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Development of the Pedestrian Anger Scale. A Pilot Study

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Abstract. Anger has been closely related to risky behavior, and this last has been related to road accidents. The current research aimed to develop and validate a self-report questionnaire to measure anger in pedestrians (n = 550, 40.73% male) of a wide age rage (14–65 years, M = 27.91, SD = 13.21). The Parallel Analysis showed that the 15 items of the Pedestrian Anger Scale fitted satisfactorily in a four-factor solution: Anger because of obstructions or slowdowns caused by other pedestrians (α = .79), Anger because of hostility from drivers (α = .64), Anger because of bad conditions of the infrastructure (α = .62), and Anger because of dangerous situations caused by vehicles (α = .71). The global scale had also a good internal consistency (α = .83). Further analyses suggested convergent, divergent and incremental validity by correlating the global score of the questionnaire with both risk and anger measures. Middle-aged people (19–30 years) scored higher in anger as pedestrians than eldest (> 45 years), η^2 = .02, but no significant effect were obtained by gender. Practical implications from both clinical and road safety viewpoints are discussed, and both future research proposals and limitations of the current study are also commented.

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Keywords: anger, pedestrians, risk perception, risky behavior, trait anger.

Traffic accidents involving pedestrians are a relatively frequent cause of death and injury in Spain. According to official data, in 2016 there were 14147 pedestrians who were involved in traffic accidents. Of them, 389 were killed and 1989 were injured. During 2016, pedestrians were the 21% of the total amount of people death in traffic accidents in Spain. Moreover, about 44% of the total of pedestrians that were run over outside the cities had committed a traffic infraction, while it was about 22% of the cases of pedestrians crashed into the cities committing and infraction (Dirección General de Tráfico, DGT, 2017). Therefore, it seems that pedestrians´ human factor is crucial in traffic accidents involving pedestrians as in other road accidents (Evans, 1991).

Within human factor, risky behaviors have been proposed as one of the main predictors of road accidents among pedestrians (Barić, Pilko, & Starcevic, 2018). Following the well-supported Driver Behavior Questionnaire theoretical model, it has been proposed that there are three types of risky behaviors that are applicable to pedestrians as well as to drivers: violations, errors and lapses (Reason, Manstead, Stradling, & Baxter, 1990). Violations are those behaviors in which drivers contravene a traffic rule deliberately, having a motivational basis. They are the most dangerous type of risky behavior, being related to anger and aggressive behavior (Berdoulat, Vavassori, & Muñoz Sastre, 2013). Otherwise, errors are characterized for violating a traffic rule by mistake (with no intention about it), so it is due to misbehavior because of a bad calculation (the intention is not appropriate). Finally, lapses are non-deliberated risky behaviors which are usually due to distractions. Of these tree types of risky behavior, violations are the most related to traffic accidents (Zhang, Yau, & Chen, 2013). This theoretical approach has been applied to the study of both drivers´ behavior (Berdoulat et al., 2013; Reason et al., 1990; Zhang et al., 2013) and pedestrians´ behavior (Elliott & Baughan, 2004; Granié, Pannetier, & Guého, 2013). Finally, it has been proposed that risky behavior is a result of the perception of risk and the threshold of risk. Therefore, pedestrians who have a low threshold of risk, and perceive the risk in a situation to be high might adopt safer behaviors (Herrero-Fernández, Macía-Guerrero, Silvano-Chaparro, Merino, & Jenchura, 2016).

Then, predictors of risky behavior should be analyzed in order to prevent this kind of behavior, and ultimately road accidents. In this sense, one of the variables that has been closely related to risky behavior is anger, both in a general context (Ferrer, Maclay,

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Litvak, & Lerner, 2017) and in the specific field of driving (Herrero-Fernández & Fonseca-Baeza, 2017). Anger has also shown strong relationships with aggressive behavior, both in a general context (Spielberger, Krasner, & Solomon, 1988) and in driving (Deffenbacher, Deffenbacher, Lynch, & Richards, 2003). Therefore, anger, aggression and risky behavior are closely related each other. On one hand, it has been proposed that anger and risky behavior could reinforce each other in a kind of feedback process (Berkowitz & Harmon-Jones, 2004). On the other hand, in spite of the strong relationship and the apparent theoretical overlap between aggression and risk, it is important to differentiate them. Whereas an aggressive behavior is characterized by the intention of causing harm to other persons (e.g. other drivers or pedestrians), risky behavior does not have this intention, being characterized by making dangerous behaviors which increase crash-risk, such as running red lights (Suhr & Dula, 2017). Then, the same behavior could be risky or aggressive, depending on the intention of the person who engages in it.

According to the Berkowitz´s theory, anger results from a combination of feelings, cognitions and physiological reactions, which are associated with the intention to punish whoever caused the individual's anger (Berkowitz & Harmon-Jones, 2004). Besides this, it has been proposed that anger is due to both situational variables, such as a provocative situation, and personal variables, such as trait anger (Deffenbacher, Oetting, & Lynch, 1994). Therefore, situational variables have been explored with the aim of identifying the events which are more likely to generate anger in people. One of the better empirically supported approaches is the original Deffenbacher´s trait driving anger theoretical model, empirically conceptualized in the Driving Anger Scale (DAS). It proposed that there were six types of situations where drivers with higher anger trait were more likely to become angered: Hostile gestures, illegal driving, police presence, slow driving, discourtesy and traffic obstructions (Deffenbacher et al., 1994). However, this questionnaire has been analyzed in several countries and cultures, obtaining different structures as situations generators of anger. All in all, almost all of the versions share three common factors: Reckless driving, referred to anger provoked as a result of a risky behavior from other road user; hostile gestures, referred to anger provoked because of direct aggressions from other road users such as obscene gestures, and progress impeded, referred to anger provoked as a result of the slowdown of the progress. It has been observed in versions from such different countries as Spain (Herrero-Fernández, 2011), Argentina (Escanes & Poo, 2018) and United Kingdom (Lajunen, Parker, & Stradling, 1998). These three situations could be applicable to pedestrians, as they as referred to general aspects of traffic. Whereas there are important differences among drivers and pedestrians (for example the anonymity), both of them share other characteristics: risk of suffering an accident (related to anger for reckless driving of other drivers), movement or desire of going from one place to another one (related to anger because of progress impeded), and the possibility of being the target of the aggressive behavior from others (related to hostile gestures). Besides, the interaction of both situational variables and trait anger is on the basis of the Driving Anger Scale model and the general trait anger model (Spielberger et al., 1988).

