

Conceptualization of aggressive driving behaviors through a Perception of aggressive driving scale (PAD)



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ABSTRACT

Research on traffic safety has highlighted the importance of studying and intervening in aggressive driving in order to reduce crashes and accidents. The main objective of this work is to describe the perception of what people consider an aggressive behavior, and their perception of which are the most aggressive acts performed when driving. The sample was composed of 1079 Spanish drivers aged over 14. They participated in a national telephone survey, completing a questionnaire which gathered socio-demographic data and information on the drivers' profiles, containing a "Perception of aggressive driving Scale (PAD)". The unifactorial ANOVA test for repeated measures of the General Linear Model (GLM) with $\alpha = 0.05$ procedure was used for the comparison of mean values. Results show that drivers tend to make higher valuations regarding the aggressive character of the PAD ($M = 7.86$ $SD = 0.05$). The situation that most concerned Spanish drivers was "To produce damage to other people with some type of object or weapon" ($M = 9.47$ $SD = 0.05$), which does not necessarily correspond to the driving context. Differences in perception were found depending on socio-demographic variables. Women, drivers over 29 years old, low-middle social classes, and drivers who had suffered two accidents, tended to evaluate PAD as more aggressive. These findings suggest that differences in the perception of aggressive behaviors depend on social situations and on the driver's personal features. Finally, the findings of this research will help road safety researchers understand the concept of aggressiveness under different perspectives, and take into account the existing differences between dangerous and punishable behaviors. Moreover, these outcomes showed the necessity to deepen the research on those behaviors that Spaniards perceive as aggressive, and to develop knowledge on why the perception of aggressiveness changes according to the characteristics of the population, and how this perception is reflected in people's attitudes and behaviors towards road safety.

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1. Introduction

The human being is biologically predisposed to show aggressive behaviors of defense and attack that help them ensure survival (Lang & Bradley, 2013). Aggressiveness and violence are useful on certain occasions, but they sometimes lose their survival purposes and are directed against others, resulting in harm for other individuals as well as for society. This is the

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case of aggressive driving. This type of driving behaviors cannot be expected to be totally eradicated, but an attempt to make them less dangerous (for both drivers and traffic in general) is possible. Unquestionably, according to the studies and the references on this subject, we see that there is a real concern about the nature, the causes and the consequences of aggressiveness in driving, and especially about how this form of human aggressiveness is increasingly present in the field of road safety (Kováčová, Rošková & Lajunen, 2014; Shinar & Compton, 2004). Moreover, the occurrence of such behavior in the traffic field has also been related to a lack of road safety education, which is evident in most of the countries (Alonso, Esteban, Useche, & Manso, 2016c).

When we think of aggressive behavior in the driving scope, many inferences can be made depending on the subject or point of view that we employ to theorize and understand its meaning. In this regard, the National Highway Traffic Safety Administration [NHTSA] (2001) defines aggressive driving as: "...driving a motor vehicle endangering or likely to endanger persons or property". The Traffic Safety Committee of the New York State Governor's defines aggressive driving as "driving a motor vehicle in an unsafe and hostile manner, without respect (consideration) for other users" (Goehring, 2000). A progression of actions such as *speeding*, *zigzagging* or *unsafe overtaking* may endanger or be likely to endanger road users, and it could range from numerous illegal offenses to risky or aggressive driving behaviors which are not contemplated by the law. However, performing them does not necessarily imply a conscious attempt against the safety of others. Conversely, the British Automobile Association included as examples of aggressive driving behaviors: "*flashing*", *obscene gestures*, *deliberate obstruction of equipment*, *verbal abuse* or *strike*, and labeled these behaviors as defining of the *road rage* (Johnson, 1997). Some authors even report that *aggressive driving* and *road rage* are used as synonyms but, in order to make a distinction between them, we will say that *road rage* is associated with criminal behaviors punishable by law (Shinar, 1998).

Aggressive driving also includes frequent or unsafe lane changes, failing to signal, tailgating, failing to yield the right of way, and disregarding traffic controls (Miles & Johnson, 2003), and it is also related to processes such as fatigue (Alonso, Esteban, Useche, & López de Cózar, 2016b), personality traits (Jovanović, Lipovac, Stanojević & Stanojević, 2011) and stress (Oz, Ozkan & Lajunen, 2010; Taylor & Dorn, 2006).

Even though theoretical conceptualization is important, it is also essential to consider what aggressive driving represents for the target audience. Then, which behaviors do people consider representative of this kind of driving? Let's recall, for instance, the words of James and Nahl (2000): "most do not know what the law considers 'aggressive driving', or even know the law on 'aggressive driving' and when we discovered, may not agree on what the law considers 'aggressive'" (p.6). In this regard, Sarkar, Martineau, Emami, Khatib, and Wallace (2000), analyzed accidents involving what was considered "aggressive driving" by drivers. These authors took as a data source the recorded information from telephone calls made by drivers in San Diego, and thus obtained five categories used to classify aggressive behavior: (1) aggressive driving that involved speeding with other types of transgression, (2) incidents of reported weaving or cutting, or both, without any mention of speeding, (3) incidents that reported tailgating, (4) road rage and (5) speeding.

Moreover, Lajunen and Parker (2001) also attempted to establish which actions were perceived as the most aggressive by other drivers. This was done through a voluntary sample of British drivers which completed a self-report questionnaire that had been adapted from the scale originally developed by Deffenbacher, Oetting, and Lynch (1994). The results of this study indicated that drivers considered the following actions, when performed by other drivers, as the least likeable: "someone cuts in and takes the parking spot you have been waiting for", "someone is driving very close to your rear bumper", and "someone cuts in right in front of you on the motorway". Additionally, they measured the self-reported possible reaction to these behaviors, and "someone cuts in and takes the parking spot you have been waiting for" obtained the highest rate in leading aggressive responses.

