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

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A B S T R A C T

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, Rasle, & 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
approach (side to side with other parked vehicles), parallel to the lane of approach (in a line with other parked vehicles), angle parking (at an angle to the lane of approach) and any other. Participants also had to indicate whether they parked in a forward or backward direction. For the sake of clarity, in the questionnaire, each type of manoeuvre was illustrated by an image.

**Information on parking elsewhere than at home** included the same questions as in the previous section (except the type of obstacles to parking), plus the manoeuvre they seek and the frequency of parking difficulties. For each type of parking difficulty, participants had to indicate on a 10 cm linear scale (0 = never; 10 = always) the frequency of occurrence of the mentioned behaviours. The linear scale was chosen instead of the Likert scale because it provides a more sensitive choice in responding. It is also easy to start with the higher positive values either on the left or on the right, to try to avoid uncontrolled responses from the participant.

**Onboard special equipment** concerned automatic gear, steering assistance and parking assistance (cameras or ultrasound). For parking assistance, some questions concerned the frequency of use of onboard equipment, its ease of use and the driver’s degree of satisfaction. The participants had to indicate the frequency of use on a 10 centimetres linear scale (0 = Never; 10 = Always). The same type of scale was used to assess ease of use (0 = Very easy; 10 = Very difficult) and satisfaction regarding parking assistance (0 = Very satisfied; 10 = Not satisfied at all). The participants without parking assistance were invited to give their expectations about the use of parking assistance.

**History of parking accidents and/or incidents within the last 3 years.** Participants had to indicate whether as drivers they had been involved in at least one parking accident and/or incident. They were also required to indicate the frequency of collisions with parked vehicles on a 10 centimetre linear scale (0 = Never; 10 = Always).

**Self-reported aberrant parking behaviours.** Reason et al. (1990) proposed a conceptual framework to identify the origins of human errors. Three types of basic errors have been described (slips/lapses, mistakes and violations). Slips correspond to actions not carried out as intended or planned and lapses to missed actions and omissions. Mistakes are related to errors brought about by a faulty plan and violations to deliberate illegal actions. To explore aberrant parking behaviour, we developed a specific tool inspired by the DBQ. Seven questions were presented for each of the three previously mentioned categories. Overall, this section included 21 items. Two of them were unchanged from the original DBQ (‘hit something when reversing’ and ‘illegal parking’); the remaining items were created (for example, ‘doubts about steering direction while manoeuvring’). For each item, participants had to indicate on a 10 centimetre linear scale the frequency of occurrence of the mentioned behaviours during the past year (0 = Never; 10 = Always). The instructions given to the participants were the same as for the original DBQ (Reason et al., 1990), asking them to respond quickly and to be as honest as possible. The questionnaire and instructions are available on request from the authors.

### 2.3. Overall score of parking difficulty

In order to evaluate the parking difficulties encountered by our respondents, we built an overall score with three questions related to the behaviour of drivers trying or failing to overcome these difficulties. The questions investigated the frequencies of (i) collisions with parked vehicles while manoeuvring, (ii) asking another person for help, and (iii) rejection of a parking space because of manoeuvring difficulty. For each question, the answers could be given using the 10 centimetres linear scale described earlier. The scores given by the participants were used to calculate an overall score for parking difficulty as follows. The three situations were classified in terms of the driver’s parking difficulties they represented. Colliding with parked vehicles received the highest coefficient of 3. Frequency of asking another person for help was given a coefficient of 2. Finally, rejecting a parking space was considered as being the minimum level of difficulty relative to the two previous situations and was given a coefficient of 1. The frequency scores were therefore multiplied by corresponding coefficients, and the results were added. The sum was divided by 6 so that the value of the overall score could be situated on a 10 centimetres linear scale from 0 (minimal parking difficulty) to 10 (maximal difficulty) points.

