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Parking and manoeuvring among older drivers: A survey investigating special needs and difficulties

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ABSTRACT

A postal survey was conducted among 698 older French drivers in order to identify their special needs and difficulties encountered during parking. Their most frequent manoeuvres were back parallel and front perpendicular parking. A questionnaire, inspired by the Driver Behaviour Questionnaire, was developed to identify the psychological origins of parking errors and to examine its relative predictive value with respect to self-reported parking difficulties. Four types of aberrant parking behaviour were identified: slips or lapses, execution errors, anticipation errors and violations. Accident and/or incident history and reported aberrant parking behaviours are the strongest predictors of difficulties encountered during parking manoeuvres.

1. Introduction

Driving is the main means of transport among seniors in the US and in many other industrialized countries (Hu & Reuscher, 2004; Oxley & Whelan, 2008; Sirén, Heikkinen, & Hakamies-Blomqvist, 2001). Consequently, it is essential in preserving the quality of life of older people (Banister & Bowling, 2004; Metz, 2000). A personal vehicle helps preserve their autonomy and social integration, and prevents isolation (Marottoli et al., 1997, 2000). However, ageing is accompanied by anatomical, physiological and cognitive changes that could affect driving performance. Such changes may affect vision and visual exploration such as decreased visual acuity (Owsley & Sloane, 1990) and neck and trunk mobility, decreased eye movement amplitude (Chamberlain, 1970; Clark & Demer, 2002; Clark & Isenberg, 2001), reduced useful visual field (Rogé, Pébayle, Campagne, & Muzet, 2005) and modify information updating and processing as well as executive functions (Adrian, Postal, Moessinger, Rascle, & Charles, 2011; Eby, Trombley, Molnar L. J., & J. T., 1998; Janke, 1994). As these processes are essential for driving, any decline could limit car use by older people (Fontaine, 2003; Tokoro, 2004).

For each trip completed, parking is an unavoidable complex activity. In addition to control of the vehicle's position and orientation, the driver must check the parking environment as much as possible to discriminate objects (McGwin, Chapman, & Owsley, 2000) and detect any obstacle or unexpected hazardous event. Driver must then expand the visual search, especially in the case of reverse parking. In such conditions, any decline in visual, physical and/or cognitive processes with ageing

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could render the parking activity more difficult. Indeed, failure to turn the head to check back over the shoulder is the most frequent driving error during older drivers' license review tests (Di Stefano & Macdonald, 2003). Moreover, Herriots (2005) tried to identify specific vehicle design requirements based on particular difficulties experienced by older drivers. In his postal survey the most reported difficulty was turning to look out of the rear window. The main reason was restricted neck mobility, whereas the head restraint design of the vehicle was a minor factor.

The greater difficulty of driving can decrease the self-confidence of older drivers and forces them to develop self-regulatory behaviour. Generally, they reduce driving frequency and distance and avoid risky situations such as driving at night (Fontaine, 2003; Hakamies-Blomqvist, Raitanen, & O'Neill, 2002; Tokoro, 2004). Some recent studies provided a better understanding of older drivers' self-regulation. Charlton et al. (2006) found a tendency towards avoiding driving in participants that (1) were older females, (2) aged 75 years and older, (3) were not the principal driver in the household, (4) had been involved in a crash in the last 2 years, (5) participants who reported vision problems, and (6) had lower confidence ratings. Avoidance is also more often associated with drivers' inner states or adverse conditions than situations related to infrastructure (Sirén & Meng, 2013). Also, driving simulator studies suggest that older adults who were training for a road test were quite capable of undertaking self-regulatory behaviours on the basis of their metacognitive monitoring (Moták, Huet, Gabaude, & Bougeant, 2012). Self-regulation is also observed for parking manoeuvres. For example, in a survey, conducted among older Australian drivers, a strong correlation was found between self-confidence and avoidance of parallel parking, meaning that seniors who lacked confidence in performing this kind of manoeuvre managed to avoid parallel parking (Baldock, Mathias, McLean, & Berndt, 2006). In their survey, parallel parking is the most difficult and therefore the most avoided manoeuvre reported by older adults. Given that increasing difficulty of manoeuvring affects seniors' driving activity, it could also contribute to lower self-confidence in their overall driving skills.

Despite the avoidance strategy adopted by some individuals, the risk of parking accidents is still present. It is difficult to estimate the actual frequency of such accidents since accidentology databases often contain crashes involving corporal damage. However, some available data show that hitting something while reversing remains a frequent driving error among older drivers (Assailly et al., 2006; Joseoh-Theodore, 2000; Sullivan, Smith, Horswill, & Lurie-Beck, 2011). It is therefore important to understand the difficulties they encounter in order to identify driving assistance design requirements. Such an approach should lead to development of parking assistance adapted to this category of road users.

Studies centred on older drivers' behaviour while parking are still rare. That led us to conduct a postal survey in order to uncover special circumstances in which they are manoeuvring at home and elsewhere, and to describe and classify the parking difficulties they encounter. Secondly, in order to investigate the nature of such parking difficulties, we adopted an approach inspired by the Driver Behaviour Questionnaire (DBQ; Reason, Manstead, Stradling, Baxter, & Campbell, 1990). The Parking Behaviour Questionnaire (PBQ) was developed to study unsuitable or aberrant parking behaviours in order to identify factors linked to them. We also tested the external validity of the PBQ by exploring the links between aberrant parking behaviours and age, gender, annual mileage, functional limitation and history of parking accidents. Identification of aberrant parking behaviours of older drivers should help us to describe the difficulties they experience while manoeuvring. Moreover, we hypothesized that the level of parking difficulty should be predicted by reported aberrant parking behaviours.

2. Materials and methods

2.1. Participants

A questionnaire was mailed, in December 2011, to 2970 inhabitants of the Rhône department in France. Addresses were provided by the French Post Office, they were shared-out between two areas with different population densities. The address selection criteria were: (i) being retired; (ii) owning a car registration document. Among the returned questionnaires (28% without reminder), 698 were properly completed and could be included in the analyses (23.5%). The majority of respondents lived in medium-sized cities (between 20,000 and 100,000 inhabitants; 38.3%) and large cities (>100,000 inhabitants; 48.4%), remaining lived in small towns (13%) or did not answer the question about their place of residence (0.3%).

2.2. Material

The questionnaire included 75 items. A disclaimer on the front page stated that only people who drive regularly were invited to complete the questionnaire and send it back using a pre-paid envelope. The estimated time it should take a respondent to complete the questionnaire was about 15 min. Questions were divided into 7 sections: (1) general information on participants, (2) self-reported driving habits, (3) information on parking at home (4), information on parking elsewhere than at home, (5) onboard special equipment, (6) history of parking accidents and/or incidents within the last 3 years and (7) self-reported aberrant parking behaviours (adapted from the French version of the DBQ; Gabaude, Marquié, & Obriot-Claudel, 2010).

General information. Information was collected about age, gender, self-reported physical limitations impacting driving activity (head and trunk movements).

Self-reported driving habits included mean mileage per year and driving frequency per week.

Information on parking at home included parking lot situation, type of parking manoeuvre, presence and type of obstacles and criteria for parking space choice. The types of parking manoeuvre were defined as follows: perpendicular to the lane of