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Measuring situational avoidance in older drivers: An application of Rasch analysis

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ABSTRACT

Situational avoidance is a form of driving self-regulation at the strategic level of driving behaviour. It has typically been defined as the purposeful avoidance of driving situations perceived as challenging or potentially hazardous. To date, assessment of the psychometric properties of existing scales that measure situational avoidance has been sparse. This study examined the contribution of Rasch analysis to the situational avoidance construct. Three hundred and ninety-nine Australian drivers (M = 66.75, SD = 10.14, range: 48–91 years) completed the Situational Avoidance Questionnaire (SAQ). Following removal of the item *Parallel Parking*, the scale conformed to a Rasch model, showing good person separation, sufficient reliability, little disordering of thresholds, and no evidence of differential item functioning by age or gender. The residuals were independent supporting the assumption of unidimensionality and in conforming to a Rasch model, SAQ items were found to be hierarchical or cumulative. Increased avoidance was associated with factors known to be related to driving self-regulation more broadly, including older age, female gender, reduced driving space and frequency, reporting a change in driving in the past five years and poorer indices of health (i.e., self-rated mood, vision and cognitive function). Overall, these results support the use of the SAQ as a psychometrically sound measure of situational avoidance. Application of Rasch analysis to this area of research advances understanding of the driving self-regulation construct and its practice by drivers in baby boomer and older adult generations.

1. Introduction

Maintaining independence, engaging in social and recreational activities, and accessing essential services outside of the home are all key determinants of quality of life (Gabriel and Bowling, 2004; Oxley and Whelan, 2008). For older adults, much of this relies on their capacity to drive a motor vehicle (Oxley and Whelan, 2008). Driving is a complex skill dependent upon a combination of visual, cognitive and physical abilities (Anstey et al., 2005). Many of these component abilities are vulnerable to age- and disease-related decline and are thought to underlie the unique profile of older driver crashes (Anstey et al., 2005; Anstey and Wood, 2011; Cicchino and McCartt, 2015; Langford and Koppel, 2006a; McGwin and Brown, 1999). However, there is considerable variability in both normal and pathological ageing processes (Anstey and Low, 2004). This variability, combined with the negative consequences of driving cessation (e.g., Fonda et al., 2001; Marottoli et al., 1997, 2000; Oxley and Charlton, 2009; Ragland et al., 2005), has prompted the search for ways in which older driver safety may be balanced with their continued mobility (Berry, 2011; Dickerson et al., 2007; Hakamies-Blomqvist et al., 2004). One particularly promising strategy is 'driving self-regulation'.

Driving self-regulation refers to the process whereby older drivers voluntarily modify their driving practices in an attempt to reduce the perceived demands of the driving task (Ball et al., 1998; Charlton et al., 2006a; Donorfio et al., 2009). Although the evidence is mixed (e.g., Owsley et al., 2004; Ross et al., 2009), it has been argued that by avoiding challenging driving situations, older adults are actively involved in reducing their crash risk (Charlton et al., 2006b; Hakamies-Blomqvist, 1993). Practically, a graduated reduction in driving among at-risk older adults would not only maintain their independence, but would also reduce the financial and social burden that would be present if the largest segment of Australia's population was denied access to a motor vehicle (Berry, 2011; Langford and Koppel, 2006b; Taylor and Tripodes, 2001). When we consider that the baby-boom generation, born between the years 1946 and 1966, are now entering late adulthood,

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these mobility benefits become particularly persuasive (Australian Bureau of Statistics, ABS, 2014; Dobbs, 2008).

Driving self-regulation can occur at all three levels of driving behaviour or decision-making (Michon, 1985; Rasmussen, 1983, 1987). Decisions at the strategic or knowledge-based level encompass trip planning, including the choice of trip goals and route (e.g., to minimise time or avoid a certain route), as well as an evaluation of the risks involved (Michon, 1985; Ranney, 1994). These plans are typically made prior to getting in the car. At the tactical level, drivers exercise manoeuvring control on a moment-to-moment basis, allowing negotiation of the traffic environment (Michon, 1985). Decisions at this level include gap acceptance in overtaking or merging, how to negotiate an upcoming intersection and what speed to adopt (Smiley, 2004). While under the drivers' control for the most part, these behaviours are also constrained by the traffic environment and other road users (e.g., entering an intersection is influenced by the presence of other drivers) (Smiley, 2004). Lastly, the operational level involves basic vehicle control and largely consists of automatic action patterns (e.g., accelerating, steering or braking) (Michon, 1985). These behaviours are least amenable to conscious self-regulation, though there is some evidence that older adults adopt different vehicle control (Hakamies-Blomqvist et al., 1999) and visual scanning (Charlton et al., 2005) practices than younger drivers. When considered together, appropriate decisions made at higher levels of this hierarchy are believed to result in on-road driving behaviour that is experienced as less taxing on the resources or overall skill level of a driver (Michon, 1985; Ranney, 1994).

A great deal of research has been conducted examining the characteristics and incidence of driving self-regulation (Braitman and McCartt, 2008; Braitman and Williams, 2011; Charlton et al., 2006a; D'Ambrosio et al., 2008; Marie Dit Asse et al., 2014; Molnar et al., 2013b; O'Connor et al., 2012), its association with indices of on-road safety (Baldock et al., 2006a,b; Ball et al., 1998; Keay et al., 2009; Molnar and Eby, 2008; Okonkwo et al., 2008; Owsley et al., 2004; Ross et al., 2009), and factors that facilitate or serve as a barrier to the practice of driving self-regulation (Ackerman et al., 2011; Anstey et al., 2005; Lyman et al., 2001; Marottoli and Richardson, 1998; Molnar et al., 2014; O'Connor et al., 2010; Rudman et al., 2006; Wong et al., 2014). In the above-cited research, driving self-regulation has often been operationalised as the extent to which participants report avoidance of driving in situations pre-defined by researchers as challenging or potentially hazardous.