On the other hand, aggressive driving is also studied from the perspective of the frustration-aggression model, which claims that every aggression is an outcome of frustration. In this model, aggression is understood as a "sequence of behavior, the goal-response to which is the injury of the person toward whom it is directed" (Dollard et al., in Shinar, 1998, pp. 138). As an example of what has just been said, Lajunen, Parker & Summala, 1999, explored the idea that aggressive behaviors could be associated with specific scenarios of frustration, such as the rush-hour driving. However, this study found a low correlation between exposition to bottlenecks and behaviors associated with aggressiveness.

As we see, the definitions and considerations of *aggressive driving* revolve around behaviors which can be observed within the phenomenon, but there is no agreement among researchers on what aggressive driving is. Anyway, despite the lack of a standardized concept of aggressive driving, we can currently count on many investigations with interesting proposals which have contributed to the decreasing of accidents.

As a result of what has just been said, we can state that there are at least three behavioral elements which have been categorized as aggressive driving: "(a) intentional acts of physical, verbal, or gestured aggression; (b) negative emotions (e.g., anger, frustration) while driving; and (c) risk-taking" (Dula & Geller, 2003, pp. 560). A huge range of research instruments and designs comes from this, and they are good examples of the existing variety within the consideration of aggressiveness.

Thus, nowadays, there are different instruments that allow researchers to obtain information on this topic and on each one of the separately-studied dimensions of aggression. Some of them focus on both how aggressiveness is reproduced, and how it is perceived (Alonso, Sanmartín, et al., 2002). These tools have been widely used and validated in different languages. They have focused on different concepts, such as in the case of the Driving Anger Scale (DAS) (Deffenbacher, et al., 1994), one of the most common measurements of anger in driving (Deffenbacher, Stephens & Sullman, 2016); the Driver Vengeance Questionnaire, which assesses aggressiveness in driving focusing on revenge (Hennessy & Wiesensthal, 1999, 2002); and the Aggressive Driving Scale (ADS) which focuses on observable behaviors only (Krahe & Fenske, 2002), among many others.

Even though those instruments and questionnaires are valuable tools for researching in road safety, we need to point out two limitations associated with their use. First, the conceptualization problems that we have already mentioned above. And second, translation challenges, especially when the instruments are used in a linguistically different population (Yu, Lee & Woo, 2004). Regarding the second threat, in the case of aggressive driving, most of the measuring tools are being developed for English speakers, making it necessary to translate and adapt them to other contexts. The result obtained through this adaptation process does not necessarily obey the reality of different countries, and this is the case of Spanish-speaking ones. For this reason, the attempts to modify these tools are part of a more than necessary update in this area of knowledge, with some examples existing in the literature (Cordazzo, Scialfa, & Ross, 2016).

1.1. Study framework

The revision of the existing theory enables us to recognize that aggressiveness has been studied by various disciplines and theoretical approaches, finding a wide variety of definitions and considerations regarding it. Within the most relevant approaches, it is possible to describe biological, psychoanalytical, ethological and psychological explanations of aggressiveness.

In order to develop the current research, aggression, as a general phenomenon, will be characterized by three main components: the production of a noxious stimulus, the attempt to create damage, and the fact that the attack has higher than zero chances of success (Edmunds & Kendrick, 1980, in Alonso, Esteban, et al., 2002). Thus, for the purposes of this research, aggressive driving will be conceived as the entire set of behaviors related to aggression, performed during the driving task, always determined by the intentionality of the road user (i.e. the driver) and by the circumstances in which the action takes place. Therefore, aggressive driving is not the result of simple lapses and errors while driving. At this point, we shall add the nuance of intentionality to the debate on aggressiveness: this allows us to consider the distinction between violent –but non-aggressive – behaviors, and aggressive, but non-violent behaviors. Following Lajunen, Parker and Stradling (1998) ideas: “driver aggression is intentional behavior by a car driver and its target is another road user. By this definition, the intention behind the driving behaviour defines whether that behaviour is aggressive or just reckless driving without any intention to harm other road users” (pp. 108).

On the other hand, if we consider the study of this phenomenon in Spain, we find that the observation and categorization of aggressive behavior based on empirical research has been evidently limited. This makes it necessary to deepen the analysis of these behaviors in order not only to determine their potential social impact, but also to prevent and improve our understanding of the incidence and causes of road aggressiveness, as these are also related to traffic violations, personality types, emotional states, health impacts and alcohol/drug consumption (Alonso, Esteban, Montoro, & Tortosa, 2014).

Furthermore, most drivers are usually unaware of the potential consequences of aggressiveness and, being subjected to psychosocial phenomena such as stress and fatigue, have behaved this way at least once in life (Paleti, Eluru, & Bhat, 2010), potentially increasing the risk of having and/or causing an accident. In addition, more than a half of active drivers do not extensively know what is meant by “aggressive driving” and its legal implications (James & Nahl, 2000). This makes behaviors such as exceeding the speed limit, hand gestures, shouting, running red lights, illegal turns, and risky driving even more common than driving under the influence of alcohol (Cook, 1996). The growing recognition of road aggressiveness has led to a major concern among citizens, professionals, officials, legislators and police, who consider that aggressive driving might be simply not acceptable in our current society. Furthermore, recent evidence has shown a clearer relationships between different variables such as physical and mental health issues (Hilton, Staddon, Sheridan & Whiteford, 2009), as well as occupational factors in the case of professional drivers (Bawa & Srivastav, 2013), and the aggressive trends of drivers.

