

Article

The Role of Big Five Personality Traits in Explaining Pedestrian Anger Expression

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Abstract: Although the relationship between anger and personality characteristics in the literature is well-acknowledged for drivers, there is a lack of systematic investigation of pedestrians. The current study aimed to evaluate pedestrian anger expression (PAX) and its contributing factors, including demographics, travel habits, and the big five personality traits. To test the effects of different variables on PAX scales, data from 742 respondents were collected. The data were analyzed through a two-stage approach of clustering and a logistic regression model. Participants were clustered into two groups of low expression and high expression based on their responses to PAX items. An exploratory factor analysis identified significant constructs of PAX, including “Adaptive/Constructive Expression”, “Anger Expression-In”, and “Anger Expression-out”. It was found that males were more likely to show high anger expressions. Public transport usage and previous crash involvement could significantly increase the probability of high anger expression. On the other hand, life satisfaction and intention to avoid traffic were negatively associated with high anger expression. The results revealed that neuroticism, extraversion, and openness to experience could positively contribute to higher anger expression; however, agreeableness and conscientiousness were negatively associated with high anger expression for pedestrians.



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Keywords: pedestrian; anger expression; big five; personality traits; questionnaire; vulnerable road users

1. Introduction

Pedestrians have always been considered vulnerable road users, and several studies have been conducted in order to improve their safety [1]. Most of the past literature on pedestrian safety have identified road-related factors and driver-related factors as the main contributors to risky pedestrian behavior; however, the contribution of pedestrians was neglected [2]. In recent years, researchers have focused on pedestrians’ characteristics (e.g., demographic and psychological factors) to improve pedestrian safety. For example, older pedestrians were less inclined to cross the street, which is risky, in comparison with the youth [3]. Middle-aged pedestrians also showed a higher intention to run a red light than older pedestrians [4]. Furthermore, studies tested the effect of gender differences on pedestrian street-crossing behavior. Females were less likely to show risky behavior when crossing the street [5]. Previous literature has confirmed that there is a relationship between pedestrian behavior and crashes [6]. Moreover, studies showed that angry drivers reported more risky behavior than other drivers, which can lead to a higher probability of being involved in traffic crashes [7]. Such trends have been observed among other road users, including motorcyclists [8] and cyclists [9].

Despite various studies in the field of pedestrian behavior [10,11], a recent study developed a questionnaire that measures pedestrian anger expression (PAX) [12]. A principal component analysis revealed that pedestrians deal with their anger in three major ways: externally, internally, and constructively. These three methods were titled adaptive/constructive expression, anger expression-in, and anger expression-out, respectively.

While the effects of age and gender on PAX were investigated in [12], other studies on other road users have stated that, in addition to demographic characteristics, other factors, such as mindfulness, narcissism, forgiveness, and consideration, were also influential in explaining anger expression [13,14]. People with a higher level of “mindfulness” and “forgiveness and consideration” reported lower levels of anger expression. On the contrary, a higher level of narcissism resulted in a higher anger expression; therefore, personality characteristics were important in explaining anger expression.

Many recent studies have used the big five personality traits to assess the relationship between drivers’ personality traits and their risky behaviors and accidents [15–17]. The big five are broad personality characteristics of agreeableness, extraversion, openness to experience, neuroticism, and conscientiousness, which can summarize differences between individuals in thought, feelings, and behaviors [18,19]. Furthermore, Abele [20], by using a simulator-based approach, stated that there was a positive association between the verbal expression of drivers and lapses. This study also found a negative relationship between verbal expression and constructive expression. Gestural expression also had a positive impact on both violations and aggressive expressions for drivers.

