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Road users' evaluations and perceptions of road infrastructure, trip characteristics, and daily trip experiences across countries

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ABSTRACT

Governments in every country have made attempts to encourage road safety, and road users' perceptions of these attempts are crucial to understanding community needs and the effectiveness of road safety initiatives. However, while many studies compare countries with respect to fatality rates or possible causative factors related to these fatalities, little is known about how road users in different countries evaluate and perceive their tangible road environments from their own points of view. Therefore, the purpose of this study is to statistically explore drivers'-motorcyclists', pedestrians', cyclists' and public transport users' evaluations and perceptions of road infrastructure, trip characteristics and daily trip experiences in Estonia, Greece, Kosovo, Russia, and Turkey. In total, 1221 participants completed a questionnaire battery that included different sets of questions for different types of road users. Chi-Square analysis was used to examine the similarities and differences in the evaluations and perceptions of different road users across five countries. The main findings suggest that all road users across the five countries evaluated environmental characteristics significantly differently from each other. No similar trend could be observed within and between road users and countries. This is a quantitative study that provides descriptive information about road users' perceptions and evaluations across countries, which can be used for both conceptual and practical purposes. In future studies, this study finding can be used for system-based interventions and may inform government regulation on human or human-environmental interactive factors in order to improve regional and overall road safety.

Introduction

A growing body of literature investigates risk factors in order to improve road safety regionally and globally. Analysis indicates that the global improvement related to road safety has gone through regional improvement because most traffic fatalities (nearly 93%) occur in low and middle-income countries where approximately 60% of the world's

vehicles are registered (WHO, 2018a; 2018b). This finding highlights the importance of the difference between regions. Regional differences in road traffic safety exist in European countries as well. Therefore, while socioeconomic factors are important in traffic safety, other factors in which regional differences are seen (e.g., the size of the country/region; composition, density and quality of the road network, which is part of the road infrastructure of a country; characteristics of the vehicle

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stock, transit and tourist density and general condition of a country; behavioral aspects and institutional/governmental factors such as the education system, enforcement strategies, public transport usage or emergency applications of a country) and rapid urbanization and motorization effects should also be investigated in order to gain a deeper understanding of the differences between regions (Hyder and Peden, 2003; Murray and Lopez, 1997; Statistical Office of the European Communities, 2017; WHO, 2018a; 2018b).

Besides the possible factors that affect different traffic safety parameters, risk factors related to road traffic accidents have also been examined in cross-country studies in order to explore differences and gain an understanding of accident trends across countries for different road user groups (e.g., “Rasouli et al. (2008) for drivers”, “Law et al. (2009) for motorcyclists” and “Pucher and Dijkstra (2003) for cyclists”). With global understanding, accident causation is broadly categorized into human, vehicle, and road factors and can be investigated under three concepts, namely road users, vehicles, and the environment (Shinar Accident et al., 2007; Congress, 1997). The human factor (as a sole or a contributory factor) is generally found to dominate accident causation, followed by environmental factors and vehicle-related factors (Rumar, 1990; Shinar Accident et al., 2007; Treat et al., 1979). This explains why human-related factors have traditionally been hot topics in the area of traffic safety.

Parallel to the general traffic safety literature, cross-country studies or regional difference studies of accident rates generally focus on human-related risk factors. On the other hand, little is known about the interaction between the other main causes of accidents, i.e., vehicle and environmental factors and how environmental characteristics affect road users' safety and transport mode choices in general. Moreover, there is a strong interaction between human, vehicle and environmental factors that should not be ignored (Tahir, 2012). For example, Kerr et al. (2016) examined walking and cycling opportunities as predictors of the travel mode choices of road users in different countries. They found that choosing to walk was significantly related to perceived residential density, land use mix-access, street connectivity, aesthetics, and safety, while no significant relationship was found between cycling for transport and these neighborhood characteristics across cities and countries. In another study conducted by Saphioğlu and Yüzer Günay (2016) separated bicycle lanes, road grades, bicycle accident-prone locations, bicycle lane markings, bicycle parks on their way, come across to a bus stop, vehicle roadside parking, and location of bus lines were reported as important factors in cyclists' choices.

From a broad perspective, it can be said that human factors or factors involved in the human-environment relationship are complex. That is, if a specific road user group usually violates the law to some extent, this violation could either be solely related to human factors or to the interaction of certain factors with human factors. However, violation of law may also be related to the administrative side (Newnam and Goode, 2015). This behavior could be related to infrastructure, enforcement or the needs of users. For this reason, specific road user groups cannot be blamed, and the contribution of governmental interventions should also be taken into account when investigating crash occurrence (Nikolaou and Dimitriou, 2018).

Enforcement systems, intervention plans, the quality of infrastructure and the education system may reflect a country's governance in general. It can be said that traffic safety is directly dependent on governmental practices since regulations regarding transportation are directly linked to governmental authorities (Gaygisiz, 2010). Therefore, while focusing directly on road users, the impact of governmental interventions that directly affect enforcement strategies or environmental planning should not be ignored.

Governmental interventions in different regions and their relations with road traffic crashes is not within the scope of the current study. Of interest here is how different road users' perceptions of their traffic environments is related to governmental interventions such as road infrastructure or enforcement strategies. It is known that there is a

tendency that former of an intervention or application perceive intervention or application more than latter or user. Therefore, rather than focusing on authority perceptions and evaluations, those of road users give much more information about the needs of the community and internalized safety practices (Auzoult et al., 2015).

To the authors' knowledge, there are no studies investigating different road users' perceptions of road and trip characteristics and their experiences related to these tangible characteristics of a specific region or country. In addition, there are no studies comparing countries with different income levels or different regional characteristics with respect to the perceptions and experiences of different types of road users. Therefore, in this study, the aim was to investigate different road users' perceptions of the tangible characteristics of road environment, and related experiences, in order to understand regional differences in travel mode choices and accident statistics. Moreover, road users' evaluations related to road environment characteristics are investigated through yes or no questions to eliminate other confounding factors related to individual characteristics.

In this study, five countries with different income levels were selected for comparison: Estonia, Greece, Kosovo, Russia, and Turkey. Available data indicates that Estonia and Greece are categorized as high-income countries, Russia and Turkey are categorized as upper-middle income countries and Kosovo is categorized as a lower-middle-income country (World Bank, 2017). In addition to these income level differences, death rates per 100 000 inhabitants, death rates by type of road user, and safer roads and mobility factors, as documented in WHO reports, vary greatly among these countries (See Table 1). The current study also aimed to add new descriptive information on vulnerable road users such as pedestrians, motorcyclists and cyclists who represent the majority of fatalities worldwide (Bhattacharya et al., 2007). Alongside these road users, drivers and public transport users were also included in order to obtain a complete picture of the traffic context.

The overall aim of this study was to systematically explore and compare the evaluations and perceptions of different groups of road users (drivers-motorcyclists, pedestrians, cyclists, and public transport users) experiencing different road environments in countries with different characteristics, namely Estonia, Greece, Kosovo, Russia, and Turkey. Since more than half of all traffic fatalities are among pedestrians, cyclists or motorcyclists (WHO, 2018a; 2018b), these groups of road users were investigated in this study alongside drivers and public transport users. Identifying similarities and differences between road users' evaluations between and within countries may reveal specific trends that researchers can use to understand how different road users perceive their tangible environments and how their daily routine be shaped based on these evaluations. Descriptive data about different regions and different road users can facilitate the successful implementation of governmental road safety interventions. With the results of this study, perception and evaluations related to specifically tangible characteristics of traffic environment could become a part of system-based interventions and may inform government regulation on human or human-environmental interactive factors.

Method

Participants

The data for this study were collected from five different countries—Estonia, Greece, Kosovo, Russia, and Turkey—as a part of the Traffic Safety Culture (TraSaCu) Project (see Azik et al., 2018 for detailed information about participants' inclusion criteria and procedure). The participants of this study were 1221 road users, including drivers, motorcyclists, pedestrians, cyclists, and public transport users from these five countries. Participants were assigned to road user groups based on how frequently they use the stated transportation types. As such, one participant could be assigned to more than one road user group depending on their role in the traffic environment. With respect to

Table 1
Profiles of Studied Countries.