### 2.4. Statistical analysis

The exploratory analyses were conducted using Chi-squared tests for parameters that were of interest for the present survey. Principal component analysis was conducted to explore the internal validity of this version of the Parking Behaviour Questionnaire (PBQ). The introduction of the PBQ in this survey also allowed us to explore its external validity by using the factorial scores to analyse the relationship between aberrant parking behaviours, participants’ characteristics, and self-reported physical limitations. Finally, sequential multiple linear regressions were conducted to understand how the identified factors predict the parking difficulties of older drivers. Analyses were conducted using the SPSS Statistics software (Version 15).

### 3. Results

3.1. Sample characteristics

3.1.1. General information and self-reported driving habits

Table 1 shows the main characteristics of the sample. Participants were between 65 and 92 years old (M = 73.8 ± 6.4) and half of them were males (52.1%). About 19.2% of the participants reported physical limitations impacting their driving
activity. Half of the sample (41.7%) drove 8000 km and over per year and reported a mean driving frequency of 4 times per week. About a quarter of respondents (24.6%) reported at least one parking accident during the last three years.

3.1.2. Information on parking at home

Most of the participants had a closed parking lot (58.2%). The parking lot was situated outside for 38.4% of the participants, and 2.3% reported a mixed parking lot situation, $X^2 (2) = 340; p < 0.001$. The remaining participants did not respond (1.3%). Some manoeuvres were more frequent than others. Perpendicular forward parking was reported as being the most frequent manoeuvre (54.7%), followed by perpendicular reverse parking (20.3%), angle reverse parking (10.2%), parallel forward parking (6.7%), angle forward parking (4.6%) and parallel reverse parking (3.4%), $X^2 (5) = 771; p < 0.001$. Already parked vehicles were reported by 19.9% of the participants as being the most common obstacle for parking at home. Other obstacles were small objects such as kerbs and posts (7.4%), moving obstacles like traffic, pedestrians and cyclists (5.6%) and, finally, lack of available space for manoeuvring (3.5%).

The most important criterion for choice of a parking space was the ease of manoeuvring (mentioned in 18.7% of responses). In second and third positions were the type of manoeuvre and safety for the driver and his/her vehicle (18.7% and 17%, respectively). The space available for manoeuvring was cited in 15.9% of responses and the parking tax in 2.8%.

3.1.3. Information on parking elsewhere than at home

Most of the participants parked in urban (56.7%) and suburban (19.2%) environments. Parking in a rural environment was reported by 9.4% of participants. Parking in a private street while visiting relatives was reported by 11.1% of participants, and in a public parking lot by 3.6% of participants. The most reported type of manoeuvre performed was parallel backward parking (44.8%), followed by perpendicular forward parking (29.3%), forward angle parking (10.8%), perpendicular reverse parking (7%), parallel forward parking (4.1%) and angle reverse parking (4%), $X^2 (5) = 553; p < 0.001$.

Parking difficulties included the frequency of rejection of a parking space because of the manoeuvre’s difficulty ($M = 3.4; SD = 2.8$) and the frequency of asking another person for help ($M = 1.1; SD = 1.8$). The mean frequency of impacts with parked vehicles while manoeuvring was equal to 2 ($SD = 2.1$). The mean overall score of parking difficulties calculated on the basis of the frequencies of each situation was equal to 1.4 ($SD = 1.27$).

3.1.4. Use of onboard special equipment

Most of the participants had steering assistance (82.5%), but not parking assistance (19.2% cameras and/or ultrasound sensors) and automatic gear (11.2%). The mean score of parking assistance usefulness was 8.4 ($SD = 2$). Overall, the participants evaluated their system as not easy to use ($M = 1.7; SD = 2.4$), although the mean level of satisfaction was 7.8 ($SD = 2.9$).

Participants expressed their expectations regarding parking assistance. Three hundred and fifty-five responses were collected. The most important expectation concerned information on the parking environment (obstacle detection and/or

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Table 1

Characteristics of the sample ($N = 698$).

