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Validity of the Driving Anger Expression Inventory (DAX) in a Mexican Sample

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Abstract: This study assessed and validated in a Mexican sample (n = 987) the Driving Anger Expression Inventory (DAX), a measure of how people express their anger on the road. As a result, confirmatory factor analysis revealed the DAX original four-factor structure did not fit the Mexican sample. Exploratory factor analyses yielded a valid, six-factor solution. Three factors (personal physical aggression, use of the vehicle to express anger, and adaptive/constructive expression) were similar in their content to the original DAX, but not with the same number of items. Three new factors emerged (nonverbal aggression, verbal aggression aloud, and silent verbal aggression), which are not present in the original study of the DAX. Cronbach's Alphas ranged between .76 and .89.

Keywords: Aggression, angry drivers, driving behaviors, expression of driving anger.

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I. INTRODUCTION

When anger is frequent and intense, one of the reactions is expressing this emotion toward other individuals, for example, yelling or making obscene gestures showing disapproval to others. One of the settings for anger expression is that of driving, probably because obstacles and frustrations are very likely. This research validated in a Mexican sample an inventory which is widely used to assess self-control and behavioral reactions when drivers feel anger.

The Driving Anger Expression Inventory (DAX) was constructed to assess how drivers show their anger while driving (Deffenbacher, Lynch, Oetting, & Swaim, 2002). It has four subscales. First, verbal aggressive expression (e.g., "I swear at the other driver aloud"); second, personal physical aggressive expression, that is, using one's body to show anger (e.g., "I give the other driver the finger"); third, use of the vehicle to express anger (e.g., "I try to cut in front of the other driver"); and four, adaptive/constructive expression (e.g., "I try to think of positive solutions to deal with the situation").

We found ten studies (Esiyok, Yasak, & Korkusuz, 2007; Ge, Qu, Zhang, Zhao, & Zhang, 2015; Herrero-Fernández, 2011; Sarbescu, 2012; Stephens & Sullman, 2014; Sullman, 2015; Sullman, Stephens, & Hill, 2016; Sullman, Stephens, & Kuzu, 2013; Villieux & Delhomme, 2008, 2010) that assessed the factor structure of the DAX in several countries, including British Isles, China, France, New Zealand, Romania, Spain, Turkey, and Ukraine. Some factors have been consistently replicated across studies, while other factors have not. The more solid factors are the use of the vehicle to express anger and the adaptive expression scale, which were replicated in the ten studies. The verbal aggressive expression factor was retained in seven studies (Esiyok et al., 2007; Ge et al., 2015; Herrero-Fernández, 2011; Stephens & Sullman, 2014; Sullman et al., 2013, 2016; Sullman, 2015), and six studies retained the personal physical aggressive expression factor (Esiyok et al., 2007; Ge et al., 2015; Herrero-Fernández, 2011; Stephens & Sullman, 2014; Sullman et al., 2013; 2016). While

different samples, methods, and data analyses may account for different findings and number of factors, the DAX factor structure cannot be assumed, and has to be stablished empirically in each country.

At the moment of writing this manuscript, we did not find studies that validated the DAX in Mexico. However, anger exists and deserves further study in this country. For example, some Mexican drivers experience high levels of anger and aggression, which were associated with hostility and violent reactions to other drivers (Martinez, 2011). Actually, some Mexican drivers experience aggression that lead to lethal consequences. Compared to individuals with low aggression, those with high aggression while driving were more involved in car accidents during the last 12 months, which resulted in injuries or death (Dorantes-Argandar, Cerda-Macedo, Tortosa-Gil, & Ferrero, 2015a). Aggressive behaviors while driving were also associated with stress and less prosocial behaviors in this country (Dorantes-Argandar, Cerda-Macedo, Tortosa-Gil, & Ferrero, 2015b). For some individuals, the most stressful situation while driving in Mexico is encountering people who drive violently (Dorantes-Argandar, Tortosa-Gil, & Ferrero, 2016). As a result, aggressive driving negatively impacts other drivers. The validation of the DAX might be relevant to detect individuals with aggressive expressions while driving, and to assess treatments about the reduction of anger expressions in Mexican drivers.

