

The role of values in road safety culture: Are motorcycle riders' higher accident risk a result of their appreciation of freedom to take risk?

Tor-Olav Nævestad¹, Alexandra Laiou², George Yannis³

¹ Institute of Transport Economics, Gaustadalleen 21, 0349 Oslo, Norway, Tor-Olav.Naevestad@toi.no

² Department of Transportation Planning and Engineering, National Technical University of Athens, Zografou Campus, Iroon Polytechniou 5, GR-15773, Athens, Greece, alaiou@central.ntua.gr

³ Department of Transportation Planning and Engineering, National Technical University of Athens, Zografou Campus, Iroon Polytechniou 5, GR-15773, Athens, Greece, geyannis@central.ntua.gr

Abstract

Focus on paternalistic values versus individual freedom is a fundamental theme, which defines the status of road safety in different settings. The present study examines the role of values related to freedom to take risk in traffic in road safety culture (RSC) based on survey data from car drivers and (n=882) motorcycle riders (n=330) from two countries with distinctly different road safety records: Norway, which had the lowest road mortality rate in Europe with 20 road deaths per million inhabitants in 2017, and Greece, which had 69 road deaths per million inhabitants, which was well above the EU average of 50. In line with our first hypothesis, we find that the Greek drivers and riders value freedom to take risk in traffic higher than drivers and riders from Norway. We suggest that this is due to a lower focus on individual freedom to take risk in traffic (and higher acceptance of paternalistic measures) among the Norwegian respondents, as this country has adopted Vision Zero, has the highest road safety level in Europe and presumably the most comprehensive regulations of drivers' freedom. In line with our second hypothesis, we find that motorcycle riders in both countries value freedom to take risk in traffic significantly higher than car drivers in their country. Regression analyses indicate a relationship between higher valuation of freedom to take risk in traffic and risky rider behaviors, which are related to accident involvement. Our results indicate that values focusing on freedom to take risk have an important role in RSC, presumably legitimizing and motivating risky driving. This is in line with previous research, where riders cite freedom as the main enjoyment factor for riding. Previous studies find six times higher accident risk among riders than drivers, which is explained partly by pointing to risky rider behaviours.

Keywords: road safety culture, values, motorcycles, Vision Zero, Norway, Greece

¹ * Corresponding author. Tel.: 0047 95 14 73 26
E-mail address: ton@toi.no

1. Introduction

1.1 Background

National focus on paternalistic values versus individual freedom is a fundamental theme, which defines the status of road safety in different countries [1]. Elvebakk [1] points out that paternalistic measures force people to do something for their own sake, which they might not have chosen to do themselves, if they had not been “forced” to do so. The balance between individual freedom and state intervention, or “paternalism” is largely a political (ideological) and cultural issue, and increased road safety is often a result of increased paternalism and less individual freedom for road users. Moeckli and Lee (2007) link for instance the relatively low level of road safety in the United States to the American values of individualism, self-realization and freedom (to take risk in traffic). Correspondingly, the risk of road fatalities per million population is twice as high in the US, as the European average (WHO 2018). This indicates that there might be a link between cultural values involving acceptance for paternalistic measures, low focus on individual freedom to take risk in traffic and road safety.

Road safety culture is a relatively new analytical concept, and although there are no commonly accepted definitions of road or safety culture [4] several of the existing definitions include values and attitudes [2,5]. We define road safety culture (RSC) as shared values and attitudes signifying what is important (e.g. safety, mobility, respect, politeness), shared norms prescribing certain road safety behaviours, and thus shared patterns of behaviour and shared expectations regarding the behaviours of others [6]. Values and attitudes legitimize and motivate road user behaviours and the norms prescribing behaviours [7,8,9].

The current study examines values related to freedom to take risk in traffic (i.e. the opposite of paternalism). The Cambridge Dictionary defines freedom as “The condition or right of being able or allowed to do, say, think, etc. whatever you want to, without being controlled or limited”² When applied to traffic and road safety, individual freedom concerns the right to “act as you want” (i.e. take risks) without being controlled or limited. This may apply to e.g. drivers’ speeding in traffic, driving without using seat belt, driving when drunk etc. Although individual freedom is a crucial value in Western democracies, road users’ individual freedom to take risk in traffic is restricted in several ways. The road safety progress in Western countries in the last decades is closely related to measures limiting individuals’ freedom to take risk in traffic, e.g. limiting speed, enforcing seat belt use [2].

The present study examines the role of individual freedom values in RSC based on survey data from car drivers and motorcycle riders from two countries with distinctly different road safety records: Norway, which had the lowest road mortality rate in Europe with 20 road deaths per million inhabitants in 2017, and Greece, which had 69 road deaths per million inhabitants, which was well above the EU average of 50 [10]. We hypothesize a lower focus on individual freedom to take risk among the Norwegian riders and drivers, as this country has adopted Vision Zero, has the highest road safety level in Europe and presumably the most comprehensive regulations of drivers’ freedom (Hypothesis 1). Previous research indicates that there seems to be a link between cultural values involving high focus on individual freedom to take risk in traffic, risky behaviours and low road safety [1] Nævestad et al [6] has found such relationships, comparing car and bus drivers in Norway, Greece and Israel.

