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Boško Matović, PhD¹

E-mail: boskom@uns.ac.rs

Miloš Pljakić, MSc²

E-mail: pljakicmilos@gmail.com

Aleksandar Bulajić, PhD³

E-mail: bulajic@vtsns.edu.rs

Predrag Stanojević, PhD⁴

E-mail: stanojevicpredrag@yahoo.com

Svetlana Bačkalić, PhD¹

E-mail: basic@uns.ac.rs

¹ Faculty of Technical Sciences, University of Novi Sad
Novi Sad, Serbia

² Faculty of Technical Sciences, University of Priština in Kosovska Mitrovica
Kosovska Mitrovica, Serbia

³ Technical College of Applied Sciences
Novi Sad, Serbia

⁴ Technical College of Applied Sciences Uroševac with temporary seat in Leposavić
Leposavić, Serbia

FACTOR STRUCTURE OF THE DRIVING ANGER SCALE AMONG SERBIAN DRIVERS

Key Words

Road accident;
Driving anger;
Risky behavior;
Factor
structure;
Road safety

Abstract

Driving anger is situational personality trait that may predispose individuals to risky and aggressive driving behaviour on the roads. In this paper we examined factor structure of the original DAS in Serbian driving conditions. The study was cross-sectional in design, and carried out in the sample consisted of 380 regular drivers. We conducted CFAs of the data on the DAS, comparing five competing models. The results shown that the five-factor and bifactor solutions offered the best fit to the data relative to the other models. However, in absolute terms, neither of these models offered an acceptable representation of the data. The results were discussed and compared with findings of the previous research.

1. INTRODUCTION

Road accidents remain one of the most prevalent causes of injuries on a global level. They are also estimated to be the most dominant cause of premature mortality and the eighth leading cause of all deaths globally. According to the estimations of the World Health Organization (WHO), more than 1.2 million traffic fatalities occur on the world's roads every year. Over 90% of fatal injuries occur in low-income and middle-income countries (WHO, 2015). In the Serbian context, there were 8.4 fatalities per 100,000 inhabitants in 2015 compared with 2.5 in the best-performing countries, such as Norway, Sweden, and the United Kingdom (ITF, 2017). It is now well recognized that the behaviour of road users is an important contributing factor in both accidents and fatalities (Moyano-Díaz, 1997; Bendak, 2005; Zhang et al., 2013).

Previous studies have shown that various human factors such as gender, age, driving skills and styles, personality traits, and socio-cognitive factors play an important role in predicting traffic violation behaviours (Dahlen et al., 2005; Rhodes and Pivik, 2011; Taubman-Ben-Ari and Yehiel, 2012; Delhomme et al., 2012; Bachoo et al., 2013; Jovanović et al., 2017). One personality trait that may predispose individuals to risky and aggressive driving behaviour is anger. It has become apparent that anger can be paramount in predicting driving behaviours. A growing body of research indicates that large amounts of anger are more likely to cause several risky and aggressive behaviours pertaining to driving. Naturally, accidents are also more likely to occur. (Dahlen et al., 2005; Nesbit et al., 2007; Jovanović et al., 2011; Delhomme et al., 2012; Bachoo et al., 2013; Zhang et al., 2015; Bogdan et al., 2016; Wickens et al., 2016).

The DAS factor structure and psychometric properties were widely examined in samples from the United Kingdom (Lajunen et al., 1998), New Zealand (Sullman, 2006), France (Villieux and Delhomme, 2007; Villieux and Delhomme, 2010; Albertosa et al., 2018), Spain (Sullman et al., 2007), Turkey (Yasak and Esyok, 2009), Malaysia (Sullman et al., 2014), China (Li et al., 2014; Feng et al., 2016) and Romania (Sârbescu, 2016). Nevertheless, certain authors bring to our attention a variety of issues that are psychometric in nature and have to do with utilizing the DAS.

These several studies have raised doubts about the dimensionality of the DAS. A range of factor structures that were acquired in the mentioned research shed light on what the most adequate structure would be for such a scale. Lajunen et al. (1998) have argued in favour of a three-factor solution. Through the elimination of non-anger provoking situations and the factor analysis procedure, the DAS 21-item version was established in the United Kingdom (UK). Specifically, they have argued that driving anger should be partitioned into the dimensions: "progress impeded", "reckless driving" and "direct hostility". Subsequently, Sullman (2006) suggested a four-factor model drastically different than what was devised in the research conducted in the USA and the UK (risky driving, progress impeded, discourteous behaviour and hostile gestures). Recently, Feng et al. (2016) revised the original DAS and devised a version of the DAS containing 19 items. In its