Therefore, this research assessed and validated the DAX in a country not previously studied. In particular, it assessed through confirmatory factor analysis (CFA) if the four factor solution of the original DAX is a valid measure in a sample of Mexican drivers. If it is not, the goal is to identify a valid factor solution for the DAX, which may identify forms of anger expression in Mexican drivers. In addition, correlations between the DAX, general anger and anger expression were examined.

II. METHOD

Participants

The non-random, convenience sample consisted of 987 Mexican university students (487 men and 500 women) from 34 different majors. The highest proportion of students was from nutrition (13%), with other majors below 13%; all from a private university. Mean age was 21.24 (*SD* = 2.66) and most of the students were catholic (78.6%), had another religion (7.6%) or expressed no religion preference (13.5%). Three participants did not provide religion status. Regarding car insurance, 78.7% had one, 20.1% did not have, and 1.2% did not answer. Participants informed a mean of 2.86 (*SD* = 2.11) hours driven per day during weekdays, and years of driving experience was in average 4.55 (*SD* = 2.68).

Measures

Driving Anger Expression Inventory (DAX). The scale measures four manners of expressing anger while driving (Deffenbacher et al., 2002). The 12-item Verbal aggressive expression scale (α = .88) assesses overt (e.g., "I swear at the other driver aloud") and covert verbal aggression (e.g., "I call the other driver names under my breath") with some nonverbal behaviors such as glares (e.g., "I give the other driver dirty looks"). The 11-item Personal physical aggressive expression scale (α = .81) measures physically aggressive displays (e.g., "I give the other driver the finger"), but not where the person uses the car as an instrument of aggression. The 11-item Use of the vehicle to express anger scale (α = .86) taps the use of the vehicle or one's driving behavior to frustrate, intimidate, or express displeasure to the other driver (e.g., "I flash my lights at the other driver"). The 15-item Adaptive/constructive expression scale (α = .90) measures cognitive and behavioral strategies for safe driving, problem-solving, distraction, and cognitively reframing the situation (e.g., "I try to think of positive thinks to do"). Answer choices range from 1 (*almost never*) to 4 (*almost always*).

Multicultural Latin American Inventory of Anger Expression and Hostility (ML-STAXI). The 44-item ML-STAXI measures two aspects: anger experience and expression (Moscoso, 2000; Moscoso & Spielberger, 1999). The anger experience dimension has two scales (state and trait anger). The 10-item state anger scale (α = .82) assesses the anger intensity at the moment of answering the questionnaire. It has two subscales. The 5-item feeling anger subscale (α = .77) measures the intensity of the emotion (e.g., "I am furious"); and the 5-item desire to express anger subscale (α = 86) assesses the desire to express anger physically or verbally (e.g., "I want to insult someone"). The 10-item trait anger scale (α = .83) measures the propensity to get angry easily across time and situation. The trait anger scale has two subscales. One assesses trait temperament (5 items, e.g., "I am a hotheaded person") or the tendency to experience anger in general with any situation, α = .83. The other subscale measures trait reaction (5 items, e.g., "I get angry when I do a good job and people do not give value to it") or the propensity to experience anger when facing specific frustrating events, α = .78.

The anger expression component of the ML-STAXI has four subscales. First, the 6-item anger-in subscale (α = .65) to assess anger-inwards or feeling the emotion without expressing it (e.g., "I harbor grudges that I do not tell to anyone"). Second, the 5-item anger-out subscale (α = .70) to measure anger expression toward other individuals (e.g., "I argue with others"). Third, the 6-item anger control-in subscale (α = .86) to assess the efforts to reduce anger intensity through relaxing (e.g., "I take deep breaths to relax"). Fourth, the 7-

item anger control-out subscale (α = .72) to measure the attempts to control one's behavior during anger episodes (e.g., "I control the way I react"). Answer choices range from 1 (*almost never*) to 4 (*almost always*). Higher scores reflect higher frequency in the content of the items. The ML-STAXI has a valid factor structure for Latin American samples (Moscoso, 2000), including Mexico (Alcázar, Deffenbacher, & Byrne, 2011).