Country	Income Level	Death Rates per 100,000 Inhabitants	Death Rates Drivers/Passengers of 4-wheeled vehicles	Death Rates Drivers/Passengers of 2- or 3- wheeled vehicles	Cyclists	Pedestrians	Other Road Users	Formal audits required for new road construction projects	Regular inspections of existing road infrastructure	Policies to promote walking or cycling	Policies to encourage investment in public transport	Policies to separate road users and protect VRUs
Estonia	High	7.1	50.6	6.2	11.1	28.4	3.7	Yes	Yes	Yes	Yes	Yes
Greece	High	9.1	43.9	32.5	2.1	17.2	4.3	Yes	Yes	Subnational	Subnational	Yes
Kosovo*	Lower Middle	10.1	66		No info.	34	No info.	No info.	No info.	No info.	No info.	No info.
Russia	Upper Middle	18.9	57.3	4.3	1.7	28.9	7.8	Yes	Yes	Subnational	Subnational	Subnational
Turkey	Upper Middle	8.9	25.0	4.3	0.9	26.2	43.6	Yes	Yes	Subnational	Yes	No

Note. Data was gathered from the [World Bank, 2017](#), Global Health Observatory Data Repository Statistics ([WHO, 2015a; 2015b](#)), and Country Profiles of the [WHO \(2015a\); \(2015b\)](#).
* The data related to Kosovo could only be gathered from national sources (Road Safety Strategy and Action Plan for Kosovo, 2012).

road user roles, 1009 participants were drivers, 208 were motorcyclists, 1158 were pedestrians, 395 were cyclists, and 736 were public transport users. The drivers and motorcyclists were assigned to the same group as they use a similar transportation mode (motor vehicles) and answered the same set of questions about road infrastructure and environmental characteristics related to the road and daily traffic experiences in their own country. The other road user groups in each country were pedestrians, cyclists and public transport users.

The age range of participants was between 18 and 77, with a mean of 35.62 ($SD = 13.36$). The age range of the drivers, pedestrians, and public transport users was between 18 and 77, with means of 36.87 ($SD = 13.20$), 35.50 ($SD = 13.40$), and 33.81 ($SD = 13.97$), respectively. In addition, the age range of motorcyclists was between 18 and 63 ($M = 35.29$, $SD = 11.39$), while that of public transportation users was between 18 and 76 ($M = 35.08$, $SD = 12.99$).

The gender distribution of road users from the five countries showed that 465 (38.1%) participants were female and 757 (62%) were male. Among them, there were 340 (33.7%) female and 669 (66.3%) male drivers; 48 (23.1%) female and 160 (76.9%) male motorcyclists; 446 (38.5%) female and 712 (61.5%) male pedestrians; 118 (29.9%) female and 423 (57.5%) male bicyclists; and 313 (42.5%) female and 423 (57.5%) male public transport users. Detailed demographic information of the participants in each country and in the sample as a whole can be seen in [Table 2](#).

Measures

Road users completed a questionnaire battery comprising a demographic information form and yes/no questions about their perceptions of road infrastructure, trip characteristics, and experiences during their daily trips.

Demographic information form

This form included questions about age, gender, mileage, accident history and the frequency of travel mode choices. The frequency of travel mode choices was used to categorize road users as drivers, motorcyclists, pedestrians, cyclists and public transport users for cross-country analyses.

Yes/No questions about road Users' perceptions of road Infrastructure, trip Characteristics, and daily trip experiences

These questions were developed and used by [Schweizer et al. \(2012\)](#) in order to investigate trip and infrastructure characteristics and the characteristics of the travel experiences of different types of road users. Drivers and motorcyclists were assigned to the same group and responded to a scale with nine items, with the first 2 items relating to road infrastructure and trip characteristics and the last 7 items relating to daily trip experiences. Pedestrians responded to thirteen items, with the first 6 items relating to road infrastructure and trip characteristics and the last 7 items relating to daily trip experiences. Cyclists also responded to thirteen items, the first 7 of which related to road infrastructure and trip characteristics, while the last 6 items related to daily trip experiences. Finally, public transport users responded to ten items, with the first 4 relating to road infrastructure and trip characteristics and the last 6 relating to daily trip experiences. The survey was originally constructed in English but was translated into Estonian, Greek, Albanian, Russian and Turkish using forward and back-translation by different translators. All items for different road user groups can be seen in [Appendix 1](#).

Statistical analyses

Chi-Square analyses were performed to test the differences and similarities between Estonian, Greek, Kosovar, Russian and Turkish road users. The analyses were conducted in two parts. In the first part, an overall comparison was made of responses from all five countries to

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Table 2

Demographic characteristics of the participants in each country.

Country	N (%) ^a	Women	Men	Age		
				Mean	SD	Min.-Max.
Estonia	179 (14.66% – 100%)	95 (53.1%)	84 (46.9%)	46.69	13.58	22–76
• Drivers	157 (87.70%)	80 (51%)	77 (49%)	45.84	13.34	22–76
• Motorcyclists	8 (4.47%)	2 (25%)	6 (75%)	43.75	9.31	32–62
• Pedestrians	176 (98.32%)	94 (53.4%)	82 (46.6%)	46.60	13.50	22–76
• Bicyclists	73 (40.78%)	34 (46.6%)	39 (53.4%)	45.78	11.87	28–76
• Public Transport Users	134 (74.86%)	70 (52.2%)	64 (47.8%)	47.46	13.95	22–76
Greece	403 (33% – 100%)	150 (37.2%)	253 (62.8%)	42.23	10.45	18–77
• Drivers	372 (92.3%)	145 (39%)	227 (61%)	42.06	10.51	18–77
• Motorcyclists	117 (29.03%)	27 (23.1%)	90 (76.9%)	40.79	8.60	21–63
• Pedestrians	381 (94.54%)	138 (36.2%)	243 (63.8%)	42.45	10.45	18–77
• Bicyclists	130 (32.26%)	29 (22.3%)	101 (77.7%)	41.08	10.50	18–67
• Public Transport Users	173 (42.92%)	71 (41%)	102 (59%)	41.12	11.47	18–77
Kosovo	223 (18.26% – 100%)	62 (28.3%)	160 (71.7%)	33.38	11.42	18–72
• Drivers	197 (88.34%)	51 (25.9%)	146 (74.1%)	33.63	11.62	18–72
• Motorcyclists	30 (13.45%)	7 (23.3%)	23 (76.7%)	30.61	8.65	19–46
• Pedestrians	212 (99.10%)	58 (27.4%)	154 (72.6%)	33.58	11.57	18–72
• Bicyclists	67 (30.04%)	13 (19.4%)	54 (80.6%)	30.49	10.39	18–72
• Public Transport Users	121 (54.26%)	42 (34.7%)	79 (65.3%)	31.38	11.42	18–68
Country	N (%) ^a	Women	Men	Age		
				Mean	SD	Min.-Max.
Russia	216 (17.69%)	55 (25.5%)	161 (74.4%)	22.84	6.58	18–57
• Drivers	151 (69.90%)	23 (15.2%)	128 (84.8%)	23.27	7.27	18–57
• Motorcyclists	38 (17.59%)	5 (13.2%)	33 (86.8%)	22.87	8.88	18–57
• Pedestrians	210 (97.22%)	54 (25.7%)	156 (74.3%)	22.90	6.65	18–57
• Bicyclists	75 (34.72%)	19 (25.3%)	56 (74.7%)	22.69	6.57	18–57
• Public Transport Users	160 (74.07%)	49 (30.6%)	111 (69.4%)	22.31	6.21	18–57
Turkey	201 (16.46% – 100%)	102 (50.7%)	99 (49.3%)	28.66	9.18	19–64
• Drivers	123 (61.19%)	48 (39%)	75 (61%)	29.86	9.62	20–64
• Motorcyclists	15 (7.46%)	7 (46.7%)	8 (53.3%)	28.07	8.79	21–55
• Pedestrians	188 (93.53%)	95 (50.5%)	93 (49.5%)	28.34	9.20	19–64
• Bicyclists	50 (24.87%)	23 (46%)	27 (54%)	28.4	8.49	19–51
				27.24	8.38	19–59