Additionally, we hypothesize a higher focus on individual freedom to take risk among motorcycle riders across countries (Hypothesis 2). There are two main reasons for this. First, many riders cite freedom as the main enjoyment factor of riding [11]. In a survey directed to motorcycle riders, Broughton [11] asks respondents to provide their main reasons for liking motorcycle riding. Freedom, was the most common reason for riding, followed by riders’ sense of belonging to ‘the biking, community’, the convenience of riding a powered two wheeler, while excitement was listed as the fourth reason. Second, previous studies find higher accident risk among riders than drivers [12, 13]. In Norway, the accident risk of motorcycle riders is six times that of car drivers [12] The generally higher risk also applies internationally [13]. The higher accident risk of motorcycle riders is explained partly by pointing to risky rider behaviours, e.g. over speeding [12,13]. Cars and motorcycles are different in several additional respects, e.g. related to physical vulnerability [14]. Moreover, previous research also indicates that motorcycle riding more often than car driving is related to identity, and that those in the group with which one rides represent an important source of social influence [15]. Thus, it is not unreasonable to expect the existence of common road safety values related to individual freedom to take risk in traffic among motorcycle riders and a common motorcycle RSC, extending across countries.

We hypothesize that there is a relationship between motorcycle riders’ valuation of freedom to take risk, risk taking and accident risk. Based on previous research [7,8,9,16], we hypothesize that the influence of RSC values on road

² <https://dictionary.cambridge.org/dictionary/english/freedom>

safety behaviors generally is mediated analytically through attitudes, as they are more specific. While, values refer to desirable goals, and transcend specific actions and situations, attitudes focus on specific phenomena. Attitudes can be defined as a summary evaluation of an entity with some degree of favour or disfavor [16]. Thus, while freedom to take risk in traffic may represent a general RSC value, more specific attitudes may be related to specific types of risk taking, e.g. speeding, non-use of seat-belt and driving under the influence. According to Gehlert et al [4], attitudes consist of a cognitive, an affective and a behavioural component. If we take attitudes to driving under the influence as an example, the cognitive component contains thoughts and ideas that a person holds about this (“it is dangerous”), the affective component consists of feelings and emotions concerning driving under the influence (“it is morally despicable”) while the behavioural intention component concerns the practical implications (“I will never do it”). These issues are also discussed in detail in Nævestad et al [6].

1.2 Objectives

The objectives of the study are to: 1) Compare the values/attitudes related to individual freedom to take risk among car drivers and motorcycle riders in Norway and Greece, 2) Examine the factors influencing values/attitudes related to individual freedom to take risk in these groups, 3) Examine the relationship between values/attitudes, risky driving and accident involvement, and 4) Discuss whether values/attitudes can be influenced in an attempt to increase road safety.

2. Methodology

2.1 The Safe Culture project

The study was conducted within the research project “Safety culture in private and professional transport: examining its influence on behaviours and implications for interventions”, undertaken by the Institute of Transport Economics of Norway (TOI) in cooperation with the National Technical University of Athens (NTUA). Results from this project focusing only on bus drivers in Norway and Greece have been presented in Nævestad et al [18] and results from both professional and private drivers in Norway and Greece have been presented in Nævestad et al [17]. The present study builds on and takes further a previous paper, focusing only on riders and drivers in Greece [19]. The purpose of the previous study was to compare road safety behaviours and road safety culture across five geographical regions in Norway and Greece. The previous study did not focus on road safety values/attitudes among the studied groups, as the current study does.

2.2 Recruitment of respondents

The study is based on survey answers from car drivers and motorcycle riders in Norway and Greece (cf. Table 1). The Norwegian car drivers were recruited through the Preference Database of the Norwegian Postal Service. In September 2017, e-mails with web-links to the survey were sent to people in three Norwegian counties, including the capital Oslo. Counties were selected based on differences in accident risk and attitudes. Of the 45,452 people who received the e-mail, 6,727 people (14.8%) opened the e-mail, and 645 (9.6%) completed the survey. The Norwegian motorcycle riders were recruited with the help of the Norwegian motorcycle union, which distributed the survey link to its members in Oslo and the two counties. To increase response rates, Norwegian respondents were informed that they could participate in a draw for a present card of 2,000 NOK, if they wanted to. The Greek car drivers and motorcycle riders were recruited through a marketing research company in Greece, which was under the scientific supervision of researchers from the NTUA. Recruitment of drivers in Greece was also difficult, therefore, it was decided to approach candidates in person and further explain the scope of the survey. This helped eliminate their doubts and fears about confidentiality and about the use of the information they would provide. Respondents in Greece were sampled from two different areas: the capital Athens and a Greek island.