<table>
<thead>
<tr>
<th>Variables</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>65–74</td>
<td>399</td>
<td>57.2</td>
</tr>
<tr>
<td>&gt;75</td>
<td>299</td>
<td>42.8</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>364</td>
<td>52.1</td>
</tr>
<tr>
<td>Female</td>
<td>334</td>
<td>47.9</td>
</tr>
<tr>
<td>Annual mileage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;3000 km</td>
<td>189</td>
<td>27.1</td>
</tr>
<tr>
<td>3000–8000 km</td>
<td>218</td>
<td>31.2</td>
</tr>
<tr>
<td>8000–13,000 km</td>
<td>182</td>
<td>26.1</td>
</tr>
<tr>
<td>13,000–18,000 km</td>
<td>59</td>
<td>8.5</td>
</tr>
<tr>
<td>&gt;18,000 km</td>
<td>39</td>
<td>5.6</td>
</tr>
<tr>
<td>N/A</td>
<td>11</td>
<td>1.6</td>
</tr>
<tr>
<td>Parking accident or incident/3 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>488</td>
<td>69.9</td>
</tr>
<tr>
<td>At least one</td>
<td>172</td>
<td>24.6</td>
</tr>
<tr>
<td>N/A</td>
<td>38</td>
<td>5.4</td>
</tr>
<tr>
<td>Physical limitations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>134</td>
<td>19.2</td>
</tr>
<tr>
<td>No</td>
<td>564</td>
<td>80.8</td>
</tr>
</tbody>
</table>

---

1 Because several respondents provided more than one response, despite the instruction to provide only one, we prefer to report the total number of responses instead of the total number of respondents.
available space; 60.8%), the reliability of the device (36.6%), whilst the need for automatic parking was spontaneously mentioned in only 2.5% of responses.

3.2. History of parking accidents and/or incidents within the last 3 years

At least one parking accident or incident during the last three years was reported by 24.6% of participants, while 69.9% reported no incident. The remaining (5.4%) did not respond. In cases of a parking accident and/or incident, the most damaged parts of the car were the bumpers and wings (47.5% and 24.7%, respectively).

3.3. Validity of the PBQ

Principal component analysis with varimax rotation was conducted on the answers to the 21 questions of the PBQ. As the distributions of collected data were not normal, the method of unweighted least squares was applied. According to Kaiser’s criterion, 6 factors were identified, but two of them were strictly associated with only one question (illegal turn or not paying parking tax) and were therefore discarded. The results of the principal component analysis are shown in Table 2. Four factors explained 40.5% of the total variance. The first factor (F1) concerned slips and/or lapses and explained 22.2% of the total variance (Cronbach’s alpha = 0.68). The second factor (F2) covered mistakes and explained 7.1% of the total variance (Cronbach’s alpha = 0.65). The third factor (F3) concerned errors of anticipation and explained 5.9% of the total variance (Cronbach’s alpha = 0.55). The fourth factor (F4) mainly concerned deliberate violations and explained 5.3% of the total variance (Cronbach’s alpha = 0.41). Four questions (taking the wrong parking space, being surprised by a vehicle leaving its parking space, embarrassing parking and illegal parking) did not load on any other factor.

3.4. Predictors of the score of parking difficulty

We examined the relative predictive value of the PBQ with respect to parking difficulties expressed by drivers. Three sequential multiple regression analyses were performed with the personal characteristics and reported aberrant parking behaviours as independent variables, and the score of overall parking difficulties as dependent variable. We entered in the regression models age, gender, frequency of driving per week, and accident or incident history, which are variables with a known or suspected influence on self-regulatory behaviours. These variables were entered as independent variables in the first analysis (model 1). In the second (model 2), perceived functional limitations and personal relation to driving were added. In the third analysis (model 3), the four PBQ factor scores (slips or lapses, execution errors, anticipation errors and violations) were also added.

As shown in Table 3, in model 3 the parking difficulty score was significantly predicted by 6 variables, which explained 36.5% of the total variance. In order of decreasing importance, the results showed that parking difficulty was greater among drivers who reported at least one parking accident or incident during the last three years, who made more execution errors during manoeuvres, who made more slips and/or lapses while manoeuvring, who committed more parking rule violations, who perceived driving as a necessity rather than as a pleasant activity, and who made fewer anticipation errors while manoeuvring. Functional limitations and personal relation to driving were poorer predictors of parking difficulty score as they added only 2% of the explained variance in model 2. Aberrant parking behaviours and execution errors were the best predictors of the parking difficulty score since they increased the explained variance by 15% (model 3).