This global research about aggression and driving used a questionnaire composed of a set of items in different sections. Firstly, socio-demographic and descriptive information of road users was collected. Further sections were included to gather information about the following areas: “Data of the subjects related to driving”; “General views regarding perception and importance of aggressive driving”; “Behaviors that are considered as aggressive driving, and their frequency of performance”; “Situations and types of vehicles associated with aggression”; “Global solutions and measures to reduce aggressive driving” and classification data. Each of these dimensions was completed by additional factors that had also been studied. For a full review, please consult the original study framework, carried out in Spain by Alonso, Sanmartín, et al. (2002).

The study described in this article uses the results of the category “Behaviors that are considered as aggressive driving, and their frequency of performance”. Specifically, the main objective of this work is to describe the perception of what people consider as an aggressive behavior. Additionally, as a specific goal, this report will deeply analyze how this perception relates to socio-demographic features.

2. Methods

2.1. Participants

Sample calculations were carried out considering the Spanish municipal statistics from the year 2000, reported by the National Statistics Institute. The considered variables were gender, age and region within the universe of Spanish drivers who were 14 or older, since by the year 2000, it was possible to drive a scooter at the age of 14 in Spain. The data was

collected by a Simple Random Sampling (SRS). A total of $n = 1.200$ was the number of participants necessary to represent a margin error for the general data of ± 2.89 with a confidence interval of 95.5% in the most unfavorable case of $p = q = 50\%$. Interviews were completed by 1.228 Spanish drivers, 149 of which were not valid (reported driving frequency was “never”). The final sample size was $n = 1.079$, composed of 485 women (44.9%) and 594 men (55.1%), over 14 years old, in possession of any kind of driving license.

2.2. Design and procedure

Following an exploratory and descriptive methodology, this cross-sectional study gathered the data using a survey conducted through computer-assisted telephone interviewing (CATI), in order to reduce interview length and minimize recording errors. The average duration of each survey was 25 min.

To achieve the proposed objectives, the following variables were considered:

- Socio-demographic variables: gender, age, educational level and social status. Complementarily, variables related to driving habits such as type of driving license, experience (by years of driving and years of possession of driving license), and accidents record were also taken into account.
- *Perception of aggressive driving Scale (PAD)*: a set of 24 behaviors (listed in Table 1) was taken from different questionnaires regarding the available literature on aggressive driving, in an attempt to obtain answers about different dimensions of driving behavior such as hostility indicators, indefinite character of aggressiveness, communication, intention and regulations (Alonso, Esteban, et al., 2002; Alonso, Sanmartín, et al., 2002). Participants answered the question: “Do you consider that the following situations are cases of aggressive behaviors? (“A = is it aggressive?”), and they were scored with a Likert scale from 0 to 10, where 0 means *it is not aggressive*, and 10 means *it is very aggressive*.

Finally, this research took care of possible response biases by means of: obtaining a sample that was proportional to the universe of Spanish drivers; and providing the participants with a wide scale of answers, which posed the items in the same directions which have been proved to be a reliable strategy for avoiding response patterns in epidemiological studies (Van Sonderen, Sanderman & Coyne, 2013). In addition to what has been previously said, the CATI procedure was conducted by trained interviewers, thus preventing the respondents from getting confused or distracted.

Table 1
Perception of aggressive driving Scale (PAD).

Aggressive Behaviors	M	SD	95% CI		
			LL	UL	
“A = is it aggressive?” Total scale.	7.86	0.05	7.76	7.96	
1. Producing damage to other people with some type of object or weapon, or with punches and kicks	9.47	0.05	9.37	9.57	
2. Stopping and getting out of the car with the purpose of confronting another user	8.86	0.07	8.73	8.98	
3. Shouting and cursing	7.64	0.72	7.50	7.78	
4. Exhibiting aggressive or rude gestures	7.23	0.07	7.08	7.38	
5. Making repeated or insistent light signals. Headlight flashing	6.03	0.08	5.87	6.20	
6. Honking continuously or insistently	6.42	0.08	6.26	6.58	
7. Abruptly braking the vehicle	8.18	0.08	8.04	8.33	
8. Approaching the vehicle behind, “treading on heels”	7.87	0.08	7.72	8.02	
9. Blocking with a vehicle to prevent passing	7.97	0.08	7.82	8.13	
10. Deliberately obstructing others from moving their vehicle	7.73	0.08	7.57	7.89	
11. Getting into the lane abruptly causing the braking of the other vehicles	8.11	0.08	7.96	8.26	
12. Sudden and frequent change of lane	7.64	0.08	7.49	7.79	
13. Racing with another driver	8.97	0.07	8.83	9.10	
14. Running the traffic lights in red	9.07	0.07	8.94	9.20	
15. Passing through a yellow traffic light	6.51	0.08	6.35	6.66	
16. Using the right lane to overtake	7.74	0.09	7.57	7.91	
17. Driving at high speed above the normal pace of road circulation	7.84	0.08	7.68	8.00	
18. Driving under the influence of alcohol	9.30	0.06	9.18	9.41	
19. Not signaling turns and lane changes	7.44	0.08	7.30	7.59	
20. Having the car door knock against another car that is parked next to it	7.04	0.09	6.85	7.22	
21. Accelerating when another driver wants to overtake	8.18	0.07	8.04	8.32	
22. Making sudden and unexpected movements to threaten another driver	8.56	0.07	8.44	8.69	
23. Quickly occupying a parking space while another vehicle is waiting	7.01	0.08	6.84	7.17	
24. Not yielding to a crossing pedestrian	7.80	0.08	7.65	7.96	
Note. CI = confidence interval; LL = lower limit, UL = upper limit					
Result of Repeated Measure ANOVA ^a	Type III sums of squares	Degrees of freedom	Root mean square	F	Significance
ITEM	19657.47	23	854.67	247.75	<0.001
Error (Item)	60302.43	17,480	3.45		

^a These results only indicate there is at least one of the items in the PAD scale whose average value is different from the average value of the other groups. Post-hoc analysis and Bonferroni correction were not performed, since 276 comparisons should have been made, with the correspondent adjustment of p .