Procedure

The DAX was translated from English to Spanish by two Mexican professional translators. Both lived in United States and now they work in a Mexican company of simultaneous translation and translation of documents. The lack of agreement in some words and phrases was solved through rewording items to improve comprehension for Mexican individuals. A group of 20 drivers from a private university completed the translated DAX with the instruction to report any aspect that was not clear. No problems emerged. Two native English speakers who lived in the U.S. most of their lives, but lived in Mexico for the last 8-10 years back-translated the DAX from Spanish to English. The back-translated DAX kept equivalent words and meanings to the original.

Questionnaires were administered during class hours to groups of 8-25 students. Teachers were present during the reading of the instructions, which were read aloud, clarifying the study was anonymous, and participation was voluntary. No student refused participation. When students turned in questionnaires, they were thanked for participation. This research was approved by the Institution's Research Department.

III. RESULTS

Confirmatory factor analysis

We used confirmatory factor analysis to assess the original DAX four factor structure (Deffenbacher et al., 2002) in the Mexican sample. Robust maximum likelihood methods of EQS 6.1 (Bentler, 1995) were used because multivariate kurtosis normalized estimate was 146.57 (> 3.00), revealing non-normality of data (Bentler, 2004). Model fit was assessed by: (1) the χ^2 and the Satorra-Bentler χ^2 scaled statistic (S-B χ^2) where nonsignificant values indicate good fit, although this statistic is highly sensitive to sample size such that a good fitting model may have a significant χ^2; (2) the comparative fit index (CFI) and (3) robust comparative fit index (RCFI) where values above .95 are considered good (Hu & Bentler, 1999); (4) the standardized root mean square residual (SRMR), where values below .08 are good (Hu & Bentler, 1999); and (5) the root mean square error of approximation (RMSEA) where values below .06 are good (Hu & Bentler, 1999). As a result, chi squares were significant, χ^2 and S-B χ^2 (*df* s = 1,121) = 6,690.59 and 5,032.20, *p*s < .001, although this is not unexpected in large samples. The SRMR (.081), RMSEA (.064), CFI (.73), and RCFI (.74) did not reach good fit. Therefore, the original four factor structure (Deffenbacher et al., 2002) does not seem to adjust to the Mexican sample.

Exploratory factor analyses

Because the 49-item DAX's original four factor structure did not replicate, we undertook Exploratory Factor Analyses (EFA) to identify the latent constructs the DAX measured in the Mexican sample. In particular, we used the principal axis method (Fabrigar, Wegener, MacCallum, & Strahan, 1999) because data had non-normal distribution. Oblique (promax) rotation was used to find factors that were conceptually independent, but empirically related (Nunnally & Bernstein, 1995). We retained items based on these criteria: (1) items had to load .40 or above on its factor, (2) the item could not load .30 or above on another factor, and (3) the item conceptually fits the factor. Finally, factors were retained if they had at least three items.

As a result, 12 items were eliminated in the first EFA, and four in the second. The third EFA was a satisfactory 33-item solution, yielding six straight factors that accounted for 59.02% of the variance (Table 1). Factors 1 to 3 replicated factors of the original DAX, but with different number of items. In particular, Factor 1 (7 items) indicated personal physical anger expression (e.g., "I try to scare the other driver"). Factor 2 (10 items) was about constructive/adaptive expression (e.g., "I try to think of positive things to do"). Factor 3 (6 items) tapped the use of the vehicle to express anger (e.g., "I try to cut in front of the other driver").

