	36.8	37.04
SD	12.2	11.1	11.9
Driving experience in years			
Mean	15.7	17.4	16.2
SD	11.5	11.3	11.4
Driving frequency			
less than once per week	7.9%	-	5.7%
1-3 times in a week	23.6%	11.8%	20.3%
daily driving	68.5%	88.2%	74%
Average mileage per week			
Up to 50 km	16.9%	2.9%	13%
50 – 100 km	15.7%	8.8%	13.8%
101- 200 km	31.5%	26.5%	30.1%
201 – 500 km	31.5%	23.5%	29.3%
More than 500 km	4.5%	38.2%	13.8%

Comparison analysis showed that non-professional and professional drivers were similar in age (Student's  $t = .091$ ,  $df = 121$ ,  $p > .05$ ) and did not differ significantly in driving experience (Student's  $t = -.764$ ,  $df = 121$ ,  $p > .05$ ). It was found no significant difference in driving frequency ( $\chi^2 = 5.65$ ,  $df = 2$ ,  $p = .59$ ). However, professional drivers had significantly higher average mileage per week than non-professional drivers ( $\chi^2 = 25.50$ ,  $df = 4$ ,  $p < .0001$ ).

## 2.2. Instruments

The multidimensional driving style inventory (MDSI; Taubman - Ben-Ari et al. 2004) was used to measure different driving styles. Forty-four items evaluated four different driving styles: a) reckless/careless; b) anxious; c) aggressive/hostile and d) careful/patient. Higher scores of each scale describe driving manner of each driver. Authors present this inventory as reliable for different drivers' group (Taubman - Ben-Ari et al. 2004). Originally internal consistency is quite good (Cronbach  $\alpha .72 - .86$ ), results in Lithuania professional and non-professional drivers' sample show average internal consistency (Cronbach  $\alpha$  ranged from .54 to .85).

Hazard perception skills were measured with newly developed Lithuanian hazard prediction test LHP12 (Endriulaitienė et al., in press). Participants were shown 12 video clips from the driver's perspective. Every single clip contained one hazard with a precursor which help to identify the situation as hazardous. After the clips were automatically stopped, participants were asked "What happens next?" and were asked to choose only one of four possible answers. The time to place the answer was not limited (for more see Endriulaitienė et al., in press). The length of the clips varied from 9 sec. to 37 sec. The total number of correct answers was calculated, higher score showed better hazard perception skills.

Risk assessment was measured by self-report risk perception scale, developed by Rosenbloom and others (2008). The scale consists of 34 items, each item describes different driving-related situation. Participants were asked to rate riskiness of each situation on Likert scale, from 1 – not risky at all, to 5 – very risky. The higher scores indicate risk assessment as high. Previous studies confirm good internal consistency of scale (Cronbach  $\alpha .91$ ) (Rosenbloom et al., 2008). Similarly, internal consistency of scale in this study is high – Cronbach  $\alpha = .92$ .

## 3. Results

Descriptive statistics of variables used in the study (hazard perception, risk assessment scores and scores of four driving styles: reckless/careless, anxious, aggressive/hostile, careful/patient) are introduced in Table 2. The results revealed that the mean value of hazard perception skills was quite small (3.7 and 3.5 right answers out of 9 and none of participants from both groups reached the maximum score) for both drivers' groups which indicate that despite driving experience both drivers' groups had similar difficulties to recognize and indicate hazards in real life driving situations. Contradictory results may be noticed in self-report risk assessment. The lowest observed score of risk assessment in the both samples suggest tendency to perceive and evaluate driving situations as risky. Mean analysis of different driving styles showed the tendency to agree mostly with statements about careful and patient driving styles in both non-professional and professional drivers (mean score is quite close to maximum value).

Table 2. Descriptive statistics of variables used in the study.

Variable	Drivers Group	N	Minimum value	Maximum value	Mean	Standard Deviation
Hazard perception	Non-professionals	89	0	9	3.7	1.7
	Professionals	34	0	7	3.5	1.9
Risk assessment	Non-professionals	89	69	164	118.9	19.1
	Professionals	34	81	170	119.8	17.5
Reckless/careless driving style	Non-professionals	89	11	41	20.1	6.8
	Professionals	34	13	43	23.3	7.2
Anxious driving style	Non-professionals	89	17	58	28.9	7.4
	Professionals	34	17	51	28.1	7.4
Aggressive/hostile driving style	Non-professionals	89	5	20	9.3	3.5
	Professionals	34	5	25	11.1	4.3
Careful/patient driving style	Non-professionals	89	20	54	39.1	5.6
	Professionals	34	34	50	40.7	4.6

Further, comparison analysis of the main variables was implemented in non-professional and professional drivers' groups. Results showed no significant difference in hazard perception skills (Student's  $t = .439$ ,  $df = 121$ ,  $p > .05$ ) and risk assessment (Student's  $t = -.243$ ,  $df = 121$ ,  $p > .05$ ) among

non-professional and professional drivers. Also, no significant difference was found in possession of anxious (Student's  $t = .571$ ,  $df = 121$ ,  $p > .05$ ) and careful/patient (Student's  $t = -1.485$ ,  $df = 121$ ,  $p > .05$ ) driving styles in both drivers' groups. However, professional drivers possessed significantly higher aggressive/hostile (Student's  $t = -2.258$ ,  $df = 121$ ,  $p = .02$ ) and reckless/careless (Student's  $t = -2.334$ ,  $df = 121$ ,  $p = .02$ ) driving style than non-professional drivers. Therefore, further correlational analysis was made in two separate drivers' groups.