When comparing motorcycle riders in Norway and Greece, it is important to note that powered two wheelers (PTWs), i.e. mopeds and motorcycles are common in Southern European countries. In comparison, motorcycle riding is generally a seasonal (summer) activity in Norway, which often is related to leisure [13]. Based on this, we may expect that the purpose of the motorcycle trips in Norway and Greece often may be different (e.g. leisure vs. practical daily transport), that the average rider characteristics (e.g. age, gender) are different, and that the types of motorcycles are different (e.g. larger and more powerful motorcycles in Norway vs smaller and more flexible motorcycles in Greece). To make the motorcycle rider samples as comparable as possible, we have only included motorcycle riders from both countries, and not riders of PTWs in general (i.e. mopeds are not included).

2.3. Survey Themes

Background variables. Both surveys among car drivers and motorcycle riders included questions on background variables like age, experience as a driver, gender, kilometers driven with a car, or motorcycle in the last two years, how often respondents drive/ride, what kind of car or motorcycle they drive/ride and respondents’ education.

Values/attitudes: The survey includes three questions on individual freedom to take risk in traffic. These questions are partly based on Elvebakk et al [20], and measure attitudes that we hypothesize to reflect underlying values related to road safety. Previous factor analyses [18] using these questions have indicated a “freedom to take risk factor”, comprised of three questions: 1) Road users should be able to choose risky activities in traffic, as long as they do not expose other to risk, 2) A skilled person can take more risks than others, 3) Road users know best themselves how they should behave in traffic. These questions were combined into an index (min=3, max=15). (Cronbach’s Alpha: .526) In previous studies, we have also included a scale measuring paternalistic values [6,17] but we concluded that this scale measures attitudes to national road safety measures, and not attitudes which are related to behaviours. For that reason we only included the scales measuring individual freedom to take risk in the present study.

Descriptive norms. Shared (descriptive) norms are one of the key elements in our definition of RSC. Descriptive norms refer to individuals’ perceptions of what other people (in the relevant reference group) actually do [21]. We measure descriptive norms by means of seven questions, based on the Driver Behaviour Questionnaire (DBQ) items [24]. Respondents were asked: “When driving in my country, I expect the following behaviour from other drivers:” 1) “That they sound their horn to indicate their annoyance to another road user”, 2) “That they become angered by a certain type of driver and indicate their hostility by whatever means they can”, 3) “That they overtake a slow driver on the inside”, 4) “That they drive when they suspect they might be over the legal blood alcohol limit”, 5) “That they drive without using a seatbelt”, 6) “That they disregard the speed limit on a motorway road”, and 7) “That they disregard the speed limit on a residential road”. Five answer alternatives ranged between 1 (non-very few) and 5 (almost all/all). The 7 items were combined into a descriptive norms index (Cronb.’s Alpha: .897).

Road safety behaviours are measured by means of ten items taken from the DBQ. The DBQ answer alternatives have been changed from relative to absolute alternatives (e.g., Question: “For every ten trips, how often do you ...?”, Alternative answers: “Never”, “Once or twice”, “Three or four times”, “Five or six times”, “Seven or eight times”, “More than eight times but not always”, “Always”). The behaviours are: “Disregard the speed limit on a residential road”, “Disregard the speed limit on a motorway road”, “Pull out of a junction so far that the driver with right of way has to stop and let you out”, “Drive when you suspect you might be over the legal blood alcohol limit”, Drive without using a seat belt/helmet?”, “Race away from traffic lights with the intention of beating the driver next to you”, “Sound your horn to indicate your annoyance to another road user”, “Become angered by a certain type of driver and indicate your hostility by whatever means you can”,

“Become angered by another driver and give chase with the intention of giving him/her a piece of your mind” and “Overtake a slow driver on the inside”. These were combined into an index (Cronbach’s Alpha: .855).

Accidents. We report results for one question on respondents’ crash involvement while driving in the last two years, with four answer alternatives: 1) no, 2) yes involving property damage, 3) yes, involving personal injuries, 4) yes, involving fatal injuries.

2.4 Analysis

When comparing the mean scores of different groups, one-way Anova tests, which compare whether the mean scores are equal (the null hypothesis) or (significantly) different are used. Tukey post-hoc tests are conducted. Three regression analyses have been conducted. In the first analysis, the factors predicting respondents’ scores on the freedom to take risk variable are analysed. In the second analysis, factors predicting respondents’ risky driving are analysed. Linear regression analyses are used in the two first analyses. In the third regression analysis, the factors predicting respondents’ answers on a dependent variable measuring accident involvement are analysed. Logistic regression analysis is used in this analysis, as the dependent variable has two values (no=1, yes=2). Odds ratios are presented, and they indicate whether the odds of accident involvement are reduced or increased, when the independent variables increase with one value. Of course, it is impossible to conclude about causality, as this is a cross-sectional and correlational study. The term predict is nevertheless used when the regression analyses are described.

3. Analysis and Results

3.1 Description of the sample

Respondents from Norway generally are older than the respondents from Greece, especially the motorcycle riders: 44% of the Norwegian car drivers were 46 years or older in, while 72% of the motorcycle riders was. Corresponding shares for Greek respondents were 42% and 29%. The differences in riders’/drivers’ experience are in accordance with the age differences. Over half of the riders and drivers in Norway had over 20 years of experience, while the corresponding shares in the Greek sample were 25% and 37%.