On the other hand, age and gender have been explored as demographic variables in their relationship with anger. Regarding age, there is an agreement about the negative relationship between age and anger (Deffenbacher, Lynch, Oetting, & Swaim, 2002; Herrero-Fernández, 2011). Regarding gender, there is no agreement about it, so whereas some studies propose that men are more prone to getting angry behind the wheel than women (Vanlaar, Simpson, Mayhew, & Robertson, 2008), some others have found the opposite results (Sullman, Stephens, & Yong, 2014), and some others have not found significant relationship between gender and anger propensity (Deffenbacher et al., 1994; Herrero-Fernández, 2011).

Therefore, it is crucial to develop instruments which allow assessing both risky behavior and anger in pedestrians. In the case of risky behaviors, three instruments have been developed, taking the Drivers´ Behavior Questionnaire theoretical approach (Reason et al., 1990). The first one is the Pedestrian Behavior Scale (Moyano, 1997; Torquato & Bianchi, 2010), which assesses violations, errors and lapses. The second one is the Adolescent Road User Behavior Questionnaire (Elliott & Baughan, 2004), which assesses both unsafe road crossing behavior and protective planed behavior. Finally, the most recent one is the Pedestrian Behavior Questionnaire (Granié et al., 2013), which is composed of four factors: Transgression, lapses, aggressive behavior and positive behavior. Regarding aggression, to our knowledge this last questionnaire is the only which includes a subscale to measure it. In this case, it is composed of four items based on scales of aggressive driver behaviors (Lawton, Parker, Manstead, & Stradling, 1997), and they referred to getting anger and expressing aggression by different ways. Then, there is no instrument which measures specifically anger as emotion in pedestrians, so it would be relevant to develop an instrument properly focused on exploring situations that generate this emotion in pedestrians.

The main aim of the current research was the development of a new psychometric tool to measure the

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frequency of anger in different situations in pedestrians. This scale will be analyzed in terms of factorial structure, reliability (internal consistency) and validity (convergent, divergent and incremental). Afterwards, the effect of age and gender will be analyzed.

Method

Participants

Initially the self-report questionnaires set was sent by Internet or by paper-and-pencil (see Procedure section) and 600 people from Spanish general population (convenience sampling) answered them. However, in the case of 50 participants, there were some missing data, so they were erased from the data set and the final sample consisted of 550 participants. Of them, 224 (40.73%) were male, 326 (59.27%) were female. The age ranged from 14 to 65 years (M = 27.91, SD = 13.21, Mdn = 22.50). Four groups were made based on the participants´ age for the analysis of the relationship between age and anger: 14–18 years, 19–30 years, 31–45 years, and > 45 years. Finally, 295 participants (53.64%) had a car license. All participants volunteered and signed informed consents guaranteeing the confidentiality of the collected data.

Instruments

Pedestrian Anger Scale (PAS)

Following the theoretical framework of the trait driving anger and the most used questionnaire to measure it (the DAS) (Deffenbacher et al., 1994), the Pedestrian Anger Scale was developed as a self-report questionnaire to measure the trait pedestrian anger. More concretely, three sources of drivers´ anger were taken into account and applied to pedestrians´ experience: First, impeded progress by others, which implies a slowdown in the movement (in this case, in the walking) regarding the preferred speed. In this case 8 items were designed, representing situations in which pedestrians are forced to reduce the speed of their walking. Second, reckless driving, which is referred to as anger provoked by risky situations generated by other road users. In this case 4 items were designed representing risky situations that could put them into risk of suffering an accident. Third, direct hostility, which is referred to as anger generated as a consequence of offences received from other road users. In this case 3 items were designed representing annoying situations (e.g. being honked at, a loud motor noise nearby). Then, a pool of 15 items was built. In the drafting process of the items it was taken into account the items of the aggressive behaviors factor from the Pedestrian behavior Scale (Granié et al., 2013). The instructions given to the participants were as follows: "Rate from 0 (*nothing at all*) to 4 (*very much*) the intensity of anger that the following situations provoke to you".

Risky Pedestrian Behavior (RPB)

It is a 8-item self-report which measures the frequency of risky behaviors in pedestrians (Herrero-Fernández, 2015b). The participants rate the frequency in which they behave in the described ways (e.g. "I cross the road by non-permitted places") in a four-point Likert scale (0 = *never* / 4 = *always*). The internal consistency of the scale was high with the data of the current research (α = .85).

State-Trait Anger Expression Inventory (STAXI–2)

The trait anger scale of the Spanish version of the STAXI–2 (Miguel-Tobal, Casado, Cano-Vindel, & Spielberger, 2001) was applied, in order to measure the level of anger experienced in a general context. This scale is composed of 10 items rated in a four-point Likert scale (1 = *Almost Never* to 4 = *Almost Always*), so participants indicate the amount of anger that every situation provokes him / her. Finally, this scale showed a good internal consistency with the current research data (α = .81).