2.3. Data processing

Descriptive statistics and confidence intervals were obtained first, and were used to assign drivers to different groups, according to demographic and psychosocial characteristics. To conduct the comparison of mean values, One-way Analysis of Variance (ANOVA) tests were used, based on the General Linear Model (GLM) and using the F distribution, with $\alpha = 0.05$ significance level. The Tukey post hoc approach with $\alpha = 0.05$ significance level was used as well. All statistical analyses were performed using the Statistical Package for the Social Sciences (IBM SPSS), version 23.0.

2.4. Ethics

For this type of study, ethical approval and formal consent are not required. The described research did not require official intervention of the Ethics Committee in Experimental Research, (consultative and advisory body of the University of Valencia), as no personal data was used, and the subjects participated voluntarily and anonymously. However, the Research Ethics Committee for Social Science in Health of the University Research Institute on Traffic and Road Safety at the University of Valencia was consulted, certifying that the research conformed to the general ethical principles and issued a favorable opinion to be carried out in Spain. Finally, confidentiality and scientific value of data were emphasized before starting the interview, highlighting the fact that data would be used only for statistical research purposes, and encouraging participants to provide sincere answers to all questions.

3. Results

Participants were over 14 years old, and the most numerous range was 31–45 years (26%). A significant range of drivers (40.6%) had between 0 and 10 years of experience in driving, and 25.8% had between 11 and 20 years. For annual mileage, 34.1% drove around 6000–25.000 Km/year. Regarding accidents, 14.2% of drivers had had at least one accident during their lifetime, and 6.8% had been involved in two or more accidents.

Table 1 shows the findings which correspond to the perception of participants regarding different driving situations in detail. There is a high average score assigned to all items for their consideration as aggressive behavior. In fact, all of them received more than six out of the ten points Likert scale. Results showed significant differences for indistinct items (ITEM).

If we represent $A = \text{is it aggressive?}$, the highest scores go to items “1. Producing damage to other people with some type of object or weapon, or with punches and kicks”, and “18. Driving under the influence of alcohol” (see Fig. 1).

3.1. Perception of aggressive behavior and sociodemographic features

Considering the gender variable, significant results were found for items 4, 5, 6, and 15 (see Table 2). In those items, women made a higher valuation than men. Regarding educational level, item “17. Driving at high speed above the normal pace of road circulation” also obtained significant results (see Table 2).

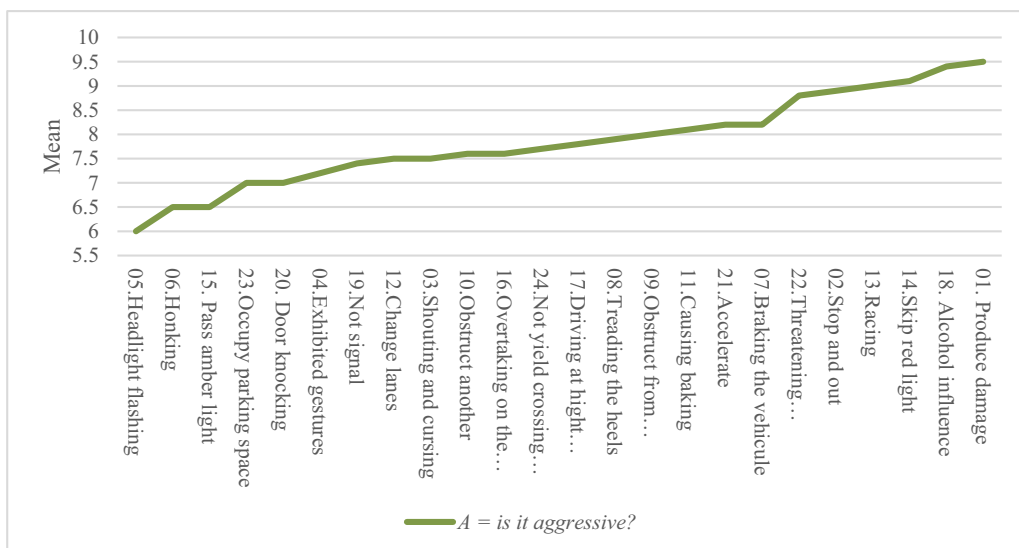


Fig. 1. Valuation of aggressive behaviors. Order from lowest to highest in terms of “ $A = \text{is it aggressive?}$ ”.

Table 2

Perception of situations as aggressive behaviors in function of gender, education and accidents.

		<i>M</i>	<i>SD</i>	<i>CI 95%</i>		<i>n</i>	<i>ANOVA(F)</i>
				<i>LL</i>	<i>UL</i>		
4. Exhibiting aggressive or rude gestures							
Men		7.05	2.12	6.88	7.22	592	<i>F</i> (1,1075) = 18.40 <i>p</i> < .001
Women		7.59	2.03	7.41	7.77	485	
Total		7.29	2.10	7.17	7.42	1077	
5. Making repeated or insistent light signals. Headlight flashing							
Men		5.85	2.38	5.65	6.03	590	<i>F</i> (1,1068) = 14.04 <i>p</i> < .001
Women		6.39	2.37	6.18	6.60	480	
Total		6.09	2.39	5.94	6.23	1070	
6. Honking continuously or insistently							
Men		6.26	2.30	6.07	6.44	590	<i>F</i> (1,1074) = 7.42 <i>p</i> = .007
Women		6.64	2.28	6.44	6.84	484	
Total		6.43	2.30	6.29	6.57	1074	
15. Passing through a yellow traffic light							
Men		6.23	2.14	6.05	6.40	590	<i>F</i> (1,1070) = 22.39 <i>p</i> < .001
Women		6.84	2.10	6.66	7.03	482	
Total		6.50	2.15	6.38	6.63	1072	
17. Driving at high speed above the normal pace of road circulation							
Educational level	No study	7.89	1.94	6.96	8.83	19	<i>F</i> (4,1063) = 6.07 <i>p</i> < .001
	Primary	7.03	2.11	6.61	7.45	98	
	Secondary (1st Grade)	7.70	1.78	7.51	7.90	318	
	Secondary (2nd Grade)	7.47	1.65	7.28	7.65	307	
	University studies	7.45	1.72	7.25	7.65	288	
	Total	7.50	1.77	7.39	7.61	1030	

Note. CI = confidence interval; LL = lower limit, UL = upper limit.