Table 2 (continued)

Country	N (%) ^a	Women	Men	Age		
				Mean	SD	Min.-Max.
• Public Transport Users	148 (73.63%)	81 (54.7%)	67 (45.3%)			
Total	1222 (100%)	464 (38.1%)	757 (62%)	35.62	13.36	18–77
• Drivers	1000 (82.64%)	347 (33.7%)	653 (66.3%)	36.87	13.20	18–77
• Motorcyclists	208 (17.03%)	48 (23.1%)	160 (76.9%)	35.29	11.39	18–63
• Pedestrians	1167 (94.84%)	439 (38.5%)	728 (61.5%)	35.50	13.40	18–77
• Bicyclists	395 (32.35%)	118 (29.9%)	277 (70.7%)	35.08	12.99	18–76
• Public Transport Users	736 (60.28%)	313 (42.5%)	423 (57.5%)	33.81	13.97	18–77

Note. ^a The first percentage value listed in column 2 for each country represents the percentage of the total sample of participants provided by that country. The percentages in columns represent each country's distribution of road users.

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items testing road users' perceptions of road infrastructure, trip characteristics and daily trip experiences. The perceptions and experiences of drivers-motorcyclists, pedestrians, cyclists and public transport users were compared in these five countries, as well. In the second part of the analyses, the data of all possible pairs of countries were compared in order to examine the specific differences and similarities between these five countries. Therefore, Chi-Square analyses were performed again on data from the following pairs of countries: Estonia-Greece, Estonia-Kosovo, Estonia-Russia, Estonia-Turkey, Greece-Kosovo, Greece-Russia, Greece-Turkey, Kosovo- Russia, Kosovo-Turkey, and Russia-Turkey.

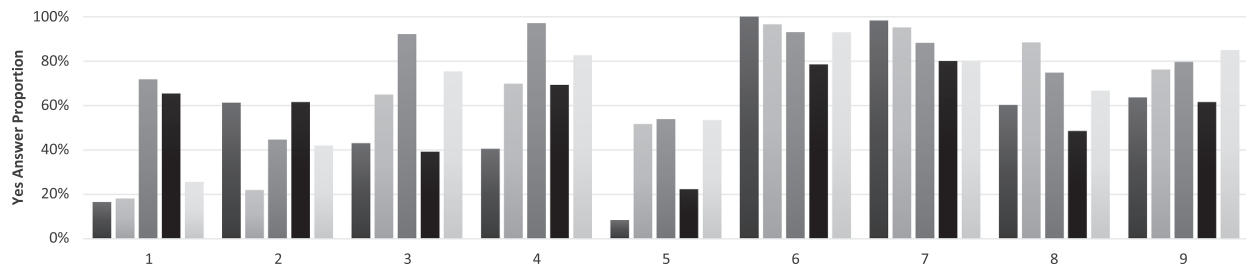
Results

Drivers' and Motorcyclists' perceptions of road Infrastructure, trip Characteristics, and daily trip experiences across countries

As previously mentioned, drivers and motorcyclists answered the same set of questions and the first phase of cross-country comparisons were performed for these road user groups. The answers of Estonian, Greek, Kosovar, Russian and Turkish drivers and motorcyclists to the nine questions examining road infrastructure, trip characteristics, and experiences on daily trips were compared. The results revealed significant differences between the ratios of the Estonian, Greek, Kosovar, Russian and Turkish samples on each item in this set of questions (See Fig. 1). Among all significant results, the Chi-square value was highest for item 1 ("Do you often see police controlling traffic?"), indicating the greatest difference between the five countries, $\chi^2(5, N = 705) = 168.20, p < .01$. The highest ratio was observed for Russian participants and the lowest ratio was observed for Estonian participants. All other significant differences between the drivers and motorcyclists in the five countries can be seen in Fig. 1.

Paired comparisons between countries were also performed to reveal the specific differences and similarities between countries. Significant results were also observed between country pairs. Comparisons were performed on each item in the order of the scale (See Appendix 1).

Paired comparisons of item 1 ("Do you often see police controlling



	1- Do you often see police controlling traffic?	2- Are all road signs and traffic lights on pedestrian crossings always visible?	3- Are you often blocked in congestions?	4-Do you have problems finding a parking spot?	5- Do you feel unsure about driving?	6-Do you use seat belt as driver?	7-Do you use seat belt as passenger?	8-Do you often see pedestrians/ cyclists: - Crossing the streets during the red light?	9-Do you often see pedestrians/ cyclists: - Stepping onto pedestrian crossings unexpectedly?
•Estonia	16.50%	61.20%	43.00%	40.50%	8.30%	100.00%	98.30%	60.30%	63.60%
•Greece	18.10%	21.90%	64.90%	69.80%	51.70%	96.60%	95.10%	88.30%	76.20%
•Kosovo	71.80%	44.70%	92.20%	97.10%	53.90%	93.10%	88.20%	74.80%	79.60%
•Russia	65.40%	61.50%	39.20%	69.20%	22.30%	78.50%	80.00%	48.50%	61.50%
•Turkey	25.60%	41.90%	75.30%	82.60%	53.50%	93.00%	80.00%	66.70%	84.90%
χ^2	168.20**	83.05**	94.11**	83.05**	98.02**	55.84**	41.41**	79.56**	23.84**
Φ	.00	.00	.00	.00	.00	.00	.00	.00	.00

Fig. 1. Road infrastructure, trip characteristics, and experiences on daily trips for drivers and motorcyclists.

traffic?") showed that Yes answer ratios of the Estonian-Kosovar, Estonian-Russian, Greek-Kosovar, Greek-Russian, Kosovar-Turkish, and Russian-Turkish were significantly different from each other. The highest Yes answer ratio was 65.40% for Russia and the lowest Yes answer ratio was 16.50% for Estonia.

Comparison results for item 2 ("Are all road signs and traffic lights on pedestrian crossings always visible?") revealed that, apart from the Estonian-Russian and Kosovar-Turkish pairs, all other paired comparisons were significant. The highest Yes answer ratios were 61.50% for Russia and 61.20% for Estonia, and the lowest Yes answer ratio was 21.90% for Greece.

Detailed comparisons of countries for item 3 ("Are you often blocked in congestion?") revealed that, apart from the Estonian-Russian and Greek-Turkish pairs, all other paired comparisons for drivers and motorcyclists were significant. The highest Yes answer ratio was 92.20% for Kosovo, and the lowest Yes answer ratios were 43% for Estonia and 39.20% for Russia.

Comparison results for item 4 ("Do you have problems finding a parking spot?") showed that, except for the Greek-Russian pair, the Yes answer ratios of all other pairs were significantly different. The highest Yes answer ratio was 97.10% for Russia and the lowest Yes answer ratio was 40.50% for Estonia.

Comparisons related to item 5 ("Do you feel unsure about driving?") showed that, apart from the Greek-Kosovar, Greek-Turkish and Kosovar-Turkish pairs, the Yes answer ratios of all other pairs were significantly different from each other. The highest Yes answer ratios were 53.90% for Kosovo, 53.50% for Turkey and 51.70% for Greece, and the lowest Yes answer ratio was 8.30% for Estonia.

Detailed comparisons of countries for item 6 ("Do you use the seat belt as a driver?") revealed that the Yes answer ratios of the Estonian-Kosovar, Estonian-Russian, Estonian-Turkish, Greek-Russian, Kosovar-Russian, and Russian-Turkish pairs were significantly different from each other. The highest Yes answer ratios were 100% for Estonia and 96.60% for Greece, and the lowest Yes answer ratio was 78.50% for Russia.