Aims and Contributions

This study aims to explain pedestrian anger expression and explore how personal and psychological factors, such as demographics, big five personality traits, and travel habits, can impact their anger expression. The contributions of this study are:

1. Although the relationship between personality traits and anger expression in the literature is well-acknowledged for drivers, there is a lack of investigation for pedestrians. Therefore, the current study developed and validated the pedestrian anger expression questionnaire to identify different levels of anger expression among pedestrians and their contributing factors.
2. Since anger is an intense emotional state that can cause a negative response [21], it was expected that individual psychological characteristics could significantly affect its expression. To test this hypothesis, the current study explored the role of the big five personality traits in anger expression by presenting a logistic regression model.
3. Due to the different attributes of transport systems (especially public transport systems) in the study country, it was expected that travel habits could affect pedestrian anger expression. Therefore, in addition to the personal and psychological factors (demographics and big five personality traits), this study assessed the role of travel habits and patterns (e.g., public transport usage, etc.) in pedestrian anger expression.
4. To present robust results regarding the factors affecting pedestrian anger expression, this study used a two-stage approach of clustering and a logistic regression model. Clustering pedestrians based on their anger expression can improve the accuracy and efficiency of subsequent logistic regression models.

The paper is ordered as follows: Section 2 presents the methodology adopted for this study, including the questionnaire and participants. Section 3 shows the results obtained by the statistical models. Finally, Section 4 discusses the model results and relevant studies.

2. Method

2.1. Questionnaire

There were four sections in the questionnaire. In the first section, demographic questions, including gender, age, education level, and the number of personal household cars were presented. The second section consisted of PAX questions (see Appendix A for the PAX questionnaire). These questions measured pedestrian anger based on:

- Adaptive or constructive expression: this represents behavior of the individual where they attempt to obey the rules and display positive interactions with other users;
- Anger expression-in: this is a type of behavior where an individual displays physical or aggressive verbal behavior toward others when becoming nervous;

- Anger expression-out: this represents the situation when the individual experiences anger and either suppresses it or expresses it.

The third part was dedicated to the big five personality trait questions. This section included:

- Agreeableness: being tolerant, good-natured, and cooperative;
- Extraversion: being assertive, impulsive, talkative, and sociable;
- Openness to experience: being original, intellectual, and interested;
- Neuroticism: being depressive, emotionally unstable, hostile, anxious, and nervous;
- Conscientiousness: being organized, responsible, and achievement-oriented.

In the last part of the questionnaire, the mobility habits and crash involvement of respondents were measured. This included: average daily walking in minutes (i.e., less than 30, between 30 and 60, and more than 60); the main reason for walking (i.e., health/fun, avoiding traffic, and no other option); the main mode of transportation (i.e., walking, cycling, public transportation, and private car); the level of life satisfaction (i.e., low, moderate, and high); and crash involvement in the past five years as a pedestrian.

2.2. Participants

The online survey was created on Porsall, one of the trusted platforms for generating online questionnaires for research purposes in Iran. To obtain a representative sample, the questionnaire link was randomly sent to about 2000 people living in Tehran, the capital of Iran. It is noteworthy that Iran does not have detailed regular census data for the demographics as in developed countries. As such, the representativeness of the sample was ensured based on the experience of the researchers, available general population demographics data, and data quality scrutiny during the survey. For example, the 48.92% female respondent distribution in the present survey aligns with the 49.5% distribution of the female population in 2020 in Iran. Due to the wide age range of pedestrians, different age groups were selected for the survey. Furthermore, the other demographic data were also continuously monitored during the survey to ensure the appropriate distribution.

Data collection was completed in May 2022. At the beginning of the questionnaire, the respondents were made aware of the details of the study. The respondents were informed that they only had to express their personal opinion and that there were no correct or incorrect responses to the PAX questionnaire. They were also assured that the questionnaire information was anonymous and confidential. The university ethics committee approved the survey. A total of 742 respondents participated in the study. Table 1 shows the demographic details of the participants.

Table 1. Sample demographics.