Table 3

Perception of situations as aggressive behaviors in function of age.

<i>Item</i>			14–17	18–22	23–29	30–39	40–49	50–64	≥65	Total
16. Using the right lane to overtake $F(6, 1063) = 2.35$ $p = .029$	<i>M</i>		7.22	7.06	7.66	8.04	7.72	7.92	7.85	6.5
	<i>SD</i>		2.39	2.34	2.42	2.24	2.34	2.51	2.81	2.15
	<i>CI 95%</i>	<i>LL</i>	6.03	6.60	6.29	7.76	7.41	7.57	7.31	6.38
		<i>UL</i>	8.41	7.52	6.92	8.32	8.04	8.28	8.39	6.63
	<i>n</i>		18	100	186	246	215	199	106	1070
17. Driving at high speed above the normal pace of road circulation $F(6, 1063) = 2.17$ $p = .043$	<i>M</i>		6.94	7.54	7.72	7.91	7.87	8.06	8.38	7.89
	<i>SD</i>		2.71	2.49	2.28	2.23	2.09	2.14	2.24	2.24
	<i>CI 95%</i>	<i>LL</i>	5.60	7.05	7.39	7.63	7.58	7.76	7.95	7.76
		<i>UL</i>	8.29	8.03	8.05	8.19	8.15	8.36	8.81	8.02
	<i>n</i>		18	100	185	246	216	199	106	1070
24. Not yielding to a crossing pedestrian $F(6, 1069) = 6.15$ $p < .001$	<i>M</i>		7.44	7.23	7.60	7.83	8.11	8.45	8.41	7.92
	<i>SD</i>		2.62	2.05	2.14	2.19	2.03	1.89	2.08	2.11
	<i>CI 95%</i>	<i>LL</i>	6.14	6.82	7.29	7.56	7.83	8.18	8.01	7.83
		<i>UL</i>	8.75	7.64	7.91	8.11	8.38	8.71	8.8	8.08
	<i>n</i>		18	100	186	246	218	200	108	1076

Note. CI = confidence interval; LL = lower limit, UL = upper limit.

For age variable, significant results were found in items 16, 17 and 24. In general, drivers over 65 years old ($M = 7.85$, $SD = 2.81$), 50–64 years group ($M = 7.92$, $SD = 2.51$), and 30–39 years group ($M = 8.04$, $SD = 2.24$) presented the highest scores of the scale (see Table 3). Depending on social status, significant differences were found in items 4, 16 and 17 (see Table 4).

For variables related to driving, findings suggest significant trends for different types of driving license in items 7, 9, 12 and 20, years of driving in item 24, and for accidents record in item 3 and item 4 (see Table 5).

4. Discussion

Several studies have shown the importance and necessity of studying aggressiveness as a forecasting variable of road accidents (Feng et al., 2017; Stephens & Sullman, 2015). Additionally, it is important to understand if people see and perceive certain behaviors as aggressive actions (Ulleberg & Rundmo, 2003), especially when researchers identify a big amount of behaviors and different concepts which do not necessarily correspond to the perception of the population. Thus, in an attempt to obtain answers about different dimensions of driving behavior, this study designed an instrument denominated

Table 4

Sample distribution by social class and different behaviors (significant results).

	<i>M</i>	<i>SD</i>	<i>n</i>	<i>CI 95%</i>		<i>ANOVA (F)</i>
				<i>LL</i>	<i>UL</i>	
4. Exhibiting aggressive or rude gestures						
Upper class	7.46	1.85	200	7.20	7.72	<i>F</i> (5,1071) = 2.53 <i>p</i> = .028
Upper-middle class	6.90	2.06	135	6.55	7.25	
Middle-middle class	7.38	2.06	420	7.19	7.58	
Lower-middleclass	7.23	2.20	161	6.89	7.57	
Lowerclass	6.94	2.42	98	6.45	7.42	
DK/NA	7.73	2.24	63	7.17	8.29	
Total	7.29	2.10	1077	7.17	7.42	
16. Using the right lane to overtake						
Upper class	7.27	2.34	199	6.94	7.60	<i>F</i> (5,1064) = 1.02 <i>p</i> = .032
Upper-middle class	7.83	2.35	132	7.43	8.24	
Midle-middle class	7.78	2.52	419	7.54	8.02	
Lower-middleclass	7.96	2.41	159	7.58	8.34	
Lowerclass	8.14	2.32	98	7.68	8.61	
DK/NA	7.95	2.21	63	7.40	8.51	
Total	7.76	2.42	1070	7.62	7.91	
17. Driving at high speed above the normal pace of road circulation						
Upper class	7.45	2.03	198	7.17	7.74	<i>F</i> (5,1064) = 4.03 <i>p</i> = .001
Upper-middle class	7.46	2.42	134	7.05	7.88	
Midle-middle class	8.06	2.18	415	7.85	8.27	
Lower-middleclass	8.22	2.24	162	7.87	8.56	
Lowerclass	8.18	2.10	98	7.76	8.60	
DK/NA	7.79	2.77	63	7.10	8.49	
Total	7.89	2.24	1070	7.76	8.02	

Note. CI = confidence interval; LL = lower limit, UL = upper limit.