Comparisons related to item 7 ("Do you use the seat belt as a passenger?") showed that the Yes answer ratios of the Estonian-Kosovar,

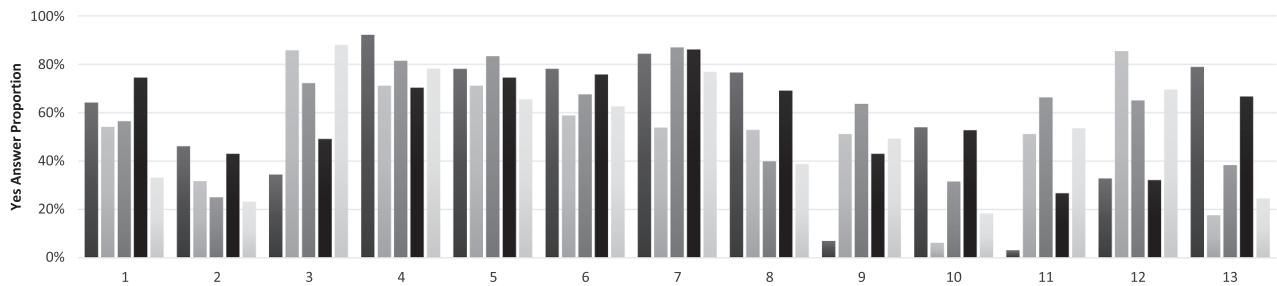
Estonian-Russian, Estonian-Turkish, Greek-Kosovar, Greek-Russian, and Greek-Turkish pairs were significantly different from each other. The highest Yes answer ratios were 98.30% for Estonia and 95.10% for Greece, and the lowest Yes answer ratios were 80% for Russia and Turkey.

Detailed comparisons of countries for item 8 ("Do you often see pedestrians/cyclists: - Crossing the streets during the red light?") revealed that, apart from the Estonian-Turkish and Kosovar-Turkish pairs, the comparison results of all country pairs of drivers and motorcyclists were significant. The highest Yes answer ratio was 88.30% for Greece and the lowest Yes answer ratio was 48.50% for Russia.

Comparison results for item 9 ("Do you often see pedestrians/cyclists: - Stepping onto pedestrian crossings unexpectedly?") revealed that the Yes answer ratios of the Estonian-Greek, Estonian-Kosovar, Estonian-Turkish, Greek-Russian, Kosovar-Russian, and Russian-Turkish pairs were significantly different from each other. The highest Yes answer ratio was 84.90% for Turkey and the lowest Yes answer ratio was 61.50% for Russia. The results of the paired country comparisons for drivers and motorcyclists can be seen in Appendix 1 and the proportion of Yes responses can be seen in Fig. 1.

Pedestrians' perceptions of road Infrastructure, trip Characteristics, and daily trip experiences across countries

Overall and paired comparisons of the five countries were also performed for pedestrians. The answers of Estonian, Greek, Kosovar, Russian and Turkish pedestrians to thirteen questions on road infrastructure, trip characteristics, and experiences on daily trips were first compared. The results showed significant differences in the ratios of the Estonian, Greek, Kosovar, Russian and Turkish responses on each item in this set of questions (See Fig. 2). Among all significant results, the Chi-square value was highest for Item 13 ("Do you feel respected by car drivers?"), indicating the greatest difference between the five countries, $\chi^2(5, N = 329) = 189.98, p < .01$. The highest ratio was observed for Estonian participants and the lowest ratio was observed for Greek participants. All other significant differences between the pedestrians in the five countries can be seen in Fig. 2.



	1- Is there an interrupted footpath?	2-Is the footpath entirely illuminated?	3-Are there obstacles(trees, cars, bins)?	4-Are there pedestrian crossing: Non-signalized crossing?	5-Are there pedestrian crossing: Signalized crossing?	6-Do you always try to use pedestrian crossing to cross the street?	7-Is your daily walk longer than 1 km.?	8-Is the footpath in a good condition?	9-Do you feel insecure while walking?	10- Do drivers always give you right of way on non-signalized crossing?	11- Do you often hear beeps/honking on pedestrian crossing?	12- Do you often see cars/ motorcycles driving through a red traffic light?	13- Do you feel respected by car drivers?
•Estonia	64.10%	46.10%	34.40%	92.20%	78.10%	78.10%	84.40%	76.60%	7%	53.90%	3.10%	32.80%	78.90%
•Greece	54.20%	31.70%	85.80%	71.20%	71.20%	58.80%	53.80%	52.90%	51.20%	6.20%	51.20%	85.40%	17.50%
•Kosovo	56.50%	25%	72.20%	81.50%	83.30%	67.60%	87%	39.80%	63.60%	31.50%	66.40%	65.10%	38.30%
•Russia	74.50%	43%	49.10%	70.30%	74.50%	75.80%	86.10%	69.10%	43%	52.70%	26.70%	32.10%	66.70%
•Turkey	33.10%	23.20%	88%	78.20%	65.50%	62.70%	76.80%	38.70%	49.30%	18.30%	53.50%	69.50%	24.60%
χ^2	50.03**	26.17**	156.26**	26.22**	12.20**	21.57**	81.52**	62.96**	94.53**	150.59**	138.30**	163.73**	189.98**
Φ	0	0	0	0	0	0	0	0	0	0	0	0	0

Fig. 2. Road infrastructure, trip characteristics, and experiences on daily trips for pedestrians.

Detailed paired comparisons were also performed. For item 1 (“Is there an uninterrupted footpath?”), the results of the comparisons showed that the Yes answer ratios of the Estonian-Turkish, Greek-Russian, Greek-Turkish, Kosovar-Russian, Kosovar-Turkish, and Russian-Turkish pairs were significantly different from each other. The highest Yes answer ratios were 74.50% for Russia and 64.10% for Estonia, and the lowest Yes answer ratio was 33.10% for Turkey.

Detailed comparisons of countries for item 2 (“Is the footpath entirely illuminated?”) showed that the Yes answer ratios of the Estonian-Greek, Estonian-Kosovar, Estonian-Turkish, Greek-Russian, Kosovar-Russian, and Russian-Turkish pairs were significantly different. The highest Yes answer ratios were 46.10% for Estonia and 43% for Russia, and the lowest Yes answer ratios were 31.70% for Greece and 23.20% for Turkey.

Comparison results for item 3 (“Are there obstacles (trees, cars, bins)?”) revealed that, apart from the Yes answer ratio of the Greek-Turkish pair, all other paired comparisons were significant. The highest Yes answer ratios were 88% for Turkey and 85.80% for Greece, and the lowest Yes answer ratio was 34.40% for Estonia.

Comparisons related to item 4 (“Are there pedestrian crossings: - Non-signalized crossing?”) showed that the Yes answer ratios of the Estonian-Greek, Estonian-Kosovar, Estonian-Russian, Estonian-Turkish pairs were significantly different from each other. No significant differences were observed in the Yes answer ratios of the other countries. The highest Yes answer ratio was 92.20% for Estonia, and the lowest was 70.30% for Russia.

Detailed comparisons of countries for item 5 (“Are there pedestrian crossings: - Signalized crossing?”) revealed that the Yes answer ratios of the Estonian-Turkish, Greek-Kosovar and Kosovar-Turkish pairs were significantly different from each other. The highest Yes answer ratios were 83.30% of Kosovo and the lowest Yes answer ratios were 65.50% for Turkey.

Detailed comparisons of countries for item 6 (“Do you always try to use pedestrian crossings to cross the street?”) revealed that the Yes answer ratios of the Estonian-Greek, Estonian-Turkish, Greek-Russian, and Russian-Turkish pairs were significantly different. The highest Yes answer ratios were 78.10% for Estonia and 74.50% for Russia, and the lowest Yes answer ratios were 62.70% for Turkey and 58.80% for Greece.

Comparison results for item 7 (“Is your daily walk longer than 1 km?”) showed that, except for the ratios of the Estonian-Kosovar, Estonian-Russian, and Kosovar-Russian pairs, the Yes answer ratios of all other pairs were significantly different. The highest Yes answer ratios were 87% for Kosovo and 86.10% for Russia, and the lowest Yes answer ratio was 53.80% for Greece.