Risk Perception

Risk perception was measured through a set of ten videos. Each one lasted between 12 and 17 seconds. In three of them it appeared a pedestrian behaving in a risky way as a traffic rule was being violated (e.g. crossing the road in a non-permitted place or when the traffic light is red). In the other two it appeared a pedestrian behaving in a safe way according to the traffic rules (e.g. crossing with traffic light in green). In the other three it appeared vehicles circulating in a risky way (e.g. overtaking with continuous line). Finally, in the other two it appeared vehicles circulating in a safe way. In each of the four types of videos, a total score was calculated by adding up the scores of each video, so it resulted in four scores: One for risk perception in situations with pedestrians behaving riskily, another one for risk perception in situations with pedestrians behaving safely, another one for risk perception in situations with vehicles ridding riskily, and another one for risk perception in situations with vehicles ridding safely. The order of presentation of the videos was the same for all the participants, having been randomized previously. The instructions given to the participants were as follows: "Rate the amount of risk that you perceive in the following situations, from 0 (*no risk*) to 5 (*much risk*)". Then, this task assesses the perception of how risky the situations are. This procedure have been

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used in previous research (Herrero-Fernández, 2015b; Herrero-Fernández et al., 2016).

Procedure

The questionnaires were sent to the participants in paper-and-pencil or by Internet (Facebook), so a snowball technique was used to collect the data. This procedure is justified in some research that have shown the equivalence in terms of validity and scores of both paper-and-pencil and Internet methods to gather self-reported data in traffic-related behavior variables (Herrero-Fernández, 2015a). Given that the main variable (anger in pedestrians) can be applied to everyone, there were no exclusion criteria to take part in the research.

Data Analysis

Data analyses consisted of four stages. First, a parallel analysis (PA) was carried out in order to explore the factorial structure. In this case, Factor 10.4.01 software was used (Lorenzo-Seva & Ferrando, 2013). The procedure selected for determining the number of dimensions was the optimal implementation of PA (Timmerman & Lorenzo-Seva, 2011), and the method for factor extraction and parameters estimation was the Unweighted Least Squares (ULS). This is the better method when the variables are non-continuous, like in this case as items were responded in a Likert scale. The rotation method to achieve factor simplicity was the Weighted Oblimin, because it was expected that the factors were correlated with each other. The quality of the global fit of the model was assessed through several robust goodness of fit statistics: the χ^2 / degrees of freedom (*df*) ratio, which should be lower than 3 (Carmines & McIver, 1981), and the Non-Normed Fit Index (NNFI), the Comparative Fit Index (CFI), the Goodness of Fit Index (GFI) and the Adjusted Goodness of Fit Index (AGFI), whose values should be above .95 (Hu & Bentler, 1999). The residuals of the model were assessed through the Root Mean Square of Residuals (RMSR), whose value should be lower than Kelley´s criterion (Kelley, 1935). Finally, the simplicity of the structure was assessed through the Bentler´s *S* simplicity index, with values close to 1 indicating a simple structure (Bentler, 1977).

In a second step, descriptive statistics of both items and factors, reliability analysis (internal consistency through α) were conducted. In the third step, both convergent and divergent validity of the PAS was analyzed by correlating it with the criteria through Pearson´s *r*. Based on this correlational analysis, a hierarchical multiple regression was conducted in order to check the amount of variance that the anger and risk measures explained of the pedestrians anger by controlling the common variance among them. This was made as an incremental validity test.

In the fourth step age and gender differences in the PAS scores were analyzed through a 2 (gender) x 4 (age) MANOVA. Age was analyzed by creating four groups: 14–18 years, 19–30 years, 31–45 years, and older than 45 years. In this case, both interaction and individual effects of age and gender were tested. Significance and effects sizes (η^2) were calculated. In this last case, effect sizes were interpreted according to the Cohen´s criterion, so values under .04 were considered small; between .04 and .14 medium, and above .14 large (Cohen, 1988). After the multivariate contrast, when the univariate tests attained significance, Hochberg´s GT2 Post Hoc test was applied. This is the better choice when sample sizes are quite different among the groups.

Results

First, a PA was carried out to explore the factorial structure of the PAS. The Kaiser-Meyer-Olkin test (KMO = .84) and the Bartlett´s statistic, $\chi^2(105)$ = 2,308.6, $p < .001$, showed the adequacy of the sample. The results suggested the existence of four factors, with a good fit of the model: χ^2 / *df* = 2.65; NNFI = .98; CFI = .99; GFI = .99; AGFI = .98. The analysis of residuals supported also the existence of this four factor structure, as the value of the RMSR was lower than the Kelly´s test: RMSR = .049; Kelley´s test = .052. Besides, the factorial solution showed a very simplicity structure, *S* = .94. Then, it was analyzed the fit of the model by forcing a three-factor solution (according to the original theoretical framework explained before) and a single-factor solution, in order to verify the most parsimonious model. However, both one-factor and three factor solution showed worse fit than the four factor solution: In the case of the three-factor solution: χ^2 / *df* = 4.07; NNFI = .96; CFI = .98; GFI = .98; AGFI = .97; RMSR = .068, Kelley´s criterion = .052. In the case of a single-factor solution: χ^2 / *df* = 12.55; NNFI = .86; CFI = .88; GFI = .87; AGFI = .85; RMSR = .142, Kelley´s criterion = .052. Then, four factor solution was accepted. Considering the items of each factor, the first one was labeled as "Anger because of obstructions or slowdowns caused by other pedestrians" (4 items, 30.76% of the variance, α = .79), the second one was labeled as "anger because of hostility from other drivers" (3 items, 10.80% of the variance, α = .64), the third one was labeled as "anger because of bad conditions of the infrastructure", (4 items, 9.96% of the variance, α = .62), and the fourth one was labeled as "anger because of dangerous situations caused by vehicles" (4 items, 7.51% of the variance, α = .71). On the whole, the four factors accounted for the 59.00%

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of the total variance, and the fifteen items of the PAD showed a high internal consistence (α = .83).