“Perception of aggressive driving Scale (PAD)”, in order to descriptively study the perception of what Spanish drivers perceived as an aggressive behavior in driving.

The employed methodology allowed us to find that interviewed drivers have different opinions about what an aggressive behavior in driving is. These viewpoints change and could be recognized as more or less aggressive within the general population, but they also show tendencies according to the driver's personal profile and socio-demographic features. Mostly, the summarized situations tend to receive a high valuation regarding their aggressive character. Indeed, the total scale obtained an average of $M = 7.86$ $SD = 0.05$, and the item scored with the greatest intensity received a mean value of $M = 9.47$ $SD = 0.05$ (1. Producing damage to others people with some type of object or weapon, or with punches and kicks).

So far, the results point out that for Spanish drivers, the behavior that is deemed to be the most aggressive does not necessarily correspond to aggressive driving. Actually, “producing damage to others with some object, weapon, or punches and kicks” could be considered aggressive in any scenario of life. Clearly, aggressiveness can be studied from numerous points of view. From a descriptive orientation, the Spaniards' perception about the measured behaviors shows that both infractions and dangerous behaviors correspond to aggressive driving. For instance, running red lights, which corresponds to an infraction, is considered more aggressive than shouting or insulting other people; on the other hand, hitting someone is clearly more aggressive than breaking any norm, and even more aggressive than yelling at other people (which, apart from being intentional, can cause intangible damage and wounds and is an undoubtable source of distraction when driving). Nevertheless, our results do not enable us to indicate which one or ones of these items are statistically different from the others. What we can say is that at least one of them is. On the other hand, the high average scores of aggressiveness perceived in each item are still a social issue, and even if they were not significant, they should be taken into account.

What has been said above is clearly a double bind for the research and intervention in traffic and road safety, since, for the common population, aggressiveness could basically be related to unfavorable driving events, infractions of the law which imply no damage for other people, and to voluntary damage aimed at others (with its exceptions). Speaking of the norm, as a specific example, the results are quite different depending on whether lights are red (identified as the third most aggressive behavior) or amber (position 22 of 24).

In general, the findings call us to be careful with the interpretation of intentional behaviors which are not necessarily covered by the law, but which can be harmful to other citizens, as they could lead to accidents. In addition, even when they do not trigger accidents, they have become a source of public concern (due to the high perception rates reported), and even more so if they are compared with illegal actions, which are more supervised and punished. Let us see a specific case: researchers have found that “if drivers are close to an intersection when the light is turning from yellow to red, a high percentage will not stop” (Jason, Neal & Marinakis, 1985, pp.95). Besides this, there is a denominated “dilemma zone”, where keeping driving increases the chances to get involved in a crash, but stopping could produce a rear-end collision (Allen, 1995). In the end, being involved in this action could result in accidents or in red light running, which is a violation of the law (Li, Jia & Shao, 2016). Similar results were reported in other researches, in which these differentiations are labeled

Table 5

Sample distribution by driver license and different behaviors (significant results).

		<i>M</i>	<i>SD</i>	<i>CI 95%</i>		<i>n</i>	<i>ANOVA (F)</i>
				<i>LL</i>	<i>UL</i>		
7. Abruptly braking the vehicle							
Moped		7.42	2.58	6.62	8.21	43	<i>F</i> (3, 1071) = 3.12 <i>p</i> = .025
Motorcycle		8.04	2.37	7.58	8.49	106	
Car		8.30	2.02	8.16	8.43	872	
Special		8.52	1.83	8.02	9.02	54	
Total		8.25	2.08	8.12	8.37	1075	
9. Blocking with a vehicle to prevent passing							
Moped		7.09	2.59	6.29	7.89	43	<i>F</i> (3, 1070) = 4.33 <i>p</i> = .005
Motorcycle		7.57	2.45	7.09	8.04	106	
Car		8.06	2.11	7.92	8.20	872	
Special		8.23	1.99	7.68	8.77	53	
Total		7.98	2.17	7.85	8.11	1074	
12. Sudden and frequent change of lane							
Moped		7.33	2.56	6.54	8.11	43	<i>F</i> (3, 1069) = 2.91 <i>p</i> = .034
Motorcycle		7.28	2.15	6.86	7.69	105	
Car		7.84	2.06	7.70	7.98	872	
Special		7.81	2.06	7.24	8.38	53	
Total		7.76	2.09	7.64	7.89	1073	
20. Having the car door knock against another car that is parked next to it							
Moped		7.12	2.69	6.28	7.96	42	<i>F</i> (3, 1065) = 3.95 <i>p</i> = .008
Motorcycle		6.42	2.71	5.89	6.94	106	
Car		7.26	2.51	7.09	7.42	867	
Special		6.70	2.91	5.91	7.50	54	
Total		7.14	2.57	6.99	7.29	1069	
24. Not yielding to a crossing pedestrian							
years of driving	<3	7.55	2.25	7.13	7.97	112	<i>F</i> (7, 1025) = 3.54 <i>p</i> = .001
	3–5	7.45	2.08	7.07	7.82	119	
	6–10	7.79	2.16	7.41	8.16	131	
	11–15	8.02	1.99	7.69	8.35	140	
	16–20	7.80	2.24	7.43	8.17	146	
	21–25	8.14	1.99	7.79	8.49	127	
	26–35	8.37	1.82	8.08	8.66	154	
	>35	8.39	2.18	7.97	8.82	104	
	Total	7.95	2.10	7.82	8.08	1033	
3. Shouting and cursing							
Accidents record	0	7.77	2.0	7.64	7.91	849	<i>F</i> (3, 1071) = 4.08 <i>p</i> = .007
	1	7.32	2.14	6.98	7.66	152	
	2	7.90	1.89	7.36	8.44	50	
	≥3	6.75	2.03	5.89	5.89	24	
	Total	7.69	2.03	7.57	7.81	1075	
4. Exhibiting aggressive or rude gestures							
Accidents record	0	7.37	2.05	7.23	7.51	849	<i>F</i> (3, 1072) = 2.98 <i>p</i> = .031
	1	6.96	2.31	6.59	7.33	153	
	2	7.42	1.94	6.87	7.97	50	
	≥3	6.46	2.38	5.45	7.46	24	
	Total	7.29	2.09	7.17	7.42	1076	