Attribute	Options	Number	Percentage
Gender	Female	363	48.92
	Male	379	51.08
Age	18–24	259	34.91
	25–39	216	29.11
	40–60	184	24.80
	More than 60	83	11.19
Marital status	Single	451	60.78
	Married	291	39.22
Educational level	Diploma and lower	154	20.75
	Undergraduate	389	52.43
	Postgraduate	199	26.82
Car ownership	Zero	58	7.82
	One	325	43.80
	Two and more	359	48.38

2.3. Data Analysis

In line with [12], the PAX scales were used in this study. A confirmatory factor analysis (CFA) with varimax rotation was used in SPSS AMOS 24 to analyze the questionnaire. Items or statements with factor loadings smaller than 0.4 or cross-loading statements with similar loading values (i.e., smaller than 0.20) were discarded [22]. To test the model fit, the goodness of fit statistics, including χ^2/df , GFI, and RMSEA, were calculated. To determine the effects of different variables on PAX, a two-stage approach of clustering and a logistic regression model was conducted, in line with previous literature in this area [18,19]. The weighted mean of the three main PAX factors was calculated for each participant. K-means clustering was used to cluster each respondent into two different groups of low expression and high expression based on the three PAX factors. The average silhouette was then calculated to ensure the validity of the clustering and its effectiveness and accuracy. The value ranges from -1 to $+1$, and higher values show better clustering. Subsequent to the clustering, the logistic regression model was used to test the effects of the variables on the PAX clusters. The logistic regression analysis with the dependent binary variable showed which of the proposed factors can impact the probability of respondents being in each PAX cluster.

3. Results

3.1. PAX Model

The CFA analysis resulted in twenty-six items falling into three factors. The Cronbach's alphas of 0.88, 0.80, and 0.84 indicated good reliability. The goodness of fit statistics were also acceptable ($\chi^2/df = 2.81$, GFI = 0.91, and RMSEA = 0.079). The most commonly reported responses for each factor were: I tell myself this is not worth conflict (physical) when other road users (motorists, pedestrians, motorcyclists, etc.) make me angry (adaptive/constructive expression); I shake my head in regret when other road users make me angry (anger expression-in); and I yell questions like "Where did you get your license?" when other road users make me angry (anger expression-out). The means, standard deviations, and factor loadings for each item are shown in Table 2.

Table 2. Means, standard deviations, and factor loadings (N = 742).

Items	M	SD	Factor Loading
Factor 1: Adaptive/Constructive Expression (11 Items, Cronbach's Alpha = 0.884)			
I tell myself this is not worth conflict when other road users make me angry.	2.39	0.84	0.53
I pay closer attention to avoid conflict with them when other road users make me angry.	2.04	0.83	0.57
I think things through before I respond when other road users make me angry.	1.97	0.84	0.70
I try to control my anger when other road users make me angry.	1.96	0.75	0.67
I tell myself to ignore it when other road users make me angry.	1.87	0.78	0.77
I try to admit that not everyone treats me well when other road users make me angry.	1.73	0.84	0.71
I try to think of positive solutions to deal with the situation when other road users make me angry.	1.63	0.85	0.64
I tell myself this is not worth getting all mad about when other road users make me angry.	1.62	0.84	0.73
I think about things that distract me from the problem when other road users make me angry.	1.25	0.79	0.55
I try to think of positive things to do when other road users make me angry.	1.24	0.82	0.67
I do things like take deep breaths to calm down when other road users make me angry.	1.21	0.77	0.50

Table 2. Cont.