Comparisons related to item 8 (“Is the footpath in good condition?”) showed that, apart from the Estonian-Russian, Kosovar-Turkish and Russian-Turkish pairs, the Yes answer ratios of all other pairs were significantly different from each other. The highest Yes answer ratios were 76.60% for Estonia and 69.10% for Russia, and the lowest Yes answer ratios were 39.80% for Kosovo and 38.70% for Turkey.

Detailed comparisons of countries for item 9 (“Do you feel insecure while walking?”) revealed that, except for the Yes answer ratios of the Greek-Russian, Greek-Turkish, and Russian-Turkish pairs, the ratios of all other pairs were significantly different from each other. The highest Yes answer ratio was 63.60% for Kosovo and the lowest Yes answer ratio was 7% for Estonia.

Comparison results for item 10 (“Do drivers always give you the right of way on non-signalized crossings?”) revealed that, apart from the Estonian-Russian pair, all other comparison results were found to be significant. The highest Yes answer ratios were 53.90% for Estonia and 52.70% for Russia, and the lowest Yes answer ratio was 6.20% for Greece.

Detailed comparisons of countries for item 11 (“Do you often hear beeps/honking on a pedestrian crossing?”) revealed that, apart from the Greek-Russian pair, all other country pairs were found to be significantly different from each other. The highest Yes answer ratio was 66.40% for Kosovo and the lowest Yes answer ratio was 3.10% for Estonia.

Comparison results for item 12 (“Do you often see cars/motorcycles driving through a red traffic light?”) showed that, except for the ratios of the Estonian-Russian and Kosovar-Turkish pairs, the Yes answer ratios of all other pairs were significantly different. The highest Yes answer ratio was 85.40% for Greece, and the lowest Yes answer ratios were 33.80% for Estonia and 32.10% for Russia.

The final comparison of pedestrians’ responses to item 13 (“Do you feel respected by car drivers?”) revealed that apart from the Yes answer ratio of the Greek-Turkish pair, the answer ratios of all other pairs were significantly different from each other. The highest Yes answer ratio was

78.90% for Estonia, and the lowest Yes answer ratios were 24.60% for Turkey and 17.50% for Greece. All paired country comparisons of pedestrian responses can be seen in Appendix 1 and the proportion of Yes responses can be seen in Fig. 2.

Cyclists' perceptions of road Infrastructure, trip Characteristics, and daily trip experiences across countries

The same analyses were performed on the responses of cyclists, the third road user group. Overall comparison results showed that, except for item 11 (“Do you use a bicycle helmet?”), the differences between the ratios of the Estonian, Greek, Kosovar, Russian and Turkish samples were significant for each item in this set of questions (See Fig. 3). Among all significant results, the Chi-square value was highest for item 5 (“Do you use bike and ride parking?”), indicating the greatest difference between the five countries, $X^2(5, N = 270) = 41.35, p < .01$. The highest ratio was observed for Russian cyclists and the lowest ratio was observed for Kosovar cyclists. All other significant differences between the cyclists of the five countries can be seen in Fig. 3.

Detailed paired comparisons between countries were also performed. Comparisons of responses to item 1 (“Is there a bike path on at least some parts of the route?”) showed that, apart from the Yes answer ratios of the Estonian-Russian, Greek-Turkish, and Russian-Turkish pairs, the ratios of all other country pairs were found to be significantly different from each other. The highest Yes answer ratio was 83.60% for Estonia, and the lowest Yes answer ratio was 27.30% for Kosovo.

Paired comparison results for item 2 (“Is there a bike path on the whole route?”) showed that the Yes answers ratios of the Estonian-Russian, Estonian-Turkish, Greek-Kosovar, Greek-Russian, and Greek-Turkish pairs were significantly different from each other. The highest Yes answer ratio was 36.50% for Russia, and the lowest Yes answer ratios were 5.10% for Greece and 9.10% for Estonia.

Comparison results for item 3 (“Are there safe bike parking possibilities?”) revealed that, apart from the Estonian-Russian, Greek-Turkish and Kosovar-Turkish pairs, all other paired country comparisons were significant. The highest Yes answer ratios were 57.10% for Russia and

the lowest Yes answer ratios was 21.80% for Greece.

Detailed comparisons of countries for item 4 (“Are all bike paths illuminated??”) revealed that the Yes answer ratio of the Estonian-Turkish, Estonian-Kosovar, Estonian-Turkish, Greek-Russian, Kosovar-Russian, and Russian-Turkish pairs were significantly different. The highest Yes answer ratio was 49.20% for Russia, and the lowest Yes answer ratios were 14.60% for Turkey and 12.80% for Greece.

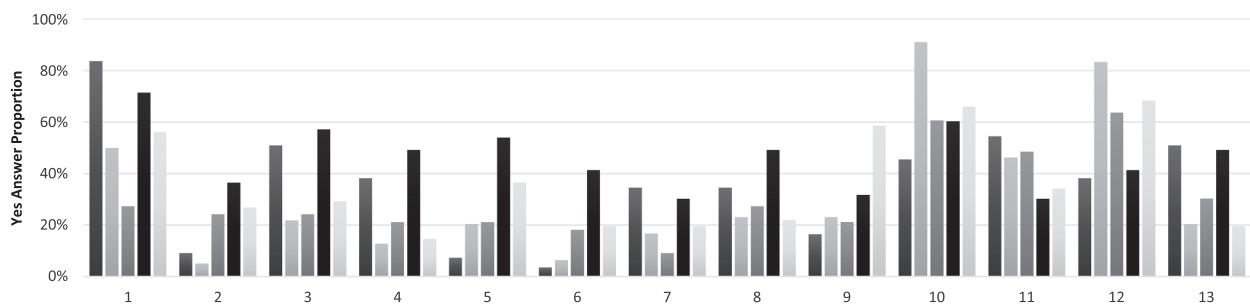
Comparison results for item 5 (“Do you use bike and ride parking?”) showed that the Yes answer ratio of the Estonian-Greek, Estonian-Russian, Estonian-Turkish, Greek-Russian, Kosovar-Russian, and Kosovar-Turkish pairs were significantly different. The highest Yes answer ratios were 36.60% for Turkey and 20.50% for Greece, and the lowest Yes answer ratio was 12.10% for Kosovo.

Comparisons related to item 6 (“Do you use a hired bike?”) showed that apart from the Estonian-Greek, Greek-Kosovar, and Greek-Turkish pairs, the Yes answer ratios of all other pairs were significantly different from each other. The highest Yes answer ratio was 41.30% for Russia, and the lowest Yes answer ratios were 6.40% for Greece and 3.60% for Estonia.

Detailed comparisons of countries for item 7 (“Do you take your bike onto the bus/train?”) revealed that the Yes answer ratios of the Estonian-Greek, Estonian-Kosovar, and Kosovar-Russian pairs were significantly different from each other. The highest Yes answer ratios were 34.50% for Estonia and 30.20% for Russia, and the lowest Yes answer ratio was 9.10% for Kosovo.

Comparisons related to item 8 (“Do drivers always give you the right of way on non-signalized crossings?”) showed that the Yes answer ratios of the Greek-Russian, Kosovar-Russian, and Russian-Turkish pairs were significantly different from each other. The highest Yes answer ratio was 49.20% for Russia, and the lowest Yes answer ratios were 23.10% for Greece and 22% for Turkey.

Detailed comparisons of countries for item 9 (“Have you ever had a bike accident?”) showed that the Yes answer ratios of the Estonian-Turkish, Greek-Turkish, Kosovar-Turkish and Russian-Turkish pairs were significantly different from each other. The highest Yes answer ratio was 58.50% for Turkey and the lowest Yes answer ratio was 16.40% for Estonia.