Factors 4 to 6 emerged from the 12-item verbal aggressive expression scale of the original DAX (Deffenbacher et al., 2002). Factor 4 (4 items) measured verbal aggression aloud (e.g., "I yell at the other driver"). Factor 5 (3 items) assessed silent verbal expression (e.g., "I swear at the other driver under my breath"). Factor 6 (3 items) was about nonverbal aggressive expression through glaring/looking with hate at the other driver and showing disapproval (e.g., "I glare at the other driver"). Alpha reliabilities ranged between .76 and .89 (Table 1).

DAX correlations, discriminant validity, and demographic variables

Driving anger expression scales formed moderate correlations between each other, suggesting they are related, although they measure different manners of expressing anger while driving (Table 2). The anger control dimension, as measured by the adaptive expression scale, was not related to the other DAX subscales. They had negligible correlations (*r*s between -.13 and .05), suggesting that anger control is not on the opposite side of the continuum of negative anger expression while driving.

We also analyzed the correlations between the DAX and the ML-STAXI, a scale that measures anger, but not in the driving context. As a result, DAX subscales had stronger correlations than those between the DAX and the ML-STAXI subscales, suggesting (1) some homogeneity within the DAX, which strengthens construct validity, and (2) the DAX seems to measure a different construct to the ML-STAXI, supporting discriminant validity.

A closer look also showed discriminant validity because traditional ML-STAXI anger expression scales like anger-in (e.g., harboring grudges) and anger-out (e.g., arguing) had low to moderate correlations (.24-.36) with measures of anger expression of the DAX. Hence, DAX subscales seem to capture forms of showing anger, not present in previous anger scales. However, in terms of anger management, ML-STAXI scales of control-in (e.g., relaxing) and control-out (e.g., being patient with others) had low to moderate correlations (.37-.50) with the DAX adaptive/constructive expression scale, suggesting some similarity between these constructs.

Other variables (age, years of driving experience, hours driven per day) showed low correlations with DAX subscales (*r*s between .00 and .11). The negligible correlations suggest these variables and DAX scores are independent in the current sample.

A multivariate analysis of variance revealed significant gender effects, $\lambda = .97$, F (6, 862) = 3.78, $p < .01$, $\eta^2 = .026$. Men used more physical aggression than women, and women used more silent verbal aggression than men (Table 3). However, effect sizes (η^2) were small according to Cohen's criteria (1988); below one percent, suggesting negligible gender effects. Men and women seem very similar on DAX subscales.

IV. DISCUSSION

The study has limitations. First, participants were university students, who may not represent non-student populations. The six-factor structure that we found should be replicated with other samples (e.g., less educated, older groups, or with lower socioeconomic status) to explore its stability in Mexico. However, the study addresses a topic poorly studied, although driving anger and aggression have had lethal consequences in this country (Dorantes-Argandar et al., 2015a). Moreover, university students are relevant because they are in the age range associated with more accidents and aggression in Mexico (INEGI, 2016), and they are also drivers. Second, we used only self-reports, which may not correspond completely with actual behaviors. Additional sources might be useful to assess the validity of the DAX. For example, collateral reports of individuals who know the participants' reactions when they get angry while driving.

This research validated the DAX in a Mexican college sample. Unlike the original DAX, which has four factors (Deffenbacher et al., 2002), we found a six-factor solution. Three factors (personal physical aggression, use of the vehicle to express anger, and adaptive expression) were similar in their content to the original DAX. The other three factors we found (nonverbal aggression, verbal aggression aloud and silently) are not present in the first study of the DAX (Deffenbacher et al., 2002).

One of the factors in the original DAX (Deffenbacher et al., 2002) is the verbal aggressive expression scale, with 12 items. However, in this study two items were eliminated, and the remaining items formed three factors: verbal aggression aloud (4 items), silent verbal aggression (3 items), and nonverbal aggression (3 items). Deffenbacher et al. (2002) explained in his sample the nonverbal aggression items accompanied verbal aggression, thus the items loaded in the same factor. Yet in the Mexican sample verbal and nonverbal aggression formed separate factors, suggesting the participants identified verbal and nonverbal anger expression as different entities.