Descriptive statistics of both items and factors are detailed in the Table 1. As it can be observed, the mean score of the items ranged from 1.24 (Item 8) to 2.91 (Item 7). Besides, all of the variables (both items and factors) were symmetrically distributed (skewness ranged from 0.00 to |0.90|). On the other hand, factor loadings were from 0.32 to 1.08, so every item has a significant contribution to the validity of its factor. Finally, correlations item-total ranged from .35 (Item 7) to .66 (Item 14), showing a relevant contribution of every items to the reliability of its factor.

In the next step, both convergent and divergent validity of the PAS were analyzed. The results of the bivariate correlations are represented in Table 2. As it can be observed, the PAS factors were significantly related to each other but with medium effect sizes. Besides, the total PAS score was positively and significantly correlated with all the variables except for the low risky situations involving vehicles, although the relationship with general trait anger was higher than with both risky behavior and risk perception.

Based on previous correlations, the incremental validity of the PAS was analyzed through a hierarchical multiple regression. The results are showed in Table 3. As it can be observed, general trait anger was the only predictor which stayed significant in the last step. It supports the incremental validity of the PAS, as the previous significant correlations of risk perception and risky behavior with it were due to common variance shared with general trait anger.

Finally, differences in the PAS scores by age and gender were analyzed. The first 2 (gender) x 4 (age) MANOVA showed a significant multivariate interaction effect, $F(12, 1{,}488) = 2.53$, $p = .003$, $\eta^2 = .02$. More specifically, it was a multivariate significant effect by age, $F(12, 1488) = 4.60$, $p < .001$, $\eta^2 = .04$, but not by gender, $F(4, 494) = 1.47$, $p = .209$, $\eta^2 = .01$. Then, univariate effects by age were explored. Significant interaction effects with low effects sizes were obtained for the "Anger because of bad conditions of the infrastructure" factor, $F(3, 505) = 3.91$, $p = .009$, $\eta^2 = .02$, for the "Anger because of obstructions or slowdowns caused by vehicles" factor, $F(3, 505) = 4.59$, $p = .004$, $\eta^2 = .03$, and for the total score in the PAS, $F(3, 505) = 3.59$, $p = .014$, $\eta^2 = .02$. In general, 19–30 year men and older than 45 women were the less anger people, while 19–30 year women were the most anger ones. Regarding the univariate differences by age, the results are showed in Table 4. As it can be observed, there were significant effects in all of the factors except for the second one ("Anger because of hostility from other drivers"), with low to medium effect sizes. In general, the 19–30 years group was the more prone to getting anger as pedestrians, while the older group (> 45 years) were the less one.

Discussion

Anger experience in pedestrians could be one of the main predictors of risky behaviors in pedestrians, and these last are one of the main predictors of road accidents. Therefore, it is relevant to get psychometric tools which allow measuring both risky behavior and anger in this specific context and activity. Whereas there are some well-validated questionnaires which measure risky behaviors, there is a gap in the options to measure anger. The aim of the current research was to propose a new tool to assess this variable, analyzing its factorial structure and its reliability and validity properties. Furthermore, the effect of age and gender on the amount of anger experienced in pedestrians were analyzed.

The results showed a good fit of the model in a four factor solution according to the PA. These factors showed in general good values of internal consistency (the factors Anger because of hostility from other drivers and Anger because of bad conditions of the infrastructure had slightly lower values of internal consistency than the common criterion, .70, which could be due to the number of items composing them) and they were easily interpretable according to the Driving Anger Scale theoretical approach (Deffenbacher et al., 1994), especially regarding the three most common situations that have been detected throughout the different cultures as anger generators. Then, the factors were labeled Obstruction / slowdown caused by other pedestrians, Hostility from other drivers, Dangerous situations caused by vehicles, and Bad conditions of infrastructure. The first one was equivalent to progress impeded factor from the DAS, as both of them are referred to the slowdown in the movement because of other road or pavement users. The second one was equivalent to the hostile gestures from the DAS, as both of them are referred to annoying situations which imply a frustration in the road user. The third one was equivalent to the reckless driving from the DAS, as both of them are referred to dangerous situations because of a misbehavior of a driver. More interesting could be the fourth factor. Despite it seems not to have equivalence in the DAS model, it would be related to a dangerous situation because of a bad road or pavement design, which at some point makes pedestrians to behave riskily. Moreover, it has been recently proposed an Argentinean version of the DAS (Escanes & Poo, 2018), and it includes a factor labelled Bad conditions of the road network, showing a clear similitude. Whereas these authors suggest that this factor could be applicable to underdeveloped

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Table 1. *Descriptive Statistics (Mean, Standard Deviation, Skewness, Factor Loading, and Correlation between Item and Total Scale) of Items and Factors of the PAD*