	1- Is there a bike path, at least in some parts of the route?	2- Is there a bike path on the whole route?	3- Are there safe bike parking possibilities ?	4- Are all bike paths illuminated?	5- Do you use bike and ride parking?	6- Do you use a hired bike?	7- Do you take your bike onto the bus/ train?	8- Do drivers always give you right of way on non-signalized crossings?	9- Have you ever had a bike accident?	10- Are you worried of having an accident?	11- Do you use a bicycle helmet?	12- Do you often see cars/ motorcycles driving through a red traffic light?	13- Do you feel respected by car drivers?
•Estonia	83.60%	9.10%	50.90%	38.20%	7.30%	3.60%	34.50%	34.50%	16.40%	45.50%	54.50%	38.20%	50.90%
•Greece	50%	5.10%	21.80%	12.80%	20.50%	6.40%	16.70%	23.10%	23.10%	91%	46.20%	83.30%	20.50%
•Kosovo	27.30%	24.20%	24.20%	21.10%	21.10%	18.20%	9.10%	27.30%	21.20%	60.60%	48.50%	63.60%	30.30%
•Russia	71.40%	36.50%	57.10%	49.20%	54%	41.30%	30.20%	49.20%	31.70%	60.30%	30.20%	41.30%	49.20%
•Turkey	56.10%	26.80%	29.30%	14.60%	36.60%	19.50%	19.50%	22%	58.50%	65.90%	34.10%	68.30%	19.50%
χ^2	34.47**	28.16**	26.48**	34.35**	41.35**	38.90**	11.63*	13.86**	24.22**	33.84**	9,26	39.03**	23.69**
Φ	0	0	0	0	0	0	0,02	0,01	0	0	0,05	0	0

Fig. 3. Road infrastructure, trip characteristics, and experiences on daily trips for cyclists.

Comparison results for item 10 (“Are you worried about having an accident?”) revealed that the Yes answer ratios of the Estonian-Greek, Greek-Kosovar, Greek-Russian, and Russian-Turkish pairs were significantly different from each other. The highest Yes answer ratio was 91% for Greece and the lowest Yes answer ratio was 45.50% for Estonia.

Detailed comparisons of countries for item 11 (“Do you use a bicycle helmet?”) showed that only the Yes answer ratios of the Estonia and Russia pair was significantly different from each other. The highest Yes answer ratio was 54.50% for Estonia and the lowest Yes answer ratio was 30.20% for Russia.

Comparison results for item 12 (“Do you often see cars/motorcycles driving through a red traffic light?”) showed that, apart from the Estonian-Russian, Greek-Russian, Kosovar-Turkish, and Russian-Turkish pairs, the Yes answer ratios of all other country pairs were found to be significantly different from each other. The highest Yes answer ratio was 83.30% for Greece, and the lowest Yes answer ratios were 41.30% for Russia and 38.20% for Estonia.

The last comparison of cyclists’ responses to item 13 (“Do you feel respected by car drivers?”) revealed that the Yes answer ratios of the Estonian-Greek, Estonian-Turkish, Greek-Russian and Russian-Turkish pairs were significantly different from each other. The highest Yes answer ratios were 59.90% for Estonia and 49.20% for Russia, and the lowest Yes answer ratios were 20.50% for Greece and 19.50% for Turkey. The results of all paired country comparisons of cyclists’ responses can be seen in Appendix 1 and the proportion of Yes responses can be seen in Fig. 3.

Public transport Users’ perceptions of road Infrastructure, trip Characteristics, and daily trip experiences across countries

Overall comparisons of responses from the five countries and paired country comparisons were also performed for the last road user group, public transport users. The main results showed that the differences between the ratios of the Estonian, Greek, Kosovar, Russian and Turkish samples were significant for each item in this set of questions (See Fig. 4). Among all significant results, the Chi-square value was highest for item 10 (“Do you feel insecure or anxious: - Inside vehicles”), indicating the greatest difference between the five countries, $\chi^2 (5, N = 531) = 78.09, p < .01$. The highest ratio was observed for Kosovar

participants and the lowest ratio was observed for Estonian participants. All other significant differences between the participants of the five countries can be seen in Fig. 4.

In addition to the overall comparisons, detailed paired comparisons were also performed on the data collected from public transport users in different countries. The comparison results for item 1 (“Is there a station/stop within 5 min. walking distance from your home?”) showed that the ratio of the Yes answers of the Estonian-Kosovar, Kosovar-Russian and Kosovar-Turkish pairs were significantly different from each other. The highest Yes answer ratio was 89.20% for Russia and the lowest Yes answer ratio was 70.50% for Kosovo.

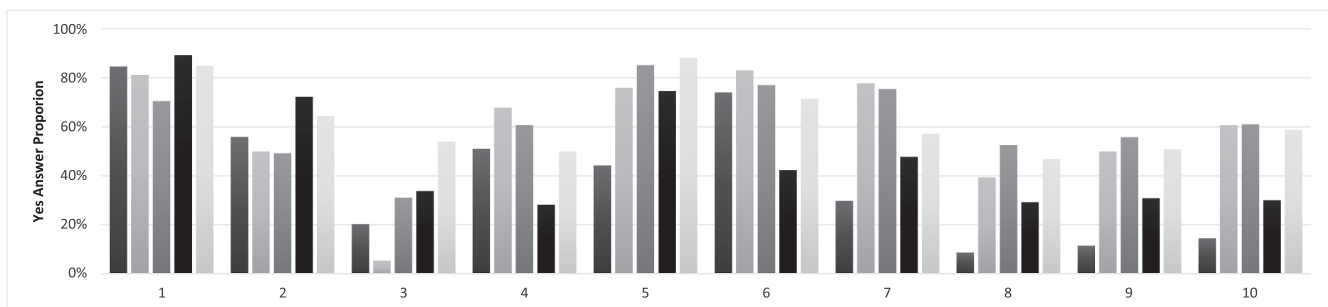
Comparison results for item 2 (“At this stop/station, is there a useful service at least every 10 min?”) revealed that the Yes answer ratios of the Estonian-Russian, Greek-Russian, Greek-Turkish, and Kosovar-Turkish pairs were significantly different from each other. The highest Yes answer ratios were 72.30% for Russia and 64.30% for Turkey, and the lowest Yes answer ratios were 50% for Greece and 49.20% for Kosovo.

A detailed comparison of responses to item 3 (“Do you exclusively use the bus?”) revealed that, apart from the Estonian-Kosovar and Kosovar-Russian pairs, the Yes answer ratios of all other country pairs of public transport users were found to be significantly different. The highest Yes answer ratio was 54% for Turkey and the lowest Yes answer ratio was 5.40% for Greece.

Comparison results for item 4 (“Do you need to transfer?”) showed that the Yes answer ratios of the Estonian-Greek, Estonian-Russian, Greek-Kosovar, Greek-Turkish, and Russian-Turkish pairs were significantly different from each other. The highest Yes answer ratio was 67.90% for Greece and the lowest Yes answer ratio was 29.20% for Russia.

Comparisons related to item 5 (“Are the vehicles often crowded?”) showed that apart from the Greek-Kosovar, Greek-Russian and Kosovar-Turkish pairs, the Yes answer ratios of all other pairs were significantly different from each other. The highest Yes answer ratios were 88.10% for Turkey and 85.20% of Kosovo, and the lowest Yes answer ratio was 44.20% for Estonia.

A detailed comparison of countries for item 6 (“At a stop, have you ever waited more than 15 min?”) revealed that the Yes answer ratios of the Estonian-Russian, Greek-Russian, Greek-Turkish, and Russian-Turkish pairs were significantly different from each other. The highest



	1- Is there a station/stop within 5 min walking distance from your home?	2- At this stop/station, is there a useful service at least every 10 minutes?	3- Do you exclusively use the bus?	4- Do you need to transfer?	5- Are the vehicles often crowded?	6- At a stop, have you ever waited more than 15min?	7- Are the vehicles and stops shabby?	8- Do you feel insecure or anxious: - At stations?	9- Do you feel insecure or anxious: - At stops?	10- Do you feel insecure or anxious: - Inside vehicles?
•Estonia	84.60%	55.80%	20.20%	51%	44.20%	74%	29.80%	8.70%	11.50%	14.40%
•Greece	81.20%	50%	5.40%	67.90%	75.90%	83%	77.70%	39.30%	50%	60.70%
•Kosovo	70.50%	49.20%	31.10%	60.70%	85.20%	77%	75.40%	52.50%	55.70%	61%
•Russia	89.20%	72.30%	33.80%	28.20%	74.60%	42.30%	47.70%	29.20%	30.80%	30%
•Turkey	84.90%	64.30%	54%	50%	88.10%	71.40%	57.10%	46.80%	50.80%	58.70%
χ^2	11.27*	17.56**	73.04**	39.52**	64.03**	55.71**	63.32**	50.70**	57.07**	78.09**
Φ	0,02	0	0	0	0	0	0	0	0	0

Fig. 4. Road infrastructure, trip characteristics, and experiences on daily trips for public transport users.