Items	M	SD	Factor Loading
Factor 2: Anger Expression-In (6 items, Cronbach's alpha = 0.796)			
I shake my head in regret when other road users make me angry.	2.08	0.80	0.53
I make negative comments about their behavior under my breath when other road users make me angry.	1.92	0.83	0.68
I swear at them under my breath when other road users make me angry.	1.67	0.83	0.76
I look angrily at them when other road users make me angry.	1.61	0.79	0.70
I make hostile gestures other than giving the finger when other road users make me angry.	1.56	0.78	0.60
I glare at them when other road users make me angry.	1.53	0.82	0.49
Factor 3: Anger Expression-Out (9 items, Cronbach's alpha = 0.840)			
I yell questions like "Where did you get your license?" when other road users make me angry.	1.22	0.73	0.55
I yell at my companions when other road users make me angry.	1.12	0.61	0.53
I yell at them when other road users make me angry.	1.09	0.60	0.70
I try to get angry with myself when other road users make me angry.	1.04	0.56	0.49
I loudly swear at them when other road users make me angry.	1.00	0.57	0.76
I try to somehow scare them when other road users make me angry.	0.91	0.52	0.66
I try to do the same as them when other road users make me angry.	0.90	0.49	0.64
I get into physical conflicts with them when other road users make me angry.	0.79	0.38	0.66
I make them get out of the vehicle when other road users make me angry.	0.79	0.33	0.63

3.2. Logistic Regression Model

A two-stage approach of clustering and a logistic regression model was conducted to determine the effects of different variables on PAX. The results of the clustering showed that the average silhouette = 0.624, indicating the appropriateness of the clustering. Table 3 presents the results of the clustering and the mean values and standard deviations for each big five personality trait based on the clusters. The low- and high-expression groups were the dependent variables in the logistic regression model. The independent variables of the model are described below:

Table 3. Participant information and the mean values and standard deviations of the big five personality trait factors for the PAX clusters.

Cluster	N	Big Five Personality Traits				
		Neuroticism	Extraversion	Openness to Experience	Agreeableness	Conscientiousness
Low expression	364	1.597 (0.51)	1.415 (0.47)	1.282 (0.45)	1.468 (0.64)	1.527 (0.34)
High expression	378	1.844 (0.62)	1.430 (0.48)	1.238 (0.41)	1.297 (0.55)	1.309 (0.29)

3.2.1. Demographics

The demographic information included gender (female or male), age group (18–24, 25–39, 40–60, and 61 and above), marital status (single or married), education level (diploma and lower, undergraduate, and postgraduate), and car ownership (no car, one car, and two or more). The details are provided in Table 1.

3.2.2. Personality Traits

Consistent with [22], a total of 31 questions were included in the questionnaire to determine the big five personality traits of the participants: agreeableness, extraversion, openness to experience, neuroticism, and conscientiousness. Table 4 shows the mean values and standard deviations of the big five personality traits. The k-means clustering was

conducted, and each respondent was clustered into two groups based on their answers in each of these five characteristics. The big five factors were entered into the logistic regression model as binary variables.

Table 4. Mean values and standard deviations of the big five personality traits.

Neuroticism	Extraversion	Openness to Experience	Agreeableness	Conscientiousness
1.720 (0.56)	1.422 (0.47)	1.260 (0.43)	1.382 (0.59)	1.418 (0.32)

3.2.3. Mobility Habits

Apart from the abovementioned questions, the participants were asked about their mobility habits (e.g., public transport usage, walking, etc.), as described in Section 2.1. The results showed that 4.9% of respondents (N = 36) were regular public transport users. Moreover, 38.0% of participants (N = 282) stated that they often used public transport, 46.9% of respondents (N = 348) rarely used the public transport system, and 10.2% of them (N = 76) were not public transport users.

Regarding walking habits, 36.1% of the participants (N = 269) stated that they walk less than 30 min per day, 41.2% (N = 305) walked between 30 min and one hour, and 19.7% of pedestrians (N = 146) reported between one and two hours of walking per day. Only 3.0% of them (N = 22) reported walking more than two hours per day.

Regarding crash involvement as a pedestrian, 83.8% of respondents (N = 622) reported that they were not involved in crashes as a pedestrian, while 10.2% of pedestrians (N = 76) were involved in traffic crashes without any injury. Only 5.9% of respondents (N = 44) were involved in crashes as a pedestrian leading to an injury.