totality, the scale was comprised of four dimensions. These included traffic obstructions, discourtesy, illegal and slow driving, which showed a significant difference compared to that of the factor structures obtained in the USA (Deffenbacher et al., 1994). The same can be said about the studies conducted in the UK (Lajunen et al., 1998) and New Zealand (Sullman, 2006). In France, Delhomme and Villieux (2007) revealed five main underlying factors of the DAS that share a similarity with those that have been identified in the initial version from the USA. Four of the five factors were fairly consistent with the original DAS (i.e. police presence, illegal driving, traffic obstructions, and hostile gestures), except the discourtesy factor. The fifth factor labeled as “progress impeded” was devised in such a way that the items from the original version of slow driving (five of them) were combined with the discourtesy factors (two items). This factor had similarities with the progress impeded factor reported in Lajunen et al.’s (1998) study. Delhomme and Villieux (2010) then proceeded to test the psychometric properties of the DAS based on these five factors. Researchers have confirmed that the five-dimensional model is valid and reliable. Furthermore, several factor analytic studies have replicated the original six-factor structure by using confirmatory factor analysis (CFA) in moderate-sized samples (Sullman et al., 2007; Sullman et al., 2014; Li et al., 2014; Albentosa et al., 2018). Finally, Sărbescu (2016) investigates the degree to which the scores of the DAS subscale are reliable, by means of utilizing the bifactor model approach. The author has revealed that it is safe to say that the collection of the items needs to be thought of as unidimensional.

The paper at hand aims to assess the factorial structure of the DAS and estimate how reliable these factors are when dealing with Serbian participants.

2. METHODOLOGY

2.1. Participants

The sample consisted of 380 regular Serbian drivers (221 males and 159 females) ranging in age from 19 to 71 ($M = 41.22$, $SD = 11.35$). A regular car driver was defined as a person having a car driving license and who has driven at least 1,000 km with a car or a van within the last twelve months. The drivers’ experience ranged from less than a year up to 54 years ($M = 19.21$.; $SD = 10.45$), and the mileage in the past twelve months was between 1,000 and 180,000 kilometers ($M = 14,024.47$; $SD = 15,451.92$).

2.1.2. Instruments

The Driving Anger Scale (DAS). The DAS is a self-report instrument designed to assess the anger engendered by specific driving-related situations (Deffenbacher et al., 1994). In its long-form, the scale consists of 33 items divided into six scales: hostile gestures, illegal driving, police presence, slow driving, discourtesy, and traffic obstructions. On each item, respondents are asked to rate the amount of

anger generated by each situation, using a 5-point Likert scale ranging from “Not at all” to “Very much”.

Background information regarding the participants' socio-demographics (e.g., age, gender, place of residence), driving characteristics (e.g., driving experience, mileage in the past 12 months), and general driving history (e.g., accident and violation involvement) was obtained.

2.1.3. Procedure

All procedures were in accordance with the revised Helsinki Declaration (2013) and all the participants gave consent before completing the questionnaires. The participants filled in the DAS in accordance with a procedure that has been approved by the Ethics Committee. The survey had no time limit. Filling in the questionnaires took 5 min on average.

We implemented a cross-sectional Internet-based survey to collect the data for this study. All the survey data was collected and organized via the JotForm online survey software and questionnaire tool. The participants were recruited into the research using social media and email invitations. Internet data collection methods have been evaluated in many studies and found to be generally equivalent to a paper-and-pencil method (Davidov and Depner, 2011; Weigold et al., 2013).

3. RESULTS

We conducted CFAs of the data on the DAS with IBM® SPSS® Amos™ 22 (Arbuckle, 2013), comparing five competing models identified in the prior studies (see Table 1). These models included a three-factor model proposed by Lajunen et al. (1998), (Model 1); a four-factor model put forward by Sullman (2006), (Model 2); a five-factor model of Villieux and Delhomme (2007; 2010), (Model 3); the original six-factor model identified by Deffenbacher et al. (1994) and confirmed by Sullman et al. (2007; 2014), Yasak and Esiyok (2009), Li et al. (2014), and Albertosa et al. (2018), (Model 4); and a bifactor model proposed by Sârbescu (2016), (Model 5).

The CFA fit indices reflect to what extent the hypothesized factor structure is explained by the covariances between the items, which refers to the model fit. The fit of these models was evaluated by using several model fit indices available in the literature. Apart from the χ^2 -test, which is known to be overly sensitive when the sample size is large, we adopted the widely accepted cut-off criteria in the scientific community. The guidelines for interpreting RMSEA (Root Mean Square Error of Approximation) are as follows: RMSEA < 0.05 indicates a good model fit; 0.05 < RMSEA < 0.08 indicates a reasonable model fit; and RMSEA > 0.10 indicates a poor model fit (Steiger, 1990; Browne and Cudeck, 1993; Hair et al., 1998). The χ^2 /df ratio needs to be between 2 to 5 to indicate an adequate model fit (Marsh and Hocevar, 1985). The values of Comparative Fit Index (CFI), Goodness of Fit Index (GFI), and Tucker-Lewis Index (TLI) greater than 0.90 and 0.95 are typically taken to reflect an acceptable and excellent fit to the data, respectively (Bentler and

Bonett, 1980; Hu and Bentler, 1999). The maximum likelihood estimation method was used, because of its good applicability to a wide range of analytical conditions (Hu, Bentler, & Kano, 1992).