Table 3. The results of correlational analysis among non-professional and professional drivers.

	Reckless/careless driving style	Anxious driving style	Aggressive/hostile driving style	Careful/patient driving style
NON-PROFESSIONAL DRIVERS				
Hazard perception	-.12	-.10	-.06	.006
Risk assessment	.14	-.16	<b>-.20*</b>	.02
PROFESSIONAL DRIVERS				
Hazard perception	-.21	.13	<b>.30*</b>	.03
Risk assessment	<b>.29*</b>	.12	.07	-.16

\* Bolded statistically significant correlational coefficients where  $p < .05$

The results, presented in Table.3, showed that low risk assessment was significantly related to more aggressive/hostile driving styles in non-professional drivers' group. Risk assessment as well as hazard perception skills were not significantly related to the rest of the driving styles among non-professional drivers. The same correlational analysis in professional drivers revealed that better hazard perception skills significantly related to more angry and hostile driving while high risk assessment were related to more reckless and careless driving style of professional drivers. No other significant relations were found in professional drivers' group.

#### 4. Discussion

The main aim of the present study was to evaluate the relationship between driving styles, hazard perception skills and risk assessment in non-professional and professional drivers' group. This study results support previous evidence that better hazard perception skills, but low risk assessment relate to risky driving styles (Crundall, Kroll, 2018). The results indicate that professional drivers with better hazard perception skills tend to drive in aggressive and hostile manner. This might be explained by assumption that high driving experience and successful dealing with hazardous situations while driving form exaggerated competence which results in strong superiority feeling towards others. This may lead to higher ignorance of how aggressive/hostile driving style can be dangerous for other drivers' safety. Also, the findings indicate that high risk assessment are related to more reckless/careless driving style in professional drivers' group. Again, high sense of risk and subjective feeling of possible successful dealing with risky situations enhance strong feeling of competence and perhaps stronger willingness to take risks while driving. Therefore, professional drivers behave recklessly on the road, even though greater risk assessment should deter from unsafe driving (Rosenbloom et.al., 2008).

It was found that non-professional drivers with greater risk assessment tend to drive in aggressive/hostile manner. In this case, not driving experience or competence itself, but cognitive ability to adequately evaluate the dangerousness of displayed aggressive/hostile style is the most important factor. Low risk assessment indicates low cognitive competence to perceive potential and/or real damage while driving in an aggressive/hostile style (Rosenbloom et.al., 2008). Thus, non-professional drivers ignore that some aggressive/hostile acts while driving (e.g., screaming and gesturing with hands inside the car) have a negative effect for attentiveness, motor skills etc., which leads to higher injury risk.

Finally, it was expected that more qualified and experienced drivers possess better road-related hazard perception skills and greater risk assessment than non-professional drivers (Crundall, Kroll, 2018). The results of this study do not confirm these findings. It was found that professional and non-professional drivers have quite similar hazard perception skills and similar risk assessment. This result might depend on quite small professional drivers sample size: data of 34 professional drivers were compared to data from 89 non-professional drivers. Also, significant differences were not found perhaps due to quite similar participants age and driving experience. However, this study findings supports the idea that professional drivers, who drive frequently and usually are obliged to drive longer distances, tend to drive in more aggressive/hostile or reckless/careless way than those, who are not professional drivers (Useche et.al., 2020). There is an assumption that the more driver is experienced to deal with various difficult driving situation, the more driving self-efficacy emerge, the less critical evaluation of riskiness in own driving is noticed. Experienced drivers usually have greater subjective control and invulnerability

feeling which tend to get stronger with driving frequency and higher mileage regardless of obligation to drive in professional and safe way.

The limitations of the study should be taken into account. Only hazard prediction skills were measured with objective measure, solving the real-life hazardous situations while risk assessment and driving styles were evaluated by self-report method. For further studies, it would be useful to replicate the study with driving simulator exploring components of driving styles in simulated driving tasks. Also, it would be useful to develop risk identification and then evaluation test from real life driving situations. A quite small professional drivers sample size is an issue of this study. A larger professional drivers sample perhaps would allow noticing more differences in risk and hazard perception skills.

## 5. Conclusions

Non-professional and professional drivers have similar road-related hazard perception skills and risk assessment. However, professional drivers tend to drive in more reckless/careless and angry/hostile style than non-professional drivers. Professional drivers higher scores of risk assessment drive in more reckless/careless way. Also, professional drivers with while better hazard perception skills drive in more aggressive/hostile style. Non-professional drivers with lower risk assessment scores drive in more angry/hostile driving style.

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