The factor we obtained about verbal aggression out loud did not emerge in other studies. This factor suggests our participants consider screaming or insulting to other drivers as a specific category, which is conceptually different to other forms of anger expression. Verbal aggression aloud implies a direct and overt message of attack to other drivers. The Mexican context might be related to the rise of this factor. For example, violence is frequently accepted as normal; individuals are exposed in their lives or in mass media to violent news, including physical or verbal fights. Thus, direct verbal aggression is normalized, and the drivers of this study identified aggression out loud as a separate category. Another explanation is the highly educated nature of the sample (university students), with more cognitive and verbal skills, which may result in verbal fluency to aggress other drivers.

The 3-item factor about nonverbal expression replicated two studies (Villieux & Delhomme, 2008, 2010) where this factor emerged with exactly the same items, as in our sample. In this study, nonverbal behaviors like glaring, giving dirty looks, and shaking one's head at the other driver seem to go together to show

anger and disapproval. As a result, these items loaded in a single factor. If the factor replicates in other Mexican samples, such nonverbal behaviors may be consistent in this country for driving anger expression.

Regarding gender, we found differences in two out of six DAX scales. Men used more physical aggression than women, which replicates other studies (Deffenbacher et al., 2002; Esiyok et al., 2007). In addition, women used more silent verbal aggression than men, suggesting women prefer less involvement in direct overt verbal aggression, at least in the current sample. The other DAX scales did not show gender differences, which is consistent with other studies (Ge et al., 2015; Herrero-Fernández, 2011; Sullman et al., 2016). The relative lack of gender differences or weak effect sizes (when found) in this and previous studies (Deffenbacher et al., 2002; Ge et al., 2015; Herrero-Fernández, 2011; Stephens & Sullman, 2014) suggest men and women are in general more similar than different in terms of anger expression while driving.

The number of hours driven per day did not correlate with DAX scales, replicating other studies (Deffenbacher et al., 2002; Stephens & Sullman, 2014). It seems the time of exposure to driving is not associated with anger expression. Anger reactions may depend on several factors, but not on the exposure to driving.

In summary, we found six reliable and valid factors for the DAX in the Mexican sample. One factor tapped the adaptive/constructive anger expression, while the others were about anger expression through the use of the vehicle to express anger, personal physical aggression, nonverbal aggression, and verbal aggression aloud and silently.

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Table 1. Item means and exploratory factor analysis of the Driving Anger Expression Inventory in the Mexican sample

Items	*Mean*	*SD*	Loading
Factor 1: Personal physical aggression, α = .89			
17, I bump the other driver's bumper with mine.	1.21	0.64	.96
18, I go crazy behind the wheel.	1.34	0.68	.82
13, I stick my tongue out at the other driver.	1.35	0.73	.69
21, I try to scare the other driver.	1.41	0.77	.69
20, I try to force the other driver to the side of the road	1.40	0.75	.69
41, I try to get out of the car and have a physical fight with the other driver.	1.35	0.76	.62
8, I try to get out of the car and tell the other driver off.	1.30	0.68	.55
Factor 2: Adaptive/constructive expression, α = .84			
35, I try to think of positive things to do.	2.40	0.94	.73
48, I tell myself to ignore it.	2.40	0.96	.69
29, I tell myself it is not worth getting all mad about.	2.41	1.00	.69
36, I tell myself it's not worth getting involved in.	2.59	1.03	.64
44, I do things like take deep breaths to calm down.	2.33	0.95	.58