Item / Factor		*M*	*SD*	Sk.	Factor Loading	Correlation item-total	*R.* without item
Obstrucciones / ralentizaciones causadas por otros peatones	*Obstruction / slowdown caused by other pedestrians*	7.31	3.86	0.00	–	–	–
4. Hay muchos peatones esperando en la acera en la que me encuentro y en la de enfrente. Cuando se pone en verde, tengo que esquivar a los que vienen en sentido contrario al mío	4. There are lots of pedestrians waiting in the sidewalk where I am as well as in the opposite sidewalk. When the traffic light turns green, I must sidestep other pedestrians walking towards me	1.48	1.24	0.56	0.45	.44	.82
13. En un paso de peatones con semáforo y mucho tráfico, tengo que esperar mucho tiempo a que se ponga en verde mi semáforo	13. In a cross walk with traffic light and much traffic, I have to wait long time for my traffic light to turn green	2.03	1.23	–0.11	0.86	.62	.73
14. Caminando por una acera tengo que ir más despacio de lo que me gustaría porque hay mucha gente	14. I have to walk slower than I would like because there are a lot of people on the sidewalk	1.98	1.25	0.04	1.08	.66	.71
..15. Camino por un acera estrecha, de manera que tengo que esquivar a los peatones que vienen de frente	15. I walk on a narrow side walk, so I have to sidestep the pedestrians coming towards me	1.81	1.19	0.07	0.90	.69	.70
Hostilidad por parte de los conductores	*Hostility from other drivers*	7.19	2.88	–0.20	–	–	–
..7. Cruzando correctamente un paso de peatones, un vehículo me pita por mi forma de cruzar	..7. I am crossing correctly a crosswalk, a vehicle horns me because of my way of crossing	2.91	1.24	–0.90	0.35	.35	.67
11. Un vehículo pasa cerca de la acera en la que me encuentro, haciendo un ruido muy intenso con el motor	11. A vehicle runs close to the side walk where I am, making a very loud noise with the engine.	2.02	1.29	–0.03	0.98	.46	.52
12. Voy caminando por la acera y una retención de vehículos hace que todos empiecen a tocar el claxon a la vez	12. I am walking on the side walk and a traffic jam makes all the vehicles begin honking.	2.26	1.25	–0.21	0.67	.54	.41
Malas condiciones de la infraestructura	*Bad conditions of infrastructure*	6.78	3.21	0.10	–	–	–
..5. Está lloviendo y voy a cruzar un paso de peatones, pero la lluvia y los paraguas de otros peatones me dificultan la visibilidad	5. It is raining and I am going to cross the sidewalk, but the rain and other pedestrians´ umbrellas make difficult to see what is happening around me	1.64	1.14	0.31	0.63	.39	.55
8. Cruzando incorrectamente la carretera un vehículo me pita por mi forma de cruzar	8. I am crossing incorrectly a crosswalk, a vehicle horns me because of my way of crossing	1.24	1.21	0.78	0.63	.38	.56
9. Tengo que cruzar un paso de peatones sin visibilidad, de forma que no estoy totalmente seguro de que no vengan vehículos	9. I have to cross a cross walk with no visibility, so I am not sure if vehicles are coming or not	2.15	1.21	–0.18	0.32	.38	.56
10. Tengo que cruzar la carretera, pero me desvío de mi ruta porque el paso de peatones está lejos de mi trayecto	10. I have to cross the road, but I deviate of my route as the cross walk is far from my way.	1.74	1.15	0.16	0.41	.44	.51

Table 1. *(Continued)*

Item / Factor		*M*	*SD*	Sk.	Factor Loading	Correlation item-total	*R*. without item
Situaciones peligrosas generadas por vehículos	*Dangerous situations caused by vehicles*	9.67	3.36	−0.40	–	–	–
1. En un paso de peatones sin semáforo, un vehículo no me cede el paso	1. I am crossing a cross walk with no traffic light and a vehicle does not yield me.	2.26	1.19	−0.19	0.82	.56	.60
2. Un vehículo se salta el semáforo en rojo y me obliga a esperar para cruzar	2. A vehicle runs a traffic light in red and it makes me wait to cross	2.82	1.05	−0.67	0.80	.54	.62
3. Hay retención y un vehículo se detiene en mitad del paso de peatones, obligándome a esquivarlo	3. There is a traffic jam and a vehicle stops in the middle of the cross walk, so I have to sidestep it	1.99	1.25	−0.01	0.51	.39	.71
6. En un paso de peatones que cruza dos carriles, el vehículo del carril más cercano a mí se para, pero el otro no, teniendo que pararme en mitad de la carretera	6. In a cross walk that cross two lanes, the vehicle of the nearest lane to me stops, but the other does not stop, so I have to stop in the middle of the road	2.60	1.11	−0.45	0.59	.50	.64
Puntuación total de PAD	*Global score of the PAD*	30.91	9.80	−0.31	–	–	–

Note. M = Mean, *SD* = Standard Deviation; Sk = Skewness. *R* without item = Reliability without item.

cities and countries, the current results suggest that it probably could be applicable to any country. Furthermore, it highlights the importance of designing safe roads and traffic-related environments, as they could have an important role in transportation safety as it is usually explored as one of the three big road safety factors: vehicle, infrastructure and human factor (Evans, 1991).

The Pedestrian Anger Scale has also shown good values of convergent and divergent validity, as bivariate correlations evidenced significant associations with both risk measures (perception and behavior) and general trait anger. In this case, the coefficient was higher in the case of the anger measure than in the case of risky behavior and risk perception. The significant but lower relationship with risk measures is congruent with previous driving related research, which show that risk and anger are both theoretically and empirically related, as a same behavior could be risky or aggressive depending on the intention of the person who makes it (Herrero-Fernández & Fonseca-Baeza, 2017). Finally, when both risk and anger measures were analyzed together as predictors in the hierarchical regression, risk measures lost their significance, showing the incremental validity of the PAS.

In the next part the effect of age and gender in the experience of anger in pedestrians were analyzed. On one hand, the results showed that there were no significant gender differences. It is in the same line with the previous research with pedestrians thorough PBQ, in which no gender differences were observed in aggressive behavior subscale (Granié et al., 2013). Otherwise, in this same study it was observed that men tended to behave more riskily than women. It supports the general traffic-related studies, which shows in general gender differences in risky perception and behavior (Herrero-Fernández, 2015b; Herrero-Fernández et al., 2016), but not in aggressive behavior (Deffenbacher et al., 1994; Herrero-Fernández, 2011). This result could be also an additional support of the validity of the PAS regarding the real measurement of anger rather than risk as an associate concept. On the other hand, significant differences have been observed for age, as in general middle-age people (19–30 year) are more prone to getting anger than both youngest (14–18 year) and eldest ones (> 45 year). Previous studies have found negative associations between age and anger, concluding that young people are more prone to getting anger than elder (Deffenbacher et al., 2002; Herrero-Fernández, 2011). However, in the current research the youngest group was 14–18 years, while in the rest of the studies normally the youngest group is > 18 years. Therefore, for future research anger in young people and teenagers should be also taken into account in

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Table 2. *Descriptive Statistics (Mean and Standard Deviations) and Correlation Coefficients (Pearson's r) among the Variables*

