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Assessing the relationship between the Driver Behavior Questionnaire and the Driver Skill Inventory: Revealing sub-groups of drivers

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ABSTRACT

The Driver Behavior Questionnaire and the Driver Skill Inventory are two of the most frequently used measures of self-reported driving style and driving skill. The motivation behind the present study was to identify sub-groups of drivers that potentially act dangerously in traffic (as measured by frequency of aberrant driving behaviors and level of driving skills), as well as to test whether the sub-groups differ in characteristics such as age, gender, annual mileage and accident involvement. Furthermore, the joint analysis of the two instruments was used to test drivers' assessment of their own self-reported driving skills and whether the reported skill level was reflected in the reported aberrant driving behaviors. 3908 drivers aged 18–84 participated in the survey. K-means cluster analysis revealed four distinct sub-groups that differed in driving skills and frequency of aberrant driving behavior. The sub-groups also differed in individual characteristics and driving related factors such as annual mileage, accident frequency and number of tickets and fines. The differences between the sub-groups suggest heterogeneity across the population, and since two of the sub-groups reported higher frequency of driving aberrations and lower skill level, they seem more unsafe than the two others. The results suggest that drivers' assessment of their driving skills is reflected in their aberrant driving behaviors, as drivers who report low levels of driving skills, also report high frequency of aberrant driving behaviors, and vice versa. The present findings highlight the need to look into driver's attitudes towards safety, and to devise differential interventions targeting specific problematic groups of the population in the attempt to improve road safety nationwide.

1. Introduction

Driving style and driving skills are crucial measures when looking at a person's ability to drive in a safe and protective manner. Driving style generally refers to the way a person prefers or habitually drives the car, whereas driving skills refer to how good a person is at handling the car (Elander, West, & French, 1993). Over the years, many instruments have been developed to assess both skill and style, and two frequently applied instruments are the Driver Behavior Questionnaire (DBQ) (Reason, Manstead, Stradling, Baxter, & Campbell, 1990) and the Driver Skill Inventory (DSI) (Lajunen & Summala, 1995).

The DBQ is used to measure three classes of aberrant driving behaviors, namely violations, errors and lapses. Violations are intended acts that the person is most likely aware of, like speeding or running on red light. Errors are acts that fail to get the planned and intended outcome due to misjudgments, like braking too abruptly. Lapses are unintentional behaviors

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performed because of attention or memory deficits, like missing the motorway exit (Reason et al., 1990). Violations are generally considered the most dangerous because they predict self-reported accident involvement (de Winter & Dodou, 2010; Glendon, 2007), in both retrospect (Lawton, Parker, Manstead, & Stradling, 1997; Parker, Reason, Manstead, & Stradling, 1995; Rimmö & Åberg, 1999) and prospect (Parker, West, Stradling, & Manstead, 1995). The distinction between errors and lapses on the one hand, and violations on the other, is considered crucial in traffic safety because it is analogous to the distinction between unintentional and intentional behavior (Reason et al., 1990). Intentional and unintentional behavior stems from different psychological processes and, because of this, it has been argued that they require different kinds of interventions or remediation (Reason et al., 1990).

Different from the DBQ, the DSI is used to measure self-reported perceptual-motor skills and safety skills. On the one hand, perceptual-motor skills refer to the drivers' ability to handle the car, namely technical driving skills such as fluent car control. On the other hand, safety skills refer to the drivers' ability to drive in a safe manner, namely accident avoidance skills such as driving carefully (Lajunen & Summala, 1995). Perceptual-motor skills rely on information processing and motor skills, whereas safety skills rely on attitudes and personality factors. The distinction between safety skills and perceptual-motor skills is highlighted as the balance between these skills reflects the drivers' attitude towards safety. This is supported by previous studies which have found drivers with high levels of perceptual-motor skills to have a riskier driving style and to be more involved in accidents than drivers with high levels of safety skills (Lajunen, Corry, Summala, & Hartley, 1998; Sümer, Özkan, & Lajunen, 2006). Perceptual-motor skills have also been found to positively relate to driver aggression, whereas safety skills have been found to negatively relate to driver aggression (Lajunen, Corry, et al., 1998; Lajunen, Parker & Summala, 1998; Lajunen & Summala, 1995; Lajunen & Summala, 1997).