Based on the described variables, the logistic regression model was used to show the effects of each variable on PAX. Table 5 presents the output of the model. The model summary showed: Chi-square = 175.602, $p < 0.001$, $-2\loglikelihood = 825.764$, and $R^2 = 0.211$ (Cox and Snell) and 0.281 (Nagelkerke). The results of the logistic regression model revealed that gender could significantly affect the probability of high anger expression. Male pedestrians were more likely to show high anger expression (OR = 2.076). It was further observed that public transport usage had a positive association with high anger expression (OR = 1.691). Furthermore, a higher level of life satisfaction could decrease the probability of high anger expression (OR = 0.481). Moreover, participants with crash experience as a pedestrian had a higher likelihood of reporting a high level of anger expression (OR = 2.073). With regard to the big five personality traits, neuroticism (OR = 2.521), extraversion (OR = 1.528), and openness to experience (OR = 1.546) were positively associated with high anger expression. In contrast, agreeableness (OR = 0.484) and conscientiousness (OR = 0.456) were negatively associated with high anger expression.

Table 5. Significant variables in the logistic regression model.

	B	S.E.	Sig.	Exp (B)
Gender **	0.730	0.176	<0.001	2.076
Self-Crash **	0.729	0.241	0.003	2.073
Public Transport **	0.525	0.182	0.004	1.691
Avoid Traffic *	−0.389	0.217	0.073	0.678
Life Satisfaction (H) **	−0.732	0.271	0.007	0.481
Neuroticism **	0.925	0.186	<0.001	2.521
Extraversion **	0.424	0.195	0.030	1.528
Openness to exp. **	0.436	0.190	0.022	1.546
Agreeableness **	−0.725	0.199	<0.001	0.484
Conscientiousness **	−0.786	0.182	<0.001	0.456

** $p < 0.01$. * $p < 0.05$.

4. Discussion

The current study aimed to evaluate pedestrian anger expression and its contributing factors, including demographics, travel habits, and the big five personality traits. To test the effects of different variables on the PAX scales, a two-stage approach of clustering and a logistic regression model were proposed. Participants were clustered into two groups of low expression and high expression based on their responses to the PAX items. A logistic regression model was suggested to test the effect of demographics and big five personality traits on PAX clusters. It was found that the chance of high anger expression was higher among males. The findings agree with [12], which confirmed that female pedestrians were less likely to express anger aggressively than male pedestrians. It can be interpreted that the cultural context and social values of the country can be a contributing factor to the result that females are less likely to show their anger.

This study showed that public transport users are more likely to express their anger aggressively. Since the study country is a developing middle-income country, pedestrians face several safety issues in the public transport industry, such as taxi fleets [23]. Further, in past studies, it was observed that public transport passengers often encounter rude behavior and that the subjective perceptions of public transport security could be influenced more by rude encounters than by real crimes in public transport [24]. Thus, it can be concluded that the negative attributes of the public transport fleet may have led users to show a higher level of anger expression in angry situations. The results also revealed that the experience of crash involvement could increase the probability of anger expression for pedestrians. On the other hand, those with a higher perception of avoiding traffic reported a significantly lower probability of high anger expression.

The results revealed that life satisfaction could be negatively associated with a high anger expression, i.e., those with a higher level of life satisfaction had more adaptive orientation in anger situations. These results are consistent with [25], which showed that the level of anger can negatively affect life satisfaction.

The results with regard to the big five personality traits showed that neuroticism, extraversion, and openness to experience were positively associated with high anger expression. These results can be interpreted to show that personal traits such as being sociable, talkative, impulsive, assertive, emotionally unstable, nervous, anxious, depressive, hostile, interested, intellectual, and original can result in a higher level of anger expression [18]. On the other hand, personal traits such as being cooperative, good-natured, tolerant, achievement-oriented, responsible, and organized can result in a more adaptive orientation and a lower level of anger expression in anger situations for pedestrians [18].