	M	*SD*	OSP	TDND	BCI	DSCV	Total PAS	High R. Ped.	Low R. Ped.	High R. Veh.	Low R. Veh.	Risky Behav.
OSP	7.31	3.86	-									
HFD	7.19	2.88	.40***	-								
BCI	6.78	3.21	.46***	.31***	-							
OSV	9.67	3.36	.33***	.38***	.37***	-						
Total PAS	30.91	9.80	.78***	.69***	.73***	.71***	-					
High R. Ped.	12.27	2.41	.03	.18**	.20***	.31***	.25***	-				
Low R. Ped.	2.69	2.32	.11	.06	.12	.13*	.15*	.27***	-			
High R. Veh.	11.46	2.08	.16*	.12	.18**	.24***	.25***	.46***	.32***	-		
Low R. Veh.	0.81	1.04	.01	.01	.08	.12	.08	.19**	.43***	.09	-	
Risky Behav.	12.51	6.52	.26***	.09	.19***	.13*	.23***	.07	.01	.12	–.22***	-
Trait Anger	21.25	5.16	.31***	.33***	.22***	.37***	.43***	.29***	-.10	.02	–.04	.36***

Note. OSP = Obstruction / Slowdown caused by other pedestrian; HFD = Hostility from other drivers; BCI = Bad conditions of infrastructure; DSCV = Dangerous situations caused by vehicles; High R. Ped. = Risk perception = high risk situations for pedestrians; Low R. Ped. = Risk perception = low risk situations for pedestrians; High R. Veh. = Risk perception = high risk situations for vehicles; Low R. Veh. =: Risk perception = low risk situations for vehicles; Risky Behav. = Risky behaviour in pedestrians.

*$p < .05$. *$p < .01$. ***$p < .001$.

Table 3. *Hierarchical Multiple Regression Predicting the Total Score of the PAS (Trait Pedestrian Anger)*

Measure	*B*	*SEB*	β
Step 1 – Risky perception and behavior			
High R. Ped.	0.11	.69	.03
Low R. Ped.	–0.70	.59	–.02
High R. Veh.	1.60	.91	.30*
Risky Behav.	0.35	.27	.22
Step 2 – Trait anger			
High R. Ped.	0.30	.64	.08
Low R. Ped.	–0.20	.55	–.05
High R. Veh.	1.23	.84	.23
Risky Behav.	0.05	.27	.03
Trait Anger	0.74	.27	.43**

Note. Trait pedestrian anger $\Delta R^2 = .15$ ($p = .203$) in Step 1; $\Delta R^2 = .15$ ($p = .024$) in Step 2.

*$p < .05$. ** $p < .01$.

order to analyze and compare them with older participant groups.

These results have several practical implications, for both clinical and road safety fields. Regarding the first one, it has been proposed a new reliable and valid tool to measure anger in pedestrians. Taking into account that anger in very closely related to aggression (Bogdan-Ganea & Herrero-Fernández, 2018), an anger prone person could be likely engaged in aggressive behaviors against other road users. Then, an efficient assessment and intervention could be crucial for the person. Regarding the road safety viewpoint, it has already been commented the relationship between anger, aggression, risky behavior and crash-related events (Herrero-Fernández & Fonseca-Baeza, 2017).

Future research should follow the current findings. First, the psychometric properties of the PAS should be verified with other samples. Confirmatory factor analyses should be conducted to verify the factorial structure that has been found with the current sample. Second, the anger propensities of pedestrians with characteristics associated with anger should be analyzed, such as in certain mental disorders or in people with antecedents of aggressive behaviors. Third, knowing the kind of situations that generate anger in pedestrians, specific treatments and interventions could be designed in order to desensitize them. It would contribute to both a more peaceful coexistence among pedestrians and a reduction of accidents in this collective. Fourth, anger should be analyzed in other road users, as bicyclists (Marín Puchades et al., 2017). It would allow analyzing the interaction among every kind of road users regarding anger experience. Finally, some important variables such as rumination or displaced aggression, which have been related to both general anger (Denson, Pedersen, & Miller, 2006) and anger in specific fields as driving (Herrero-Fernández, 2013) should be explored in relation to trait pedestrian anger. Hypothetically, both rumination and displaced aggression could explain why some people could behave aggressively in other context than a pedestrian as a result of having being angered as pedestrians.

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Table 4. *Univariate Differences by Age Group in Each Way of Trait Pedestrian Anger*

	Age Group									
	14–18 (n = 179)		19–30 (n = 171)		31–45 (n = 76)		> 45 (n = 81)			
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*	η^2
OSP	6.95b	3.39	8.31acd	3.69	6.73b	3.57	6.33b	3.67	6.14***	.04
HFD	6.72b	2.47	7.50a	2.93	7.20	2.63	7.10	3.06	2.24	.01
BCI	7.26d	3.06	6.64	2.77	5.56	2.65	5.72a	3.19	3.74**	.02
DSCV	9.16	2.77	9.94d	3.21	9.67	3.55	8.74b	4.28	3.03*	.02
Total PAS	30.09	8.11	32.39d	9.36	30.16	8.558	27.89b	11.31	3.66**	.02

Note. Differences by age, being < 23 (a), 23–30 (b), 31–42 (c), 43–53 (d) and > 53 (e), according to the Hochberg´s GT2 Post Hoc test. OSP = Obstruction / Slowdown caused by other pedestrian; HFD = Hostility from other drivers; BCI = Bad conditions of infrastructure; DSCV = Dangerous situations caused by vehicles.

*p < .05. **p < .01. p < .001.