Table 1. *(Continued)*

Items	*Mean*	*SD*	Loading
30, I decide not to stoop to their level.	2.58	1.04	.58
49, I pay even closer attention to other's driving to avoid accidents.	2.59	1.00	.57
24, I think about things that distract me from thinking about the other driver.	2.15	0.95	.55
23, I pay even closer attention to being a safe driver.	2.65	0.98	.54
32, I turn on the radio or music to calm down.	2.55	1.00	.42
Factor 3: Use of vehicle to express anger, α = .83			
3, I drive a little faster than I was.	2.09	0.84	.89
4, I try to cut in front of the other driver.	1.69	0.86	.73
15, I speed up to frustrate the other driver.	1.83	0.93	.59
2, I drive right up on the other driver's bumper.	1.39	0.68	.54
27, I drive a lot faster than I was.	2.01	0.87	.48
16, I purposely block the other driver from doing what he/she wants to do.	1.74	0.93	.46
Factor 4: Verbal aggression in loud voice, α = .82			
28, I swear at the other driver aloud.	1.68	0.93	.71
5, I call the other driver names aloud.	1.71	0.93	.71
38, I yell at the other driver.	1.63	0.90	.69
9, I yell things like "Learn to drive."	1.69	0.84	.56

Table 1. *(Continued)*

Items	*Mean*	*SD*	Loading
Factor 5: Verbal aggression in low voice, α = .78			
31, I swear at the other driver under my breath.	2.02	0.95	.76
14, I call the other driver names under my breath.	2.01	0.95	.70
39, I make negative comments about the other driver under my breath.	2.02	0.88	.66
Factor 6: Nonverbal aggression, α = .76			
40, I give the other driver a dirty look.	2.10	0.98	.82
37, I shake my head at the other driver.	2.42	0.98	.65
11, I glare at the other driver.	2.13	0.95	.55

Table 2. Correlations between DAX, anger subscales, and demographic variables

Measures	1	2	3	4	5	6
1, DAX, Personal physical aggression	--					
2, DAX, Adaptive expression	-.05					
3, DAX, Use of vehicle to express anger	.53	-.12				
4, DAX, Verbal aggression in loud voice	.57	-.13	.54			
5, DAX, Verbal aggression in low voice	.27	.12	.37	.38		
6, DAX, Nonverbal aggressive expression	.24	.05	.50	.47	.45	
7, State anger	.53	-.01	.30	.39	.23	.25
8, Feeling anger	.42	-.04	.25	.33	.19	.24
9, Desire to express anger	.56	.01	.31	.37	.23	.21
10, Trait anger	.34	-.04	.48	.45	.35	.43
11, Angry temperament	.39	-.10	.49	.47	.30	.39
12, Angry reaction	.23	.01	.36	.32	.31	.37
13, Anger-out	.24	.03	.37	.34	.25	.33
14, Anger-in	.27	.01	.36	.31	.30	.33
15, Anger control-out	-.29	.37	-.28	-.27	-.13	-.21
16, Anger control-in	-.20	.50	-.19	-.19	-.06	-.12
17, Age	.01	-.02	-.08	-.02	-.07	-.11
18, Years of driving experience	-.02	-.06	.01	.02	-.04	-.02
19, Hours driven per day	.04	.02	.00	.04	-.04	-.01

Note. $r > .07$, $p < .05$; $r > .09$, $p < .01$; $r > .12$, $p < .001$.

Table 3. Gender comparisons on DAX subscales

Measures	Full sample		Men		Women		ANOVA	Effect
	M	*SD*	*M*	*SD*	*M*	*SD*	*F*	size (η^2)
Personal physical aggression	1.33	0.55	1.37	0.60	1.29	0.48	4.80*	.006
Adaptive expression	2.47	0.64	2.48	0.65	2.45	0.63	0.59	.001
Use of vehicle to express anger	1.78	0.64	1.82	0.66	1.74	0.61	3.39	.004
Verbal aggression in loud voice	1.66	0.73	1.71	0.77	1.62	0.68	3.00	.003
Silent verbal expression	2.01	0.78	1.95	0.76	2.08	0.80	5.60*	.006
Nonverbal aggression	2.21	0.80	2.23	0.80	2.18	0.79	0.63	.001

*p<.05

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