5. Conclusions

The current study aimed to evaluate pedestrian anger expression and its contributing factors, including demographics, travel habits, and the big five personality traits. In this study, participants were clustered into two groups of low expression and high expression based on their responses to PAX items. An exploratory factor analysis identified significant constructs of PAX, including “Adaptive/Constructive Expression”, “Anger Expression-In”, and “Anger Expression-out”. The key conclusions of the current study are:

- Male pedestrians were more likely to show higher anger expression than females.
- Public transport usage and previous crash involvement significantly increased the probability of high anger expression for pedestrians.
- Higher life satisfaction and the intention to avoid traffic were negatively associated with high anger expression for pedestrians.
- Neuroticism, extraversion, and openness to experience could positively contribute to higher anger expression; however, agreeableness and conscientiousness were negatively associated with high anger expression for pedestrians.

The present study showed that it is important to understand the personality traits of pedestrians to develop countermeasures for pedestrian anger management and to promote safe walking behavior. For example, through well-designed and well-managed public

transport systems, it may be possible to reduce rude behavior in public transport, which can indirectly improve pedestrians' subjective experience and may reduce anger expression. Likewise, policymakers may consider developing education measures targeting pedestrians to reduce their anger expressions and promote a safe walking culture.

This study had some limitations. First, the sample is restricted to Iran. People from different cultures may display their anger expressions differently. In the future, similar studies can be conducted in other geographic regions to average any geographical bias related to the evaluation of pedestrian anger expression. Second, despite the impact of pedestrians' anger expression on their safety, explorations of its contributing factors are widely missing in the past literature. Therefore, future research in different contexts should be conducted to explore this challenge and compare the results. This will assist transport authorities and decision makers to develop relevant policies and pedestrian safety strategies. Third, some responses from participants may be biased, as some participants may underreport undesirable behaviors. However, the authors tried to minimize this bias by assuring the participants that their responses would be anonymous.

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Institutional Review Board Statement: The Ethics Committee of the School of Civil Engineering, University of Tehran, approved the survey study (protocol code 82-C-413, approved on 2 March 2022).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study. The participants voluntarily participated in this study.

Data Availability Statement: Data can be made available by contacting the first coauthor, Kayvan Aghabayk (kayvan.aghabayk@ut.ac.ir).

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Pedestrian Anger Expression (PAX) Questionnaire.

Adaptive/Constructive Expression	
1-	I tell myself this is not worth conflict when other road users make me angry.
2-	I pay closer attention to avoid conflict with them when other road users make me an-gry.
3-	I think things through before I respond when other road users make me angry.
4-	I try to control my anger when other road users make me angry.
5-	I tell myself to ignore it when other road users make me angry.
6-	I try to admit that not everyone treats me well when other road users make me angry.
7-	I try to think of positive solutions to deal with the situation when other road users make me angry.
8-	I tell myself this is not worth getting all mad about when other road users make me angry.
9-	I think about things that distract me from the problem when other road users make me angry.
10-	I try to think of positive things to do when other road users make me angry.
11-	I do things like take deep breaths to calm down when other road users make me angry.
Anger Expression-In	
1-	I shake my head in regret when other road users make me angry.

Table A1. *Cont.*

2-	I make negative comments about their behavior under my breath when other road users make me angry.
3-	I swear at them under my breath when other road users make me angry.
4-	I look angrily at them when other road users make me angry.
5-	I make hostile gestures other than giving the finger when other road users make me angry.
6-	I glare at them when other road users make me angry.
Anger Expression-out	
1-	I yell questions like “Where did you get your license?” when other road users make me angry.
2-	I yell at my companions when other road users make me angry.
3-	I yell at them when other road users make me angry.
4-	I try to get angry with myself when other road users make me angry.
5-	I loudly swear at them when other road users make me angry.
6-	I try to somehow scare them when other road users make me angry.
7-	I try to do the same as them when other road users make me angry.
8-	I get into physical conflicts with them when other road users make me angry.
9-	I make them get out of the vehicle when other road users make me angry.

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