Table 1 provides a distribution of drivers/riders in in Norway and Greece, including the proportion of males.

Table 1 Distribution of drivers/riders in Norway and Greece, including the proportion of males.

Country	N	%	Males (%)	Mode	N	%	Males (%)
Norway	733	61%	66%	Car	596	49%	59%
				MC	137	11%	94%
Greece	479	39%	72%	Car	286	24%	64%
				MC	193	16%	85%
Total	1212	100	68%		1212	100%	68%

3.2 Values/attitudes related to paternalism and individual freedom

The first aim of the study is to compare the values/attitudes related to individual freedom to take risk among car drivers and motorcycle riders in Norway and Greece. We made an index comprised of the sum scores of the three questions measuring individual freedom (min=3 points, max=15 points) (Cronbach's Alpha= .526). Table 2 compares mean scores on this index among car drivers and motorcycle riders in the two countries.

Table 2 Mean scores on the index for individual freedom to take risk in traffic among car drivers and motorcycle riders in the two countries.

	Individual freedom		
	Mean	Number	S.D.
Norway Car	6.4	596	2.5
Norway MC	7.5	137	2.8
Greece Car	6.9	286	2.4
Greece MC	7.8	193	2.6
Norway	6.6	733	2.6
Greece	7.2	479	2.5
Car	6.6	882	2.5
MC	7.7	330	2.7

Post-hoc tests (Tukey) were conducted to examine whether the differences between the mean scores were significantly different on the individual freedom scale, using one-way ANOVA. The main result is that the mean scores of motorcycle riders in both countries on the freedom to take risk are relatively similar ($p=.788$). This indicates shared values related to freedom to take risk in traffic among riders across countries. The mean scores between riders and drivers in each country on the freedom to take risk in traffic index were significantly different ($P=0.001$). These results are in accordance with Hypothesis 2.

The mean scores on individual freedom were significantly different at the 10% level between the car drivers in the countries ($p=.069$). Table 2 indicates a somewhat higher score on the freedom to take risk in traffic index among the Greek riders and drivers, compared with the Norwegian respondents. When we compare country samples, we see a significantly higher score (0.6 points) among the Greek riders and drivers ($p=.001$), although only the difference between the car drivers was significantly different, and only at the 10%-level. This provides some support to Hypothesis 1. The significant ($p=0.001$) difference between car drivers and motorcycle riders (1.1 points) on the freedom to take risk index is nearly twice as big the difference between countries. Thus, our data particularly supports Hypothesis 2, indicating the importance of transport mode (car vs. MC) over country when it comes to freedom to take risk in traffic.

3.3 Factors influencing values/attitudes

The second aim of the study is to examine the factors influencing values/attitudes related to individual freedom to take risk in traffic in these groups. In Table 3 we show results from a regression analysis, where we examine independent variables influencing respondents' attitudes when it comes to freedom to take risk in traffic.

The analysis in Table 3 indicates that five variables contribute significantly to attitudes focusing on freedom to take risk. Gender and age contributes negatively, which means that women and older driver focus less on drivers' freedom to take risk in traffic. Greek nationality contributes positively meaning that Greek drivers focus more on drivers' freedom to take risk in traffic. This is in accordance with hypothesis 1. Additionally, we see that the variable car-motorcycle contributes positively and significantly, indicating that motorcycle drivers focus more on freedom to take risk in traffic. This is in accordance with Hypothesis 2. The variable "Authority focus on road safety" measures whether respondents perceive that road safety is a clear priority of authorities in their

respective countries. The variable contributes negatively, indicating that respondents who perceive that the authorities in their country have road safety as a clear priority, focus less on freedom to take risk in traffic.

Table 3 Linear regression. Dependent variables: “Freedom to take risk in traffic” beta coefficients.

Variables	Individual freedom
Gender (Male=1, Female=2)	-.112***
Age	-.127***
Nationality (Norwegian=1, Greek=2)	.153***
Car-MC (Car=1, MC=2)	.124***
Authority focus on road safety	-.073***
Descriptive norms	-.196***
Education	-.080***
Adjusted R ²	.091

* $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$

We also see a significant and negative relationship between descriptive norms and focus on freedom to take risk in traffic. This means that respondents who report lower levels of road violations among other drivers in their country value freedom to take risk less than those who report higher levels of road violations among other drivers in their country. This applies to Greek respondents; whose score is significantly higher on this index (18 points versus 11 points for the Norwegian respondents ($p=0.001$)). This means that Greek respondents report riskier driving among other drivers in their country. Finally, education contributes significantly and negatively, indicating that the higher levels of education respondents have, the lower they value freedom to take risk in traffic. Finally, the adjusted R² value indicates that the model explains 9% of the variation in the dependent variable.

3.4 Relationships between values/attitudes, risky driving and accident involvement

The third aim of the study is to examine the relationship between values/attitudes, risky driving and accident involvement. Table 4 shows the results of a regression analysis with “Risky driving” as the dependent variable. This is a variable comprised of 10 DBQ items, e.g. over speeding, driving under the influence, aggressive violations, driving without helmet/seat belt etc. Norwegian respondents score 15.6 point, while the Greek score 20.2 points ($p=.001$). This means riskier driving in the Greek sample, than in the Norwegian sample. Car drivers score 16.7 points, while the motorcycle riders score 19.1 points ($p=.001$). This means riskier driving among the motorcycle riders than the car drivers.