Note. CI = confidence interval; LL = lower limit, UL = upper limit.

as violations of the normal or highway code, which seem to be associated with different kinds of effect (Mesken, Lajunen & Summala 2002). Eventually, this kind of results are a source of preoccupation, due to the possible detrimental consequences associated with them.

4.1. Differential analysis of socio-demographic features on perception of aggressive driving behaviors

There are significant trends in these general views, when we focus on driving profile. It is interesting to note how significant results are distributed among the population. First come gender and type of driving license, the socio-variables that showed more meaningful interactions with the PAD. Specifically, in relation to gender, we found out that women tend to perceive the measured behaviors as more aggressive, compared with the answers given by men; however, this is not significant for all the behaviors. Particularly, women perceive more aggressiveness in rude gestures, persistent lights and noises, and in running yellow lights. Among some of the possible explanations, the cultural role that women have as vial actor needs to be considered. Usually, the perception of women in driving has been associated with feelings of fear, and also researches argue that women try to enforce traffic rules in a place where the perception of aggressiveness is high (Oz, et al., 2010). In addition to what has been previously said, there is evidence of the fact that men tend to underestimate the level of dangerousness of some driving actions, and to overestimate their own driving abilities, which they overall consider superior to the

ones of women. Also, men were found to be more prone to engage in aggressive behaviors (Bjorklund, 2008; Shinar & Compton, 2004). In conclusion, these perception tendencies showed similar trends which had been stated in other populations regarding male being more directed/permissive towards aggressive behavior (by means of less aggressiveness perception). Moreover, it is remarkable how significant differences highlight intentional behaviors that are not punished by law.

On the other hand, according to the type of driver's license, we found two non-linear tendencies in which it is possible to delineate two groups (except for item 20): (1) lower perception of aggressiveness in drivers of motorcycles or mopeds; (2) higher perception of aggressiveness by cars and special vehicles. These results may answer to a widely-documented tendency in the literature which is that motorcyclists tend to perform more risky behaviors, including aggressive ones (Abdoli et al., 2015). Our results suggest that a possible consideration for this phenomenon is the following: drivers of motorcycles and mopeds perceive certain behaviors as less aggressive, and therefore adopt them more frequently, not necessarily because they have a predisposition to aggressiveness. Additionally, we should highlight the potential confounder role that age could rise in this case, since motorists in these categories can get their license at a young age (younger than for cars): this could lead to differences in their responses/perceptions because of their inexperience, their lack of knowledge, or because of young age itself. In fact, the interval between 18 and 30 years old has been identified as the most representative age group for motorcycle riders (Ghaffari-fam et al., 2016), and there is a strong and consistent relationship between the age of the driver and the risk of moderate or fatal injury: the older the driver, the lower the risk (Mullin, Jackson, Langley, & Norton, 2000). Of course, this element must be deeply analyzed in future studies.

Regarding age, compared to older and more experienced drivers, young drivers evaluated the items of the scale as generally less aggressive. Specifically, the groups of people that are under the age of 30 consider the evaluated conditions to be less aggressive; however, within this group there are differences regarding the assessment. Therefore, even though there is indeed a cutting point, we find no linear tendency. On the other hand, we see that people that are older than 29 tend to perceive more aggression in those behaviors (again, with differences among age intervals). These results are congruent with other studies (Constantinou, Panayiotou, Konstantinou, Loutsiou-Ladd, & Kapardis, 2011; Turner & McClure, 2003). In general, research on traffic usually identifies young drivers as more related to sensation seeking, and that young people have a probability three times higher to get involved in crashes than experienced drivers (Gianfranchi, Tagliabue, Spoto, & Vidotto, 2017). Additionally, this group has been identified as a higher-risk group in Spain (Alonso, Esteban, Sanmartin, & Useche, 2016a). This major risk could be explained by the perception of danger inherent to an action, and this research highlights that young drivers perceive less aggressiveness in the situations mentioned above. For this reason they could be performing them without identifying themselves as aggressive drivers, and not necessarily exhibiting intentional hostile tendencies.

Additionally, age is linked to a higher experience in the scope of driving, since they are collinear variables; and more experience in the field involves, most of the time, a better execution of the task. This not only implies a significant reduction of road accidents, but it also generates more confidence in expert drivers when they are facing other people's behavior. Namely, the power of anticipation (made possible by experience) could be favorable for the interaction among vial actors, who, as they grow older, consider certain situations more aggressive, compared to the perception of younger or less expert drivers. In fact, in addition to this, the increase in the age of drivers has been identified as a protective factor for motorcycle crashes, and it has shown that aggressiveness gets lower with the progression of age (Laberge-Nadeau, Maag & Bourbeau, 1992; Mullin Jackson, et al., 2000). Specifically, Spanish drivers who are more experienced at the wheel identify the action of not yielding to a pedestrian as an aggressive behavior, while less experienced drivers do not consider it as such. What is special is that this is a clearly protective behavior which could prevent various accidents involving pedestrians.