Finally, the current research has some limitations that should be taken into account for future research. First, this is the first study regarding the trait pedestrians anger and just a pilot study of the PAS. Further research is needed to confirm the factorial structure. Given that the data have been analyzed only through a PA, confirmatory factor analyses should be conducted with different samples to verify the internal structure and other aspects such as the invariance of the instrument by different variables (e.g. gender, age groups, etc.) and some other more sophisticated statistics, such as the construct reliability (as an internal consistency measure) and the average variance extracted (as a validity measure). Besides, considering the relatively low internal consistency values of two of the factors (Anger because of hostility from drivers and Anger because of bad conditions of the infrastructure), due probably to the low number of items, and relatively low factor loadings of some items (two items were under .40) psychometric properties of the scale must be replicated. However, the global scale showed a high value, which suggests that at least the instrument could be used to measure trait pedestrian anger as a whole. Second, the study was based on self-report instruments. Despite this methodology is very extended in social sciences and have demonstrated to be trust-worthy in Traffic Psychology (Lajunen & Summala, 2003), the results should be completed with research using other kind of measures, such as behavior observation or psychophysiological studies related to anger generating situations. Third, risk perception has been measured though an instrument (set of videos) that are not properly validated. Despite it has been used in previous similar research (Herrero-Fernández, 2015b; Herrero-Fernández et al., 2016), it should be validated in future research to ensure its reliability and validity.

References

Barić D., Pilko H., & Starcevic M. (2018). Introducing experiment in pedestrian behavior and risk perception study at urban level crossing. *International Journal of Injury Control and Safety Promotion*, *25*(1), 102–112. https://doi.org/10.1080/17457300.2017.1341934

Bentler P. M. (1977). Factor simplicity index and transformations. *Psychometrika*, *59*, 567–579. https://doi.org/10.1007/BF02294054

Berdoulat E., Vavassori D., & Muñoz Sastre M. T. (2013). Driving anger, emotional and instrumental aggressiveness, and impulsiveness in the prediction of aggressive and transgressive driving. *Accident Analysis & Prevention*, *50*, 758–767. https://doi.org/10.1016/j.aap.2012.06.029

Berkowitz L., & Harmon-Jones E. (2004). Toward an understanding of the determinants of anger. *Emotion*, *4*(2), 107–130. https://doi.org/10.1037/1528-3542.4.2.107

Bogdan-Ganea S. R., & Herrero-Fernández D. (2018). Aggressive thinking on the road. The mediation effect of aggressive thinking in the relationship between driving anger and aggression in Romanian drivers. *Transportation Research Part F: Traffic Psychology and Behaviour*, *55*, 153–166. https://doi.org/10.1016/j.trf.2018.02.028

Carmines E. G., & McIver J. P. (1981). Analyzing models with unobserved variables: analysis of covariance structures. In G. W. Bornstedt & E. F. Borgatta (Eds.), *Social measurement: Current issues* (pp. 112–133). Beverly Hills, CA: Sage.

Cohen J. (1988). *Statistical power analysis for the behavioral sciences* (2nd Ed.). Hillsdale, NJ: Erlbaum.

Deffenbacher J. L., Deffenbacher D. M., Lynch R. S., & Richards T. L. (2003). Anger, aggression and risky behavior: A comparison of high and low anger drivers. *Behaviour Research and Therapy*, *41*(6), 701–718. https://doi.org/10.1016/S0005-7967(02)00046-3

Deffenbacher J. L., Lynch R. S., Oetting E. R., & Swaim R. C. (2002). The Driving Anger Expression Inventory: A measure of how people express their anger on the road. *Behaviour Research and Therapy*, *40*(6), 717–737. https://doi.org/10.1016/S0005-7967(01)00063-8

https://doi.org/10.1017/sjp.2019.36 Published online by Cambridge University Press

Deffenbacher J. L., Oetting E. R., & Lynch R. S. (1994). Development of a driving anger scale. *Psychological Reports*, *74*(1), 83–91. https://doi.org/10.2466/pr0.1994.74.1.83

Denson T. F., Pedersen W. C., & Miller N. (2006). The displaced aggression questionnaire. *Journal of Personality and Social Psychology*, *90*(6), 1032–1051. https://doi.org/10.1037/0022-3514.90.6.1032

Dirección General de Tráfico (DGT, 2017). *Las principales cifras de la siniestralidad vial. España 2016* [The main figures of road accidents. Spain 2016]. Retrieved from DGT website http://www.dgt.es/Galerias/seguridad-vial/estadisticas-e-indicadores/publicaciones/principales-cifras-siniestralidad/Las-principales-cifras-2016.pdf

Elliott M. A., & Baughan C. J. (2004). Developing a self-report method for investigating adolescent road user behavior. *Transportation Research Part F: Traffic Psychology and Behavior*, *7*(6), 373–393. https://doi.org/10.1016/j.trf.2004.10.002

Escanes G., & Poo F. M. (2018). Driving anger in Argentina. *Safety Science*, *105*, 228–237. https://doi.org/10.1016/j.ssci.2018.02.019

Evans L. (1991). *Traffic safety and the driver*. New York, NY: Van Nostrand Reinhold.

Ferrer R. A., Maclay A., Litvak P. M., & Lerner J. S. (2017). Revisiting the effects of anger on risk-taking: Empirical and meta-analytic evidence for differences between males and females. *Journal of Behavioral Decision Making*, *30*(2), 516–526. https://doi.org/10.1002/bdm.1971

Granié M. A., Pannetier M., & Guého L. (2013). Developing a self-reporting method to measure pedestrian behaviors at all ages. *Accident Analysis & Prevention*, *50*, 830–839. https://doi.org/10.1016/j.aap.2012.07.009

Herrero-Fernández D. (2011). Adaptación psicométrica de la versión reducida del Driving Anger Scale en una muestra española. Diferencias por edad y sexo [Psychometric adaptation of the reduced version of Driving Anger Scale in a Spanish sample. Differences by age and gender]. *Anales de Psicología*, *27*(2), 544–549.