Table 1. Factor models with components and associated items

Model	Factor structure	Factor: DAS items
Model 1.	Three-factor (Lajunen et al., 1998)	Progress Impeded: 1, 3, 4, 8, 9, 10, 17, 20, 28 Reckless Driving: 2, 5, 6, 7, 12, 13, 14, 15, 25 Direct Hostility: 21, 24, 27 Risky Driving: 2, 5, 6, 7, 13, 15, 22, 25, 26, 30
Model 2	Four-factor (Sullman, 2006)	Progress Impeded: 11, 16, 18, 19, 23, 29, 31, 32, 33 Discourtesy: 1, 3, 4, 8, 9, 10, 12, 14, 17, 20, 28 Hostile Gestures: 21, 24, 27 Progress Impeded: 1, 3, 9, 10, 18, 20, 28
Model 3	Five-factor (Villieux and Delhomme, 2007; 2010)	Illegal Driving: 2, 6, 13, 25 Hostile Gestures: 21, 24, 27 Police Presence: 11, 16, 23, 29 Traffic Obstructions: 26, 30, 31, 32 Hostile Gestures: 21, 24, 27
Model 4	Six-factor (Deffenbacher et al., 1994; Sullman et al., 2007; Yasak and Esiyok, 2009; Sullman et al., 2014; Li et al., 2014; Albentosa et al., 2018)	Illegal Driving: 2, 6, 13, 25 Police Presence: 11, 16, 23, 29 Slow Driving: 1, 3, 4, 9, 10, 18 Discourtesy: 5, 7, 8, 12, 14, 15, 17, 20, 28 Traffic Obstructions: 19, 22, 26, 30, 31, 32, 33 Hostile Gestures: 21, 24, 27 Police Presence: 11, 16, 23, 29
Model 5	Bifactor (Sârbescu, 2016)	Slow Driving: 1, 3, 4, 9, 10, 18 Discourtesy: 5, 7, 8, 12, 14, 15, 17, 20, 28 Traffic Obstructions: 19, 22, 26, 30, 31, 32, 33 Illegal Driving: 2, 6, 13, 25

Table 2 summarizes the goodness-of-fit indices for the five models. Based on the goodness-of-fit indices, the five-factor and bifactor solutions offered the best fit to the data relative to the other models. However, in absolute terms, neither of these models offered an acceptable representation of the data.

Table 2. Model goodness-of-fit indices.

Model	χ^2	df	χ^2/df	CFI	GFI	TLI	RMSEA	RMSEA 90% CI
M1	888.50***	186	4.78	0.794	0.807	0.767	0.100	0.093 – 0.106
M2	2047.18***	489	4.19	0.708	0.733	0.685	0.092	0.088 – 0.096
M3	588.96***	199	2.96	0.869	0.871	0.848	0.072	0.065 – 0.079
M4	1443.34***	480	3.01	0.820	0.798	0.802	0.073	0.068 – 0.077
M5	1033.56***	447	2.31	0.886	0.836	0.865	0.061	0.056 – 0.066

Note: *** $p < 0.001$

4. DISCUSSION AND CONCLUSIONS

In the present study we compared the measurement models of the DAS proposed in the previous empirical research and revealed that the factor structure of the DAS developed in these studies does not seem to be entirely applicable to our Serbian sample.

The original DAS is a widely used instrument for measuring levels of driving anger and its factor structure has been investigated in various samples and across cultures. To the best of our knowledge, this is the first study using the original DAS in the Serbian driving context. Therefore, we compared five competing models (three-factor, four-factor, five-factor, six-factor, and bifactor) found in previous literature, and discovered that the bifactor model was the most supported, followed by the five-factor model. However, neither of them indicated a reasonable fit with the data. A lack of fit to the data and differences among these factor structures were also found in previous studies (Sullman et al., 2007; Sullman et al., 2014; Sărbescu, 2016; Albentosa et al., 2018). These inconsistencies may arise from cultural and methodological divergence. For example, studies used different approaches to locating the underlying dimensions of a data set. Deffenbacher et al. (1994) analyzed their data using cluster analysis, while the other studies used principal component analysis (Sullman, 2006; Yasak and Esiyok, 2009; Feng et al., 2016) or factor analysis (Lajunen et al., 1998; Villieux and Delhomme, 2007).

The study limitations should be highlighted. Firstly, the problem of giving socio-desirable responses, the context influence, and the problem recalling can lead to measurement errors due to applied self-reported measurement technique. However, in the present research respondents were convinced in anonymity and confidentiality of their responses, which should reduce social desirability and the problem of impression. Moreover, the previous research have shown that self-reported aberrant behaviors are not susceptible to social desirability. In addition, Blanchard et al. (2010) have revealed consistency between self-reported and objective exposure measures in sample of older drivers. Nevertheless, the results of the present research complement to the present practice, and suggest that adapted DAS represents useful instrument in terms of understanding the driving anger phenomenon.

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