Conceptualisations of driving self-regulation at the strategic level of driving behaviour appear to have stemmed from observations that older drivers with cataracts or other vision problems frequently report not driving in visually challenging situations (e.g., at night or in bad weather) (Ball et al., 1998; Janke, 1994; Owsley et al., 1999). Many studies subsequently adopted the use of the avoidance items from the Driving Habits Questionnaire (DHQ), or an extension of this tool (e.g., the Driver Mobility Questionnaire, DMQ, Baldock et al., 2006a), to measure driving self-regulation (e.g., Ackerman et al., 2014; Baldock et al., 2006b; Okonkwo et al., 2008; Ross et al., 2009; Vance et al., 2006). However, these scales have been presented differently across studies. While used with a similar general intention (i.e., to measure self-reported avoidance behaviour of older drivers), scale items have been deleted (e.g., *parallel parking*, Ross et al., 2009) and others added (e.g., *merging*, Oxley et al., 2003); response formats have varied (e.g., from a dichotomous yes/no response option in the DHQ (Owsley et al., 1999) to a 5-point Likert scale in the DMQ (Baldock et al., 2006a)); and the timeframe participants are asked to consider has lengthened (e.g., *during the past 3 months*, DHQ, Owsley et al., 1999; *during the past 6 months*, Oxley et al., 2003; *during the past year*, DMQ, Baldock et al., 2006a; no timeframe, Sullivan et al., 2011). These differences could contribute to the variability in rates of situational avoidance reported by participants (e.g., 8%, Baldock et al., 2006a; 80%, Ball et al., 1998).

Increased situational avoidance has been consistently associated with advanced age, female gender, and poorer physical health, cognitive functioning, and emotional wellbeing (Braitman and McCartt, 2008; Charlton et al., 2006a; D'Ambrosio et al., 2008; Naumann et al., 2011; O'Connor et al., 2012; Rimmo and Hakamies-Blomqvist, 2002). Driving confidence and perceived driving difficulty are among the strongest predictors of situational avoidance in older drivers (Charlton et al., 2006a; Lyman et al., 2001; MacDonald et al., 2008; Myers et al., 2008; Rudman et al., 2006). The most commonly avoided driving situations include driving at night, in bad weather and in busy traffic (Baldock et al., 2006a; Ball et al., 1998; Charlton et al., 2006a; Ragland et al., 2004). Rarely avoided situations include driving alone and turning across traffic (Baldock et al., 2006a; Ball et al., 1998; Okonkwo et al., 2008).

In much of the research, an overall avoidance scale score is obtained. In producing such a score, avoidance of one driving situation is assumed to be equal in weight or importance as avoidance of any other driving situation. The use of summed or averaged scores further assumes that the situational avoidance construct is unidimensional. A study by Wong et al. (2015) conducted the first known factor analysis of the DMQ (Baldock et al., 2006a) and additional situational avoidance items from Sullivan et al. (2011). A two-factor solution was produced comprised of "external" (e.g., weather-related) and "internal" (e.g., passenger-related) driving environments or situations. However, differences in item frequency or ease of endorsement were found, which can be problematic for factor analysis. When an item is difficult to endorse (or in this case, a situation was rarely avoided by the sample), it may not correlate strongly with items that are easier to endorse, even if these items are indicative of the same trait (Gorusch, 1974). In some instances, these items may not load together on a single factor, instead forming factors based on item difficulty or frequency of endorsement. The possibility that this occurred is suggested by the low means and standard deviations for items loading on the "internal" relative to the "external" factor; and two conceptual anomalies – (1) *driving other people's cars*, and (2) *driving on familiar roads*, that each loaded onto opposite factors to what would be expected based on theory (Wong et al., 2015). When frequency of endorsement is considered, these conceptual anomalies 'fit' with the other items with which they loaded (e.g., *driving on familiar roads* was less frequently avoided consistent with all "internal" factor items).

Factor analysis is a correlational model, and scales conforming to this model require that a respondent with the representative characteristic endorse *all* items within the subscale that reflects that factor label. By its very nature, situational avoidance can be compensatory or non-compensatory (Molnar et al., 2013a; Naumann et al., 2011), and compensatory avoidance may be the end result of one or more quite different functional failures (Baldock et al., 2006b; Freund and Colgrove, 2008). Thus, avoidance of one situation does not necessarily imply avoidance of another, particularly if items exist on a continuum. For example, the common avoidance of night driving has been assumed to stem from the fact that relative to young adults, vision in low light is affected in older adults with good eye health (Ball et al., 1998; Sloane et al., 1988). Avoidance of night driving is unlikely then to distinguish older adults at high risk of a motor vehicle crash. In contrast, it could be argued that avoidance of driving through, or turning at, major intersections would have greater predictive power given the higher incidence of older driver crashes at intersections (Cicchino and McCartt, 2015; Langford and Koppel, 2006a; Lyman et al., 2002), and the relative difficulty of avoiding situations related to infrastructure (Blanchard et al., 2010). Older drivers who report avoidance of intersections may be