Herrero-Fernández D. (2013). Adaptación española de la dimensión conductual del Displaced Aggression Questionnaire. Análisis de validez con medidas de ira y agresión genéricas y en la conducción [Spanish adaptation of the behavioral dimension of the Displaced Aggression Questionnaire. Analysis of validity with general and on-the-road measures of anger and aggression]. *Revista de Psicología Social*, *28*(3), 273–284. https://doi.org/10.1174/021347413807719094

Herrero-Fernández D. (2015a). A comparison of internet-based and paper-and-pencil questionnaires in assessing driving anger in a Spanish sample. *REMA: Revista Electrónica de Metodología Aplicada*, *20*(1), 1–15. https://doi.org/10.17811/rema.20.1.2015.1-15

Herrero-Fernández D. (2015b). Desarrollo de un cuestionario breve para la medición del comportamiento arriesgado en peatones jóvenes [Development of a brief questionnaire to measure risky behavior in adolescent pedestrians]. *Revista Colombiana de Psicología*, *24*(2), 271–284. https://doi.org/10.15446/rcp.v24n2.43567

Herrero-Fernández D., & Fonseca-Baeza S. (2017). Angry thoughts in Spanish drivers and their relationship with crash-related events. The mediation effects of aggressive and risky driving. *Accident Analysis & Prevention*, *106*, 99–108. https://doi.org/10.1016/j.aap.2017.05.015

Herrero-Fernández D., Macía-Guerrero P., Silvano-Chaparro L., Merino L., & Jenchura E. (2016). Risky behavior in young adult pedestrians: Personality determinants, correlates with risk perception and gender differences. *Transportation Research Part F: Traffic Psychology and Behavior*, *36*, 14–24. https://doi.org/10.1016/j.trf.2015.11.007

Hu L., & Bentler P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, *6*, 1–55. https://doi.org/10.1080/10705519909540118

Kelley T. L. (1935). *Essential traits of mental life, Harvard studies in education* (Vol. 26). Cambridge, MA: Harvard University Press.

Lajunen T., Parker D., & Stradling S. G. (1998). Dimensions of driver anger, aggressive and Highway Code violations and their mediation by safety orientation in UK drivers. *Transportation Research Part F: Traffic Psychology and Behaviour 6*(2), 107–121. https://doi.org/10.1016/S1369-8478(98)00009-6

Lajunen T., & Summala H. (2003). Can we trust self-reports of driving? Effects of impression management on driver behaviour questionnaire responses. *Transportation Research Part F: Traffic Psychology and Behaviour*, *6*(2), 97–107. https://doi.org/10.1016/S1369-8478(03)00008-1

Lawton R., Parker D., Manstead A. S. R., & Stradling S. G. (1997). The role of affect in predicting social behaviors: The case of road traffic violations. *Journal of Applied Social Psychology*, *27*(14), 1258–1276. https://doi.org/10.1111/j.1559-1816.1997.tb01805.x

Lorenzo-Seva U., & Ferrando P. J. (2013). FACTOR 9.2 A comprehensive program for fitting Exploratory and Semiconfirmatory Factor Analysis and IRT Models. *Applied Psychological Measurement*, *37*(6), 497–498. https://doi.org/10.1177/0146621613487794

Marín Puchades V. M., Prati G., Rondinella G., De Angelis M., Fassina F., Fraboni F., & Pietrantoni L. (2017). Cyclists' anger as determinant of near misses involving different road users. *Frontiers in Psychology*, *8*. https://doi.org/10.3389/fpsyg.2017.02203

Miguel-Tobal J. J., Casado M. I., Cano-Vindel A., & Spielberger C. D. (2001). *Versión española del STAXI–2* [Spanish version of the STAXI-2]. Madrid, Spain: TEA.

Moyano E. (1997). Teoría del comportamiento planificado e intención de infringir normas de tránsito en peatones [Theory of planned behavior and intention of breaking traffic rules in pedestrians]. *Estudos des Psicologia*, *2*(2), 335–348. https://doi.org/10.1590/S1413-294X1997000200008

Reason J. T., Manstead A., Stradling S., & Baxter J. S. (1990). Errors and violations on the roads: A real distinction? *Ergonomics*, *33*(10), 1315–1332. https://doi.org/10.1080/00140139008925335

Spielberger C. D., Krasner S. S., & Solomon E. P. (1988). The experience, expression and control of anger.

https://doi.org/10.1017/sjp.2019.36 Published online by Cambridge University Press

In M. P. Janisse (Ed.), *Health psychology: Individual differences and stress* (pp. 89–108). New York, NY: Springer/Verlag.

Suhr K. A., & Dula C. S. (2017). The dangers of rumination on the road: Predictors of risky driving. *Accident Analysis & Prevention*, *99*, 153–160. https://doi.org/10.1016/j.aap.2016.10.026

Sullman M. J. M., Stephens A. N., & Yong M. (2014). Driving anger in Malaysia. *Accident Analysis & Prevention*, *71*, 1–9. https://doi.org/10.1016/j.aap.2014.04.019

Timmerman M. E., & Lorenzo-Seva U. (2011). Dimensionality assessment of ordered polytomous items with parallel analysis. *Psychological Methods*, *16*, 209–220. https://doi.org/10.1037/a0023353

Torquato R. J., & Bianchi A. S. A. (2010). Comportamiento de risco do pedestre ao atraversaar a rua: Um estudo com universitarios [Risky behavior in pedestrians when crossing the street: a study with university students]. *Transpote: Teoria e Aplicaçao*, *2*(1), 19–41.

Vanlaar W., Simpson H., Mayhew D., & Robertson R. (2008). Aggressive driving: A survey of attitudes, opinions and behaviors. *Journal of Safety Research*, *39*(4), 375–381. https://doi.org/10.1016/j.jsr.2008.05.005

Zhang G., Yau K. K. W., & Chen G. (2013). Risk factors associated with traffic violations and accident severity in China. *Accident Analysis & Prevention*, *59*, 18–25. https://doi.org/10.1016/j.aap.2013.05.004

https://doi.org/10.1017/sjp.2019.36 Published online by Cambridge University Press