This research also shows that some segments of the driving population in Spain perceive more aggressiveness than others. This may suggest that even the way people understand a situation could include them in a possible risk group. Particularly, regarding social class outcomes, even though there is no clearly defined tendency in these findings, it can be observed that behaviors 4, 16 and 17 were judged by people from lower social classes as more aggressive. These results are in line with the ones related to the educational level (where there is no tendency either), in which participants with no education appear to be more concerned with the aggressive character of these elements. As it has been stated by Winkleby and collaborators (1992): "one of the strongest and most consistent predictors of a person's morbidity and mortality experience is that person's socioeconomic status (SES)" (pp. 816). Currently, SES is mainly determined by education and income, in fact the literature shows positive correlations between them. This positive correlation between education and social class (influenced by income and occupation) has also been found in drivers' population (Serge, 2015). Moreover, there are preoccupant widespread inequalities between professional and particular motorist (Serge, Ruiz, Gómez, 2018). Finally, as a huge corpus of research in psychology has found, it appears that cognitive biases are shaped according to the specific social situation of a person (Jonah, Thiessen & Au-Yeung, 2001).

Finally, it is interesting to observe that the accident record, as one of the most important index related to drivers, shows significant results for behaviors which are not necessarily punished by the law: shouting, insulting and exhibiting aggressive gestures. Specifically, drivers who suffered three (3) or more accidents perceive these behaviors as less aggressive, in relation to their comparing groups. On the other hand, the highest rates of aggressive perception are provided by drivers who have suffered two accidents, and by those who have never suffered an accident. Clearly, shouting, insulting and making offensive gestures is associated with difficulties in managing anger and hostility, together with a tendentially higher number of risks taken while driving – which lead to more traffic accidents, offenses and infractions. Additionally, this type of behavior is included as an example of "Road Rage", which, as we have stated in the introduction, is a term usually employed as a synonym of aggressive driving. In addition, as several researches show, it can increase aggressiveness and hostility, thus leading

to more traffic accidents and offenses and to a higher risk of recurrence. For what concerns Spain, at least 26% of Spanish drivers usually shout or insult in traffic, and this corresponds to a risk factor for accidents (Alonso, Esteban, Serge, & Ballestar, 2017). The importance of this data is that drivers who “are recidivist in having accidents” reduce the importance of an event which is clearly important for the driving task, since from it vengeance as a fact, distractions etc. can arise. However, as a positive result it is highlighted that people who have suffered two accidents, according to these findings, may be more aware of how dangerous performing these behaviors could be.

5. Limitations and future research

Even though this research was carried out with special care and tried to avoid response patterns as much as possible, one of the possible limitations of this work is related to the use of self-reports as the primary source of information. It could be associated with bias of social desirability (Perinelli & Gremigni, 2016) or with a poor understanding of the questions.

Even though our main objective was primarily descriptive, it is necessary to conduct confirmatory analysis on the scale. Certainly, this research reached the proposed goals, but results are suggesting the necessity to deepen the analysis. Nevertheless, a first diagnosis of the situation was necessary, and this is what we gained with the presented research. The next step we are going to develop is the factorial and structural analysis of the PAD, in addition to contrasting the comparisons between the average values obtained in the general scale, in order to know which items are significantly different from the other ones. Moreover, this step would also help us clarify the unexpected perception tendencies found in the Spanish population and in some social characteristics (such as education and social class).

Future research could perform interventions with the purpose of reducing aggressive driving, taking into account the driver's profile, his/her perception and the frequency of determined behaviors in aggressive driving. Additionally, it is important to emphasize the work of social representation and how it can be used in order to create new representations in traffic.

6. Conclusion

The information collected allows us to draw three main conclusions. First, Spanish drivers perceive the PAD behaviors as highly aggressive with $M = 7.86$, $SD = 0.05$ for the total scale. From a descriptive point of view, the behavior evaluated as the most aggressive does not necessarily correspond to the specific scope of driving; it can rather refer to any road-related context. The second and third most important items are respectively driving under the influence of alcohol and not respecting the red light. Additionally, highly dangerous behaviors such as not stopping when the traffic light is yellow, speeding, insulting, or performing sudden and frequent changes of lane are perceived as less aggressive. The results do not enable us to find out which one of these differences is significant. However, this does not mean that we should not consider them any less concerning, since all of them correspond to an aberrant driving behavior.

Second, Spaniards perceive both behaviors considered as infractions and dangerous behaviors that imply no punishment as aggressive driving. This perception is related to unfavorable driving events, infractions of the law which imply no damage for other people, and to voluntary damage aimed at other people. Since the conceptualization of aggressiveness revolves around the consideration of harm inflicted to others, we see that, for what concerns the Spanish population, the general perception does not necessarily coincide with this idea. In fact, behaviors which appear in the definition of aggressiveness (such as shouting, insulting, making rude gestures, overtaking or flashing) are perceived as less aggressive than violations of the Highway Code (driving under the influence of alcohol, running red lights, speeding). This situation corresponds to a double bind for the research and intervention in traffic and road safety, since the evidence points out a huge number of accidents caused by these dangerous behaviors, which nevertheless, are perceived as less aggressive from a descriptive point of view.

Third, the perception of aggressive driving in Spain varies, and the behaviors can be recognized as more or less aggressive, according to the driver's personal profile and socio-demographic features. Following this, women, people older than 29 and drivers who have suffered two accidents specifically tend to perceive behaviors as more aggressive, while drivers of motorcycles, people younger than 30, and men tend to perceive them as less aggressive.

Finally, as a practical application, these findings could be taken into account by researchers in order to find different points in the conceptualization of aggressiveness, in this case from the perception of the Spanish population. Additionally, the groups identified as the ones which perceive less aggressiveness in the considered behaviors could be a target for studies aiming at intervening in these subjects' perception of negative events, since the literature associates them with a higher number of accidents.

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interest.

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