There are obvious similarities between the DBQ and the DSI. Perceptual-motor skills can be regarded as the ability to drive in an error-free manner and, similarly, safety skills can be regarded as the motivation and ability not to perform violations. A key difference between the instruments concerns the way drivers are asked to assess their behavior and/or skills. In the DSI drivers are asked to assess their driving skills by comparing themselves to the average driver and the questions address general traffic behaviors (i.e., "conforming to traffic rules"). In the DBQ, drivers are asked to assess how often they engage in aberrant behaviors and the questions address specific aberrations (i.e., "disregard traffic lights"). When considering the similarities and differences between the DBQ and the DSI, ideally there should be coherence between how drivers answer on the one and on the other. Thus, if drivers indicate above average skill at "conforming to traffic rules", ideally they should not report a high frequency of "disregarding the traffic lights".

The current study jointly explores DBQ and DSI data with cluster analysis to identify sub-groups of drivers that potentially present different levels of danger in traffic (i.e., potentially more or less dangerous acts carried out in hazardous conditions). The joint analysis provides a more comprehensive understanding of the driving skills and behavior of the drivers in the different sub-groups than will be obtainable using the two instruments separately. This will give a more nuanced picture of drivers' own assessment of their driving ability. Cluster analysis is a segmentation approach frequently applied to identify sub-groups within a driving population (Deery & Fildes, 1999; Haustein, 2012; Siren & Haustein, 2013; Ulleberg, 2002). In a factor analysis or principal component analysis, that usually is applied when analyzing DBQ and DSI data, the outcome is a better understanding of the relationship (differences and similarities) among the variables in a data set. In a cluster analysis, objects are sorted based on characteristics in order to maximize between-group heterogeneity and within-group homogeneity, and the outcome gives a better understanding of the relationship among the observations in the data set. Consequently, the outcome of factor analysis is a grouping of variables, and the outcome of a cluster analysis is a grouping of observations. Thus, cluster analysis explores the data so that answers of individuals in the same cluster are homogeneous and across clusters there is heterogeneity (Kaufman & Rousseeuw, 1990). Cluster analytic procedures are different than alternative approaches (e.g., moderated multiple regression) which tend to impose artificial solutions (e.g., relationship between dependent and independent variables) on the data which may not reflect actual clustering patterns (Hodge & Petlichkoff, 2000). The literature generally reports that drivers vary in driving behavior and skills between genders, age-groups and experience levels (Lajunen, Corry, et al., 1998; Lajunen & Summala, 1995; Lawton et al., 1997; Reason et al., 1990; Rimmö, 2002; Rimmö & Hakamies-Blomqvist, 2002; Åberg & Rimmö, 1998; Özkan & Lajunen, 2006). Thus, in the present study heterogeneity across the population was expected. As both the DBQ and the DSI have been shown to be correlated with self-reported accident involvement (de Winter & Dodou, 2010; Glendon, 2007; Lajunen, Corry, et al., 1998; Lawton et al., 1997; Parker, Reason, et al., 1995; Parker, West, et al., 1995; Rimmö & Åberg, 1999), results from the two instruments are useful when designing target specific interventions to improve road safety.

On the basis of the above, the present study aims were: (1) to test whether sub-groups differing in their potential danger in traffic could be identified by joint analysis of the DBQ and the DSI, as well showing heterogeneity in individual characteristics and driving related factors; (2) to test whether drivers self-reported skill level is reflected in their self-reported frequency of aberrant driving behaviors.

2. Method

2.1. Participants and procedure

A sample of 11,004 drivers between 18 and 84 years old with minimum type B driver license (license for private car in Denmark) was randomly selected from the Danish Driving License Register. The sample included 1,572 drivers in each of