### Table 2

<table>
<thead>
<tr>
<th>Brief description of items</th>
<th>Risk level</th>
<th>F1 Slips or lapses</th>
<th>F2 Mistakes</th>
<th>F3 Anticipation errors</th>
<th>F4 Violations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colliding with something</td>
<td>1</td>
<td>0.559</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stalling</td>
<td>0</td>
<td>0.511</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Failed manoeuvre</td>
<td>0</td>
<td>0.493</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forgetting to check the rear view mirrors</td>
<td>0</td>
<td>0.466</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forgetting where the car was left</td>
<td>0</td>
<td>0.441</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doubts about steering direction</td>
<td>0</td>
<td>0.346</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Misjudgement of other vehicles’ speeds</td>
<td>0</td>
<td>0.630</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mishandling</td>
<td>0</td>
<td>0.556</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shifting into wrong gear</td>
<td>0</td>
<td>0.500</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leaving a parking space too quickly</td>
<td>0</td>
<td>0.624</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sudden braking before parking</td>
<td>1</td>
<td>0.306</td>
<td>0.471</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Omitting turn signals</td>
<td>0</td>
<td>0.305</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crossing continuous white line</td>
<td>2</td>
<td>0.611</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parking the wrong way</td>
<td>2</td>
<td>0.399</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Illegal U-turn</td>
<td>2</td>
<td>0.332</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. For the sake of clarity, factor loadings below 0.30 have been omitted. The levels of risk were defined by Reason et al. (1990) as follows: 0 – no risk to other users, 1 – possible risk to others and 2 – a definite risk to others.
4. Discussion

Parking rarely attracts researchers’ attention even though it is unavoidable whenever one has to drive. Although older people drive less, they are still confronted by the need to execute parking manoeuvres. New parking assistance devices have been developed, showing the growing interest in assisting this kind of manoeuvre. However, the behaviours of drivers with special needs have not been studied. For this purpose, we developed a specific questionnaire to better describe the parking difficulties of older people, to identify their aberrant parking behaviours, and to predict their level of difficulty while manoeuvring.

As regards older drivers’ parking behaviour in everyday life, perpendicular forward and parallel backward parking are the most frequent manoeuvres, the former being mostly performed at home and the latter elsewhere than at home. Nowadays, both types of manoeuvres can be assisted by dedicated systems. The use of such assistance may increase comfort during parking, especially by providing information about obstacles. This has been confirmed by respondents owning parking assistance devices, even though they find them difficult to use. Moreover, we expect that the use of parking assistance will also decrease the frequently reported rejection of a parking space (which seems too difficult to park in) and in the end improve the efficiency of urban trips. Since older drivers expressed specific needs for parking assistance devices, it is important to take them into account in order to improve their usability. A better description of older drivers’ parking difficulties offers an opportunity to design user-friendly and efficient parking assistance. A better communication on their advantages should also lead to a higher deployment for this type of driving assistance.