Yes answer ratio was 83% for Greece, and the lowest Yes answer ratio was 42.30% for Russia.

Comparisons related to item 7 (“Are the vehicles and stops shabby?”) showed that, apart from the Greek-Kosovar and Russian-Turkish pairs, the Yes answer ratios of all other pairs were found to be significantly different from each other. The highest Yes answer ratios were 77.70% for Greece and 75.40% for Kosovo, and the lowest Yes answer ratio was 29.80% for Estonia.

Detailed comparisons of countries for item 8 (“Do you feel insecure or anxious: - At stations?”) revealed that the Yes answer ratios of the Estonian-Greek, Estonian-Kosovar, Estonian-Russian, Estonian-Turkish, Kosovar-Russian, and Russian-Turkish pairs were significantly different from each other. The highest Yes answer ratios were 52.50% for Kosovo and 46.80% for Turkey, and the lowest Yes answer ratio was 8.70% for Estonia.

Comparison results for item 9 (“Do you feel insecure or anxious: - At stops?”) revealed that, apart from the Yes answer ratios of the Greek-Kosovar, Greek-Turkish, and Kosovar-Turkish pairs, all other ratios were significantly different. The highest Yes answer ratios were 55.70% for Kosovo, 50.80% for Turkey and 50% for Greece, and the lowest Yes answer ratio was 11.50% for Estonia.

Public transport users’ responses to item 10 (“Do you feel insecure or anxious: - Inside vehicles?”) were compared. The results were similar as those of item 9. Specifically, apart from the Yes answer ratios of the Greek-Kosovar, Greek-Turkish, and Kosovar-Turkish pairs, all other ratios revealed significant differences. The highest Yes answer ratios were 61% for Kosovo, 60.70% for Greece and 58.70% for Turkey, and the lowest Yes answer ratio was 14.40% for Estonia. The results of all paired country comparisons of public transport users’ responses can be seen in Appendix 1, and the proportion of Yes responses can be seen in Fig. 4.

General trends

Lastly, the following general trends emerged from analysis of these comparisons:

- Drivers and motorcyclists who live in Kosovo and Turkey evaluated their driving environments as less safe and they showed similarity with respect to unsafe applications in their environments.
- Pedestrians and cyclists who live in Estonia and Russia evaluated their environment as more pedestrian- and cyclist-friendly.
- There is a tendency of public transport users in Russia. Road users evaluate the system as commuter-friendly.

Discussion

The aim of this study was to explore road users’ evaluations and perceptions of road infrastructure, trip characteristics and daily trip experiences in Estonia, Greece, Kosovo, Russia, and Turkey. In addition to exploring road users’ evaluations and perceptions of their own countries, another goal of the current work was to compare the evaluations and perceptions of road users across these five countries to identify similarities and differences between countries, similarities and differences between road users within countries, similarities and differences within road user groups between countries and specific trends.

However, the evaluation trends of drivers and motorcyclists in Kosovo and Turkey, pedestrians and cyclists in Estonia and Russia, and public transport users in Russia may need further focus in future studies.

In general, results support the fact that in addition to accident statistics and cross-country differences in risk factors such as road users’ behaviors, the evaluations and perceptions of road users are also diverse across countries. As previously mentioned, the level of road safety in different regions is influenced by structural differences in the size of the country/region; composition, density and quality of the road network; population and socio-economic characteristics such as characteristics of the vehicle stock, transit and tourist traffic, or behavioral aspects

between countries. (Statistical Office of the European Communities, 2017). However, the results of this present study showed that differences related to these factors are evaluated differently by different road users and the reason of the differences in evaluations of road users did not show any particular trend across road users and across countries. A possible explanation for this finding is that different policies may be applied for different types of road users in the same country. For example, while attempts have been made to encourage public transport usage, specific initiatives to encourage walking and cycling are not widespread in Turkey, and this could have an effect on the evaluations of road users within the country (WHO, 2018a; 2018b).

Besides them, some item-based comparisons revealed interesting findings across countries. For example, the answer ratio distributions of drivers-motorcyclists for item 8 (“Do you often see pedestrians/cyclists crossing the streets during the red light?”), and of pedestrians and cyclists for item 12 (“Do you often see cars/motorcyclists driving through a red light?”) of their respective scales were similar across the five countries. For all these items, Greece had the highest Yes answer ratios, while Estonia and Russia had the lowest Yes answer ratios. This trend supports the idea that, at least for these items, different road users have parallel evaluations and perceptions across countries which could reflect the traffic safety climate/culture. Additionally, drivers’ responses to item 2 (“Are road signs and traffic lights on pedestrian crossing always visible?”) deserves further attention. This item is directly related to infrastructure characteristics such as visibility, and both within and between countries, it is related to different road users’ evaluations of red light behaviors. In future studies, more in-depth investigations of such infrastructure characteristics should be conducted, it could be studied under safety culture as explicit products of safety culture (Hampden-Turner, 2011). Therefore, based on these results, the reasons behind the evaluations of road users in these countries should be examined in detail in order to promote road safety for all road users in those countries based on both tangible and intangible factors related to countries applications. Moreover, these results could be used to identify specific road users’ needs in those countries, which is crucial to supporting road safety for all road users (Methorst et al., 2010).

The paired country comparisons also provide valuable information about road users’ evaluations. For the driver and motorcyclist group, the greatest differences were observed between Estonia and Kosovo, and Russia and Turkey, while Kosovo and Turkey were found to be similar to each other. These results could not be explained by income level or fatality rates that reflect the overall road safety of those countries. For example, Russia and Turkey are both upper-middle-income countries and their fatality rates are proportionally higher as a result of the number road traffic accidents (WHO, 2015a; 2015b; World Bank, 2017). On the other hand, the evaluations of motorcyclists and drivers were significantly different from each other. Therefore, additional factors may determine road users’ perceptions and evaluations of their environment.

Several unexpected findings emerged from the item level paired comparisons. For example, in this study, reported seat belt usage of participants as drivers and front seat passengers was very high in all five countries. On the other hand, while previous data of seat belt usage gathered from the World Health Organization (2015) and the General Directorate of Security Data of Turkey (Özkan et al., 2016) show a similar trend as being lower than this current study results. For example, in Estonia, 100% of drivers reported that they used their seat belt every time for this current study which is so high. One plausible explanation for this finding is that the age range of the participants in Estonia. For example, while in Estonia the mean age of drivers was 45.84, in Russia the mean age was 23.27. Age is known to be a strong predictor of aberrant driver behaviors, and this might affect evaluations and perceptions as well (Evans, 2004; Shinar Accident et al., 2007). However, any trend cannot be explained by age distributions alone. Therefore, further examination of the factors behind the similarities and differences in the evaluations of road users of similar age is warranted.

Another paired comparison showed that pedestrians' evaluations in Estonia and Greece, and Estonia and Turkey were significantly different from each other, while those in Estonia and Russia, and Greece and Turkey showed a similar trend. Similar trends could be a sign of the possible importance of regional proximity. In their study, Tsukaguchi et al. (2009) state that characteristics of regional environments such as topography and climate, history and culture and industrial structure might affect pedestrians' attitudes and behaviors. The results of the current study support this idea however, new research including factors related to topography and climate should be investigated deeply to support pedestrians needs in different countries.