Table 4: Linear regression. Dependent variable: “Risky driving” Standardized beta coefficients.

Variables	Individual freedom
Gender (Male=1, Female=2)	-.146**
Age	-.063**
Nationality (Norwegian=1, Greek=2)	-.012
Car-MC (Car=1, MC=2)	.044*
Descriptive norms	.488***
Freedom to take risk in traffic	.109***
Adjusted R ²	.290

* $p < 0.1$ ** $p < 0.05$ *** $p < 0.01$

Table 4 indicates that demographic background variables like respondents’ gender and age contributes significantly and negatively. This means that older drivers and female driver are involved in less risky driving. We also see that the Car-MC variable contributes positively and significantly at the 10% level, indicating somewhat riskier driving among motorcycle riders, controlled for the other variables. The variable “Descriptive norms” contributes positively and significantly, indicating that the riskier driving respondents attribute to other drivers in their country, the riskier behaviours they are involved in themselves. The variable “Freedom to take risk in traffic” also contributes significantly and positively indicating that the more respondents value freedom to take risk, the riskier behaviours they are involved in themselves, controlled for the other variables in the model. Finally, the adjusted R² value indicate that the model explains 29% of the variation in the dependent variable.

We also examine the factors influencing accident involvement, in accordance with the third aim of the study. We calculate respondents’ risk based on estimated million kilometres (kms) driven in the last two years with car or motorcycle, and the share of respondents who answered that they had experienced an accident (minimum property damage) in the last two years. As expected, we see a higher risk for motorcycle riders, and generally a higher risk for riders and drivers in Greece than in Norway. The accident risk for car drivers in Norway was 4.4 accidents per million kms, while the corresponding risks for Norwegian riders was 11.9, while it was 7.9 for Greek drivers and

14.3 for Greek riders (cf. [19]). A logistic regression analysis was conducted with accident involvement as the dependent variable. This is shown in Table 5.

Table 5: Logistic regression. Dep. variable: Accident involvement. Odds ratios. (No accident: 0, Accident: 1)

Variables	Individual freedom
Age	.969
Nationality (Greek=0, Norwegian=1)	.523***
Car-MC (MC=0, Car=1)	.913
Mileage	1.003
Risky driving	1.023**
Incidents	.339***
Freedom to take risk	.991
Nagelkerke R ²	.092

* p < 0.1 ** p < 0.05 *** p < 0.01

First, nationality contributes significantly to accident involvement, controlled for the other variable in the analysis. The value indicates that being Norwegian involves lower odds of being involved in an accident, controlled for the other variables in the analyses. Second, risky driving contributes significantly to drivers' and riders' accident involvement. This means that the more involved riders and drivers are involved in risky driving, the higher are the odds of accidents. The variable "Incidents" also contribute significantly. This refers to "near misses" in the last two years for riders, which is defined as situations where the riders or others have had to break and/or turn heavily to avoid collision. For drivers, this refers to situations where they have dented or scratched their car, or touched an object (wall, post etc). Surprisingly, experiencing such incidents is related to lower odds of accidents. The Nagelkerke R² value indicates that 9% of the variation in respondents' accident involvement is explained by the model.

4. Discussion

4.1 Values/attitudes among motorcycle riders and car drivers across countries

The first aim of the study was to compare the values/attitudes related individual freedom among car drivers and motorcycle riders in Norway and Greece. We hypothesized a lower focus on individual freedom to take risk among the Norwegian riders and drivers, as this country has adopted Vision Zero, has the highest road safety level in Europe and presumably the most comprehensive regulations of drivers' freedom (Hypothesis 1). Our results partly supported this hypothesis, as we found significantly lower scores on the freedom to take risk index among Norwegian respondents. This is in line with previous research, indicating a relationship between cultural values involving high focus on individual freedom to take risk in traffic, risky behaviours and low road safety [1].

We hypothesized a higher focus on individual freedom to take risk among motorcycle riders across countries (Hypothesis 2), as many riders cite freedom as the main enjoyment factor or riding [11], and as previous studies find six times higher accident risk among riders than drivers, which is explained partly by pointing to risky rider behaviours, e.g. speeding [12,13]. The difference between the mean scores of motorcycle riders across countries was not significant, indicating a shared valuation of freedom to take risk among motorcycle riders across countries, which was higher than that of car drivers. The difference between riders and drivers were nearly twice as big as the difference between countries. Thus, our data particularly supports Hypothesis 2, indicating the importance of transport mode over country when it comes to freedom to take risk in traffic.