To improve the description and classification of older drivers’ aberrant parking behaviour, we developed a specific tool inspired by the DBQ. Our results confirmed the typology already described (Martinussen, Hakamies-Blomqvist, Møller, Özkan, & Lajunen, 2013; Rimmö & Hakamies-Blomqvist, 2002). We identified four types of aberrant parking behaviours (slips or lapses, execution errors, anticipation errors, violations). Execution errors and slips or lapses during manoeuvring explain the bulk of parking difficulties expressed by older drivers. This could stem from the properties of the parking itself. Low-speed manoeuvres are often made in dedicated areas with speed limits and low traffic. In such conditions, successful parking is mostly dependent upon the driver’s ability to survey the environment and to control the vehicle’s position. Therefore, slips or lapses like failing to see obstacles are more likely to account for difficulties and potentially failed manoeuvres. Furthermore, age-related cognitive changes could account at least partly for difficulties in surveying the environment while reversing (see Eby et al., 1998; Janke, 1994 for review). The second type of aberrant behaviour, execution errors, could be attributed to failures of attention leading to erroneous actions (Reason et al., 1990). The third type was anticipation errors, like being surprised by a vehicle leaving its parking space, which can be attributed to failure to take into account the possible presence of other drivers. The more older drivers fail to notice the presence of other drivers, the less they anticipate their actions. Finally, the last type of aberrant behaviour is violations. Despite the common representation of older people as careful road users (Parker, McDonald, Rabbitt, & Sutcliffe, 2000), our respondents declared some risky or illegal behaviour. Previously, it was shown that an educational intervention increased self-regulation behaviour among high-risk older drivers (Owsley, Stalvey, & Phillips, 2003). Such interventions could also take into account their parking difficulties. To better identify the difficulties encountered by the trainees, the PBQ could be used. Moreover, it could offer the opportunity to adapt the intervention according to the four types of parking aberrant behaviours previously described and give clearer guidance regarding the strategies to adopt.

We also tried to identify factors that could predict the level of parking difficulties among our sample of older drivers, taking into account general information and reported aberrant driving behaviours. A similar approach has already been adopted by some authors who have shown that active accident involvement among older drivers seems to be associated with errors...
and lapses of attention, while passive accidents are associated with lapses only (Parker et al., 2000). Regarding the prediction of avoidance of difficult driving situations by older drivers, perceived abilities play a major role, while blatant driving behaviour contributes less (Gabaude et al., 2010). In contrast, the difficulty of manoeuvring is mainly predicted by the history of parking accidents and/or incidents within the last 3 years, and also by reported aberrant parking behaviours. In decreasing importance, difficulty was more frequently expressed by people who had at least one parking accident and/or incident within the last three years. It was followed by those reporting execution errors, slips or lapses, those considering driving as a necessity rather than a pleasure, and those reporting violations. Lastly, the difficulty of manoeuvring was less frequently expressed by people reporting fewer anticipation errors. Surprisingly, declared functional limitations had no significant influence on parking difficulties reported by the respondents. Two arguments can be adduced to explain this. Firstly, the existence of self-declared functional limitations was collected by asking participants whether they felt limited in their movements. It would have been better to ask directly whether or not they were actually limited. Secondly, it is possible that road users who feel they are functionally limited unconsciously adopt adaptive strategies to overcome parking difficulties. It can thus be concluded that, compared with general information and self-declared functional limitations, reported aberrant parking behaviours are more parsimonious predictors of difficulties encountered during parking manoeuvres among older drivers. To investigate the real impact of functional limitations on parking behaviours of older drivers, an experimental study will be conduct to better describe the adaptive strategies adopted.

The present study has some limitations. To take into account the social characteristics and driving habits of the targeted population, the questionnaire was sent out to two areas with different population densities. The largest proportion of respondents resided in an urban environment. This over-representation of urban inhabitants in our sample is confirmed by the return rates obtained in a previous survey by Gabaude et al. (2010), using the same method. The current sample does not reflect the entire population of older drivers, but does provide a better overview of the parking difficulties encountered by older drivers, who are more likely to share their experience (probably linked to the lack of parking spaces in the city of Lyon; Lemoine, de Laboulaye, Delourme, & Menand, 2010). Moreover, the use of self-reported measures only approximates current driving ability and behaviour. A small social desirability bias has been demonstrated for the DBQ (Lajunen & Summala, 2003) and the same can be expected for the PBQ, particularly for anticipation errors. Furthermore, the assessment of parking difficulty including only three items should have been more comprehensive, taking into account the various phases of the manoeuvres, for example. Future work should try to overcome these methodological limitations by studying the real behaviour of older drivers compared with younger ones and by collecting objective measures about the difficulty of the manoeuvres. This would also be an opportunity to explain better the failures of attention identified through aberrant driving behaviour by describing their actual impact on parking.

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