Unlike pedestrians, cyclists' evaluations were quite different in Greece and Turkey, while Estonian and Turkish cyclists, and Greek and Russian cyclists gave similar answers about environmental characteristics and experiences in daily traffic. These results are surprising because while cycling has been supported to a much greater extent in Estonia, cycling as a transportation mode has only been supported and preferred in specific neighborhoods in Turkey (Erdogan et al., 2016; WHO, 2015a; 2015b). One possible reason for the similarity in Turkish and Estonian evaluations is that the sample of cyclists in Turkey generally live in the cities in which this travel mode is supported. On the other hand, it should be noted that the proportions of cyclists were very different across five countries. Therefore, in order to verify these findings, more extended research on this road user group should be done.

Lastly, public transport users in Greece and Kosovo answered the questions differently, while Estonian and Russian public transport users evaluated the questions similarly. As is the case with the other results, further research is needed to identify the factors behind these trends in the evaluations of road users.

This study was conducted to test the similarities and differences in various road users' evaluations and perceptions of the traffic environment in Estonia, Greece, Kosovo, Russia, and Turkey and makes conceptual and practical contributions. While accident statistics and related risk factors have been studied in the literature, there are no studies that focus on road users' evaluations of environmental factors, which would reflect the interaction between road users and road environments. These interactions could be important to overall road safety for all road users.

The current study gives only a general idea about the evaluations of road users in different countries. There are also different cultures and climates within countries and within some regions inside a given country that could reflect very different trends (e.g., the west or east of Turkey or the Estonian-Russian border). Therefore, differences within countries should also be examined in future research. While this was beyond the scope of the current study, it may have been one important

confounding factor. Additional elements of this study can also be improved in future studies. Firstly, some sample groups were different in size, and the male-female and age distributions were unbalanced. Although cross-cultural studies face practical difficulties related to data collection, future studies should aim for more balanced and equal samples in order to help control possible confounding effects, even those that are controlled for statistically. In addition, although it is considered a strength of this study, the inclusion of participants in more than one road user group could be another confounding factor. In future studies, participants could be asked to answer the questions relevant to the group they think they belong to. While these sampling problems should be given particular attention in future studies, it is important to pay attention to these special issues while generalizing the results of this study.

Governments in every country have made attempts to support road safety. However, road users' perceptions of these attempts are crucial to understanding the effectiveness of the attempts. Moreover, evaluations and perceptions of different road users could reflect the specific needs of specific road users, and this is important to overall road safety within and across countries. The results of the current study provide the first step in understanding how traffic systems work inside countries, how system and system changes are evaluated by road users, how best interventions can be implemented and how interventions may be internalized by road users in different countries. Moreover, different countries and different road users' needs and perception and evaluations could be a part of system-based interventions and may inform government regulation on human or human-environmental interactive factors.

Author's Note

The data that was used in this study were collected as part of a larger project named Traffic Safety Culture (TraSaCu) funded by the European Union Horizon 2020 Research and Innovation Program under the Marie Skłodowska-Curie Grant Agreement Number 645690. Additional information regarding TraSaCu project is available at <https://cordis.europa.eu/project/rcn/194361/factsheet/en>. Names of the countries are ordered alphabetically throughout the manuscript.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix 1

The detailed comparisons of countries (Estonia-Greece, Estonia-Kosovo, Estonia-Russia, Estonia-Turkey, Greece-Kosovo, Greece-Russia, Greece-Turkey, Kosovo-Russia, Kosovo-Turkey, Russia-Turkey).

The item comparisons for road infrastructure, trip characteristics, and daily trip experiences for drivers and motorcyclists:

Items:	EN-GR	EN-KV	EN-RS	EN-TR	GR-KV	GR-RS	GR-TR	KV-RS	KV-TR	RS-TR
1- Do you often see police controlling traffic?		X	X		X	X			X	X
2- Are all road signs and traffic lights on pedestrian crossings always visible?	X	X		X	X	X	X	X		X
3- Are you often blocked in congestion?	X	X		X	X	X		X	X	X
4- Do you have problems finding a parking spot?	X	X	X	X	X		X	X	X	X
5- Do you feel unsure about driving?	X	X	X	X		X		X		X
6- Do you use the seat belt as a driver?		X	X	X		X		X		X
7- Do you use the seat belt as a passenger?		X	X	X	X	X	X			
8- Do you often see pedestrians/cyclists: - Crossing the streets during the red light?	X	X	X		X	X	X	X		X
9- Do you often see pedestrians/cyclists: - Stepping onto pedestrian crossings unexpectedly?	X	X		X		X	X	X		X

The item comparisons for road infrastructure, trip characteristics, and daily trip experiences for pedestrians:

Items:	EN-GR	EN-KV	EN-RS	EN-TR	GR-KV	GR-RS	GR-TR	KV-RS	KV-TR	RS-TR
1- Is there an uninterrupted footpath?				X		X	X	X	X	X
2- Is the footpath entirely illuminated?	X	X		X		X		X		X
3- Are there obstacles (trees, cars, bins)?	X	X	X	X	X	X		X	X	X
4- Are there pedestrian crossings: - Non-signalized crossing?	X	X	X	X						
5- Are there pedestrian crossings: - Signalized crossing?				X	X				X	
6- Do you always try to use pedestrian crossings to cross the street?	X			X		X				X
7- Is your daily walk longer than 1 km?	X			X	X	X	X		X	X
8- Is the footpath in good condition?	X	X		X	X	X	X	X		
9- Do you feel insecure while walking?	X	X	X	X	X			X	X	
10- Do drivers always give you the right of way on non-signalized crossings?	X	X		X	X	X	X	X	X	X
11- Do you often hear beeps/honking on the pedestrian crossing?	X	X	X	X	X		X	X	X	X
12- Do you often see cars/motorcycles driving through a red traffic light?	X	X		X	X	X	X	X		X
13- Do you feel respected by car drivers?	X	X	X	X	X	X		X	X	X

The item comparisons for road infrastructure, trip characteristics, and daily trip experiences for cyclists:

Items:	EN-GR	EN-KV	EN-RS	EN-TR	GR-KV	GR-RS	GR-TR	KV-RS	KV-TR	RS-TR
1- Is there a bike path on at least some parts of the route?	X	X		X	X	X		X	X	
2- Is there a bike path on the whole route?			X	X	X		X			
3- Are there safe bike parking possibilities?	X	X		X	X	X		X		X
4- Are all bike paths illuminated?	X	X		X		X		X		X
5- Do you use bike and ride parking?	X		X	X		X		X	X	
6- Do you use a hired bike?			X	X		X		X	X	X
7- Do you take your bike onto the bus/train?	X	X						X		
8- Do drivers always give you the right of way on non-signalized crossings?						X		X		X
9- Have you ever had a bike accident?				X			X		X	X
10- Are you worried about having an accident?	X				X	X	X			
11- Do you use a bicycle helmet?			X							
12- Do you often see cars/motorcycles driving through a red traffic light?	X	X		X	X	X		X		
13- Do you feel respected by car drivers?	X			X		X				X

The item comparisons for road infrastructure, trip characteristics, and daily trip experiences for public transport users:

Items:	EN-GR	EN-KV	EN-RS	EN-TR	GR-KV	GR-RS	GR-TR	KV-RS	KV-TR	RS-TR
1- Is there a station/stop within 5 min. walking distance from your home?		X						X	X	
2- At this stop/station, is there a useful service at least every 10 min?			X					X	X	
3- Do you exclusively use the bus?	X		X	X	X	X	X		X	X
4- Do you need to transfer?	X		X			X	X			X
5- Are the vehicles often crowded?	X	X	X	X			X	X		X
6- At a stop, have you ever waited more than 15 min?			X			X	X			X
7- Are the vehicles and stops shabby?	X	X	X	X		X	X	X	X	
8- Do you feel insecure or anxious: - At stations?	X	X	X	X				X		X
9- Do you feel insecure or anxious: - At stops?	X	X	X	X		X		X		X
10- Do you feel insecure or anxious: - Inside vehicles?	X	X	X	X		X		X		X

Note. Country comparisons appear in alphabetic order (EN: Estonia, GR: Greece, KV: Kosovo, RS: Russia, TR: Turkey). In these tables, “X” means there was a significant difference between countries for the related item. Only pairs of countries were compared, e.g., Estonia-Greece, Estonia-Kosovo, etc.

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