4.2. Factors influencing values/attitudes related to individual freedom

The second aim of the study was to examine the factors influencing values/attitudes related to individual freedom in the studied groups. In these analyses, we controlled for several variables. Results indicated e.g. that women and older driver focus less on drivers' freedom to take risk in traffic. In accordance with the comparisons of means, we saw that Greek drivers focus more on drivers' freedom to take risk in traffic (cf. Hypothesis 1), and that motorcycle drivers focus more on freedom to take risk in traffic (cf. Hypothesis 2). These results also apply when controlling for several variables related to the individual (e.g. age, gender) and national level (e.g. authorities' focus on road safety).

4.3 Relationships between values/attitudes, risky driving and accident involvement

The third aim of the study was to examine the relationship between values/attitudes, risky driving and accident involvement. Our results generally indicate relationships between values/attitudes related to freedom to take risk and the risky driving of the respondents, which subsequently was related to respondents' accident involvement.

We conducted a regression analysis with a ten-item “Risky driving” variable as the dependent variable. Results indicated that the more respondents value freedom to take risk, the riskier behaviours they are involved in themselves. Based on previous research [7,8,9], we assume that RSC is comprised of relatively abstract values (e.g. “freedom to take risk in traffic”) and more specific attitudes (e.g. “I can take risk in traffic as long as I do not expose others to danger”), and that the more specific attitudes are related to risky behaviours (e.g. “I exceed speed limits on motor way roads”, “I drive without a helmet”, “drive without using seat belt”). These are the relationships that we have measured in the present study. Based on previous research, we assume that RSC values influence road safety behaviours through attitudes, and more specifically the cognitive, affective and behavioural intention modes of attitudes [7,8,9,16].

Descriptive norms also contributed significantly, as indicated in our previous research [17,18,19]. This means that the level of driver violations respondents expected from other drivers in their countries, were related to their own reported levels of road violations. Descriptive norms may influence behaviour by providing information about what is normal and expected in certain groups [21]. Descriptive norms provide information about what is normal and expected among other drivers in the country, or the transport mode of the respondents (e.g. among motorcycle riders) [21]. Thus, based on Cialdini et al [21], we may hypothesize that the mechanism explaining the relationship between RSC and road safety behaviours is subtle social pressure to behave in accordance with “what is normal” in your primary reference group [17-19]. In our multivariate analyses, we see relationships between descriptive norms among the respondents in the different groups (i.e. the level national level of risky driving) and the risky driving of the respondents. To conclude, our research indicates that RSC is made up by at least the following key elements: shared values/attitudes, descriptive norms and shared patterns of behaviours. We find systematic relationships between these elements, and we also find that the shared patterns of behaviours (i.e. risky driving) are related to accident involvement.

4.4. Are values/attitudes related to freedom to take risk a cause or result of risky behaviours?

We have explained how we assume that values precede road safety behaviours above. However, with our cross-sectional research design, we do not know the extent to whether values actually precede actions, or whether it is the other way around. It is thinkable that people with risky driving behaviours, adapt their more or less espoused values related to their behaviours, to justify or legitimize their own risky driving. This would mean that values do not necessary precede actions, but that they follow actions, and that their rationale or role is to legitimize and justify this behaviour. Although it may be difficult to conclude about this, we may conclude that this discussion may be less relevant. No matter how values have come into place, this discussion indicates that the an important role of RSC values may be to legitimize and motivate road safety behaviours, whether they come before or after behaviours in the first place Below, we will delve more into the discussion of how RSC values come into place.

4.5 Can values/attitudes be influenced?

The fourth aim of the study was to discuss whether values/attitudes can be influenced in an attempt to increase road safety. We have found a relationship between values related to freedom to take risk and risky driving among motorcycle drivers across countries and Greek drivers and riders. As RSC values motivate and legitimize road safety behaviours, we may assume that if we are able to change the values, it will lead to less risky driving in the groups that have the highest valuation of freedom to take risk and the highest levels of risky driving. Following this conclusion, it is relevant to ask how RSC values come about and specify these mechanisms in order to be able to influence them. Some scholars distinguish between different cultural levels, generally referring to deep and shallow levels (e.g. [22,23]). Schein [22] provides the most well-known depiction of cultural levels. He divides organizational culture into three analytical levels. The deepest, most important level is taken-for-granted, basic assumptions that influence what we pay attention to, what things mean, how we react emotionally and how we act. Basic assumptions generate espoused values, which refer to explicit strategies, goals and philosophies. Espoused values generate artefacts (physical, verbal and actions), which represent the most shallow level of organizational culture. These are easy to discern, but hard to decipher, as Schein [22] puts it. In a similar fashion, Haukelid [23] discerns between three cultural levels: the linguistic level, a more tacit and taken for granted level and a more basic philosophical or epistemological level, where culture is considered a prerequisite of knowledge. These examples indicate that RSC values seem to reside in the deeper cultural levels, meaning that they may be hard to discern, and change, as they to some extent may be taken for granted and implicit. Values may however also be espoused, but such values may also be in conflict with taken for granted values [23].

