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Assessing individual differences in driving inattention: Adaptation and validation of the Attention-Related Driving Errors Scale to Spain

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ABSTRACT

The Attention-Related Driving Errors Scale (ARDES) is a self-reported questionnaire to assess individual differences in the proneness to make attentional errors while driving. The aims of the current work are to adapt the original Argentinean version of the ARDES to the culture, language, traffic regulations and driving habits of Spain and provide new validity evidence of the cross-cultural equivalence of the scale. In the first step of the validation process, five external independent experts reviewed the original ARDES-Argentina and proposed modifications, adapted to the culture, language, traffic regulations and driving habits in Spain. Secondly, a sample of 320 drivers completed the adapted questionnaire. Descriptive statistics and psychometric properties (corrected item-total correlation, Cronbach's alpha and factor structure) were performed on the data. Besides, in order to obtain further validity evidence, the relationships between the questionnaire scores and socio-demographic variables (age, sex, educational level, driving experience, crash involvement and traffic fines received) were analyzed. Factor analysis suggested a single factor that exceeded the parallel analysis criterion and accounted for 32.70% of the total variance. All items showed positive loadings on this factor, ranging from .41 to .72. The corrected item-total correlation values extend from .41 to .60, indicating that the items had good discrimination power. Cronbach's alpha coefficient value was .88. The analysis of the relationships between ARDES-Spain scores and socio-demographic variables provided further validity evidence of the appropriateness of the adapted questionnaire. In particular, differences in ARDES-Spain scores were found between drivers who reported traffic collisions with material damage and participants who did not. In conclusion, results in the current study suggest that the adapted version of the ARDES is a useful tool for evaluating the proneness to attentional errors during driving in the Spanish population. Future studies adapting the questionnaire to other countries with different languages, cultures, traffic regulations and driving habits are encouraged in order to expand the discussion on the cross-cultural equivalence of the ARDES.

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1. Introduction

Current research in road traffic domain shows that driver inattention is one of the main factors explaining accidents and its negative influence on safety is expected to further increase, as a consequence of the proliferation of some potentially distractive in-vehicle technologies (e.g., Klauer, Dingus, Neale, Sudweeks, & Ramsey, 2006; Ranney, 2008; Stutts, Reinfurt, Staplin, & Rodgman, 2001). Multiple research strategies, including controlled experiments in a laboratory or in driving simulators, test track and field studies and also correlation analyses of questionnaire data, are complementary being applied to better understand driver inattention and thus prevent attention-related accidents (for a review see, for example, Kircher, 2007).

According to a recent review (Regan, Hallett, & Gordon, 2011), driver inattention can be defined as "*insufficient or no attention to activities critical for safe driving*" (pp. 1775). In addition, Regan et al. (2011) proposed a taxonomy in which the different categories of inattention are distinguished by the different mechanisms that produce driver inattention. For example, among these categories, driver distraction is considered as "*the diversion of attention away from activities critical for safe driving toward a competing activity*" (Regan et al., 2011, pp. 1776), whereas other forms of driving inattention do not require a competing activity (e.g., when the driver is influenced by biological factors that physically prevent the detection of critical information, such as micro-sleeps).

Ledesma, Montes, Poó, and López-Ramón (2010) suggested that individual differences in driver inattention might reflect a relatively stable pattern of behaviour associated with attentional errors in different dimensions of everyday life and with particular psychological variables. Accordingly, those individuals who are more prone to make attentional errors while driving will also manifest inattention in their daily lives and will present specific psychological traits (Ledesma et al., 2010). Within this theoretical framework, the *Attention-Related Driving Errors Scale* (ARDES; Ledesma et al., 2010) was developed to assess individual differences in the proneness to driving inattention. Whereas Regan et al. (2011)'s taxonomy was focused on the mechanisms that *produce* driver inattention (i.e. the different *sources of inattention*, such as a micro-sleep or a distraction), the work by Ledesma et al. (2010) was aimed at measuring the *resulting errors* (i.e., the *consequences of inattention*, such as failing to spot a pedestrian crossing or to notice a leading vehicle slowing down, which can be brought by several of the inattention sources defined in Regan et al.'s taxonomy; see also Stutts et al., 2001). In this regard, a number of attention-related driving errors were used as indicators to measure the construct of driver inattention (particularly, the proneness to driver inattention) by means of the ARDES.

1.1. The Attention-Related Driving Errors Scale (ARDES)

The items in the ARDES, originally developed for Argentinean culture, language, traffic regulations and driving habits, specifically refer to non-deliberate errors in driving performance resulting from an attentional failure, such as failing to notice a pedestrian crossing the street (Ledesma et al., 2010). Items and instructions were based on previous questionnaires, such as the Attentional Lapses subscale of the Driver Behaviour Questionnaire (DBQ; Reason, Manstead, Stradling, Baxter, & Campbell, 1990), and the Multidimensional Driving Style Inventory (MDSI; Taubman-Ben-Ari, Mikulincer, & Gillath, 2004). However, according to Ledesma et al. (2010), in comparison with these questionnaires, the ARDES was specifically developed to measure driving attentional errors and avoid overlapping with other psychological constructs such as planning errors, which are not attentional in nature, or daydreaming, what is not essentially an error (actually, in Regan et al.'s, 2011, taxonomy, daydreaming is considered as a source of inattention that might lead to driving errors, and thus it is not an error *per se*). Besides, the internal consistency of the original Argentinean version of the ARDES has been reported to be higher than the Attentional Lapses subscale of the DBQ, and it covers a wider range of inattentive driving behaviour than the latter (see Ledesma et al., 2010). In consequence, the ARDES may constitute a promising tool available to researchers interested in analysing driver inattention.

Reliability and validity of the scores obtained from the original Argentinean version of the ARDES were evaluated on a sample of drivers in Argentine (Ledesma et al., 2010). An exploratory factor analysis suggested that all 19 items in the scale are multiple indicators of a one-dimensional construct related to the proneness to attention-related errors while driving (high loadings on the first factor and good discrimination indexes were observed; internal consistency was also high, Cronbach's alpha = .86). The one-dimensional factor solution was consistent with previous studies with related questionnaires, such as the Driver Behaviour Questionnaire (DBQ; Reason et al., 1990) and the Multidimensional Driving Style Inventory (MDSI; Taubman-Ben-Ari et al., 2004), in which a single inattentive driving factor was differentiated from other dimensions of driver behaviour. First, Reason et al. (1990) developed the DBQ to distinguish between non-intentional driving errors and deliberate traffic violations, supporting the idea that different psychological processes influence these factors. In their original study, a factor analysis provided support for the difference between errors and violations and, additionally, evidence was found of a third factor that mainly included minor attentional failures ("slips and lapses" or simply "lapses"). On the other hand, Taubman-Ben-Ari et al. (2004) developed the MDSI as a multidimensional instrument to evaluate eight driving styles (dissociative, anxious, risky, angry, high-velocity, distress reduction, patient and careful). Among them, the dissociative style was characterized as a tendency to get distracted easily, commit errors due to distractions and exhibit cognitive failures and experiences of dissociation during driving that could modulate inattention errors.