Additionally, values are often parts of more comprehensive RSC, where they may play an important role in a larger cultural picture. For instance, freedom plays a crucial role in the American culture, and this is coupled to freedom to take risk in traffic [2], and a lower road safety level than e.g. in Europe [3]. Additionally, freedom might be said to play a similar crucial cultural role in an overarching motorcycle culture. As indicated by the research of Broughton [11], freedom, was the most common reason for riding, reported by motorcycle rider respondents. In

our study, as in previous research, this was related to higher levels of risky road behaviours, and a higher accident risk than among car drivers [12,13]. In these cultural settings, values play an important ideological role, they are also related to identity, behaviours, and presumably also resistance against state interventions and paternalistic measures limiting the freedom to take risk. Thus, these examples illustrate that the importance and role of values in specific cultures may also influence how easy it is to change or influence them. Broughton [11] concludes that freedom is the main reason provided by motorcycle riders, indicating that this is a primary value. To use the example of RSC in the US again, freedom is mentioned as a crucial American value, also influencing American RSC [2]. This culture and its valuation of freedom has limited seat belt laws, helmet wearing laws and other paternalistic measures in the US. These examples illustrate the pervasiveness of cultural values, and how difficult it may be to change them.

Nevertheless, we may assume that values may change in different sociocultural contexts, e.g. countries and subgroups of road users. In the present study, we have examined factors influencing respondents' valuation of freedom to take risk in traffic, and found out that this was influenced by both factors at the individual level (gender, age, education) and factors at the state level (e.g. authorities' focus on road safety). Based on the latter, it is conceivable that road safety policies, e.g. the implementation of Vision Zero in Norway has influenced Norwegian road safety values. This might be seen as a successful example of cultural engineering, and/or an example of an innovative policy developed in an already paternalistic RSC. Vision Zero is both a moral value and vision and a comprehensive set of paternalistic road safety measures limiting drivers' freedom to take risk. Perhaps similar efforts can be introduced to influence RSC values among motorcycle riders. Future research should examine factors influencing road safety values both at the national level and among sub groups of road users, e.g. motorcycle riders.

Another interesting issue is whether values should be a target for interventions at all. As values are relatively abstract, often implicit and "taken for granted", it might be more practically feasible to attempt to influence attitudes related to concrete activities (e.g. speeding, helmet wearing). In practice, this would mean whether it is possible to influence the cognitive and affective components of attitudes related to specific types of risky behaviour, in manners which influences the behavioural intentions.

4.6 Methodological limitations and questions for future research

The recruitment of respondents, motivational measures and administration of the surveys were different in the two countries (cf. Section 2.2). This is a potential methodological weakness of the study which is important to bear in mind when interpreting the results. When interpreting the results, drawing inferences about differences between the RSCs in the countries and between car drivers and motorcycle riders, it is also important to remember that the national samples are relatively small, and that respondents may not be representative of the respective national populations of car drivers and motorcycle riders. Thus, future studies could involve larger samples, especially for the motorcycle riders. It is also important to remember that the population of motorcycle riders is far more heterogeneous than we have been able to communicate and examine in the present study. This is an important issue for future research, focusing on RSC, including values. This research should also focus on the potential existence of different cultural values in different cultural subgroups of motorcycle riders, and the factors influencing these values. Additionally, the attitudes we have used to measure freedom to take risk are rather general, and this indicates an important area for future research: perhaps more specific attitudes are more strongly related to risky behaviours, and thus more important for road safety. Finally, it is important to remember that the road safety contexts in Norway and Greece are very different, and comprised by several unique factors influencing RSC. Nævestad et al [17] hypothesize that national RSCs in the two countries are influenced by: (1) interaction, (2) infrastructure, (3) enforcement, (4) education, (5) road user composition, and (6) perhaps also the financial crisis.

5. Conclusions

Results indicate that riders in both countries value freedom to take risk in traffic significantly higher than drivers in their countries. This indicates shared RSC values among motorcycle riders across countries, focusing on freedom to take risk in traffic. Regression analyses indicate a relationship between higher valuation of freedom to take risk in traffic and risky rider behaviors, which are related to accident involvement. Although it may be hard to conclude whether motorcycle riders' higher accident risk than car drivers is a result of their appreciation of freedom to take risk, we see a pattern involving higher valuation of freedom to take risk, and higher levels of risk taking, which is related to higher risk of accidents. Our results indicate that values focusing on freedom to take risk have an important role in RSC, presumably legitimizing and motivating risky driving. Our discussion also indicates that values may have crucial importance in RSC, making them hard to influence in order to improve road safety. We hope that our discussion has pointed to some fruitful ways of approaching this in the future. The present

study provides a unique contribution to the literature on road safety culture, as there are few other studies focusing on the role of values in RSC, and how they influence road safety behaviours and accident involvement.

Acknowledgment

This research was funded by the Norwegian Research Council's Transport 2025 program, Grant number 250298.

References

1. Elvebakk, Beate (2015). Paternalism and acceptability in road safety work. *Safety Science*, vol. 79, p. 298- 304
2. Moeckli, J., & Lee, J. D. (2007). The making of driving cultures. In AAA (Ed.), *Improving road safety culture in the United States – The journey forward* (pp. 59–76). Washington, DC: AAA.
3. WHO (2018). <https://www.who.int/news-room/fact-sheets/detail/road-traffic-injuries>
4. Edwards, J., J. Freeman, D. Soole, B. Watson (2014) A framework for conceptualising road safety culture, *Transportation Research Part F: Traffic Psychology and Behaviour*, Vol, 26, Part B, p. 293-302
5. Lonero, L. (2007). Finding the next cultural paradigm for road safety. In AAA (Ed.), *Improving road safety culture in the United States – The journey forward* (pp. 1–20). Washington, DC: AAA.
6. Nævestad A. Laiou, T. Rosenbloom, G. Yannis(2021) The role of values in road safety culture: Examining the valuation of freedom to take risk, risk taking and accident involvement in three countries, *Trans. Res. PartF*.
7. Seymer (2013) VALUES AND POLITICAL ATTITUDES: A SYSTEMATIC AND EMPIRICAL REVIEW OF A SIMPLE (?) ASSOCIATION, DISSERTATION, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE, DOCTOR OF PHILOSOPHY, FACULTY OF CULTURAL AND SOCIAL SCIENCES OF THE UNIVERSITY SALZBURG,
8. Gehlert, T. Carmen Hagemester, Türker Özkan, (2014) Road safety climate attitudes of road users in Germany, *Transportation Research Part F: Traffic Psychology and Behaviour*, Volume 26, Part B,
9. Kaçan, B. Gizem Findık, Yeşim Üzümcüoğlu, Derya Azık, Gaye Solmazer, Özlem Ersan, Türker Özkan, Timo Lajunen, Bahar Öz, Anton Pashkevich, Maria Pashkevich, Vassiliki Danelli-Mylona, Dimitra Georgogianni, Ema Berisha Krasniqi, Muhamed Krasniqi, Evangelos Makris, Ksenia Shubenkova, Gentianë Xheladini, (2019) Driver profiles based on values and road safety climate and their relationships with driver behaviors, *Transportation Research Part F: Traffic Psychology and Behaviour*, Volume 64, 2019, Pages 246-259,
10. European Transport Safety Council (ETSC 2018). RANKING EU PROGRESS ON ROAD SAFETY, 12th Road Safety Performance Index Report. June 2018. Available online: https://etsc.eu/wp-content/uploads/PIN_AR_2018_final.pdf
11. Broughton, P.S. (2005). Designing PTW Training to Match Rider Goals. *Second International Conference in Driver Behaviour and Training*, Edinburgh.
12. Bjørnskau, T., Nævestad T.-O., & Akhtar M.J. (2012) Road safety among motorcyclists in Norway: A study of subgroups and risk factors, *Accident Analysis & Prevention*, Vol. 49, November 2012, 50-57
13. DaCoTA (2012). Powered Two Wheelers. Deliverable 4.8n of the EC FP7 project DaCoTA.
14. Rowden et al (2016). Motorcycle riders' self-reported aggression when riding compared with car driving, *Transportation Research Part F: Traffic Psychology and Behaviour*, Volume 36, 92-103.
15. Tunnicliff, D., Watson, B., White, K.M., Lewis, I., and Wishart, D. (2011). The social context of motorcycle riding and the key determinants influencing rider behaviour: A qualitative investigation. *Traffic Inj. Prev.* 12,
16. Ajzen, I. (2001). Nature and operation of attitudes. *Annual Review of Psychology*, 52, 27–58
17. Nævestad, T.-O., A. Laiou, R.O. Phillips, T. Bjørnskau, G. Yannis (2019) Safety Culture among Private and Professional Drivers in Norway and Greece: Examining the Influence of National Road Safety Culture, *Safety* 2019, 5(2), 20; Special Issue: Social Safety and Security
18. Nævestad, T.-O., Phillips, R. O., Laiou, A., Bjørnskau, T., & Yannis, G. (2019) Safety culture among bus drivers in Norway and Greece, *Transportation Research Part F* 64 (2019) 323–341
19. Nævestad, T.-O., Laiou, A., & Yannis, G. (2020) Safety Culture Among Car Drivers and Motorcycle Riders in Norway and Greece: Examining the Influence of Nationality, Region, and Transport Mode, July 2020, *Frontiers in Sustainable Cities* 2:23
20. Elvebakk, B, I. Storesund Hesjevoll, T. E. Julsrud (2016) På rett vei: Er myndighetenes trafikksikkerhetsarbeid ekspertstyring og paternalisme?, TØI rapport 1491/2016. 2016: Transportøkonomisk institutt.
21. Cialdini, R.B., Reno, R.R., and Kallgren, C.A. (1991). A focus theory of normative conduct: Recycling the concept of norms to reduce littering in public places, *Journal of Personality and Social Psychology* 58(6):
22. Schein, E. H. (2004): *Organizational Culture and Leadership*, Third Edition, San Francisco: Jossey-Bass
23. Haukelid, K. (2008): "Theories of (safety) culture revisited—An anthropological approach", *Safety Science*, Vol. 46/3, 413- 426
24. Reason, J.T.; Manstead, A.S.R.; Stradling, S.G.; Baxter, J.S.; Campbell, K. Errors and violations on the road: A real distinction? *Ergonomics* 1990, 33, 1315–1332