



Self-reported wayfinding ability of older drivers[☆]



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ABSTRACT

Some older drivers experience difficulties driving whilst wayfinding in unfamiliar areas. Difficulties in wayfinding have been associated with poorer driving performance and reduced driving mobility. The objective of the current study was to identify cognitive and demographic predictors in older drivers of perceived wayfinding difficulty, avoidance of unfamiliar areas and the use of wayfinding strategies. Five hundred and thirty-four drivers aged 65 years and over (excluding those with dementia or Parkinson's disease) completed a mail-out survey. Drivers commonly reported difficulties with wayfinding, with 59.5% reporting their abilities as poor or fair rather than good. Those significantly more likely to report difficulty were older, reported poorer health and cognition, and had less driving experience. A small proportion of drivers reported regularly avoiding unfamiliar areas (13.8%); these drivers were significantly more likely to be female and to report poorer wayfinding abilities. The most common wayfinding strategies regularly used by older drivers were using a street directory whilst driving (61.9%) and pulling over to check the map (55.1%). Regular passenger guidance (23.9%) or use of a navigation system (9.9%) was less common. The implications of this study are wide and include collecting further information about: (1) the role of cognitive processes in wayfinding ability; (2) the relationship between perceived wayfinding difficulty and restriction of driving in unfamiliar areas; and (3) older drivers' preferences for different wayfinding strategies.

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1. Self-reported wayfinding ability of older drivers

It is well documented that some older people experience declines in their driving abilities due to sensory, physical and cognitive difficulties associated with aging (Janke, 1994). Recent research has revealed that some older drivers have particular difficulty with wayfinding, or finding one's way to an unfamiliar area (Anstey and Wood, 2011; Mallon and Wood, 2004; Wood et al., 2009). Difficulties with wayfinding may be problematic to the driver in two ways. First, becoming lost is likely to be a stressful experience which may lead to drivers' avoidance of unfamiliar areas, which in turn may limit their driving mobility and involvement in community-based activities. Second, wayfinding requires that the

driver share available (and limited) cognitive resources between the task of wayfinding and driving the vehicle, potentially increasing the driver's crash risk. A study by Wood et al. (2009) found that older drivers' mistakes whilst self-directing with road signs were related to retrospective and prospective self-reported crashes. In order to keep older people driving safely for as long as possible, it is important to understand the factors that may predict which drivers are likely to have difficulty with wayfinding and identify effective strategies that may help those drivers improve their wayfinding abilities.

Driving, even under normal conditions, is a complex activity which requires many cognitive abilities, including processing speed, attention, visuospatial abilities and executive functioning (Baldock et al., 2007; Groeger, 2000; Rizzo and Kellison, 2009). Wayfinding whilst driving potentially places added demands on a range of cognitive resources and is likely to increase complexity of the driving task. To successfully perform wayfinding tasks concurrently with driving tasks, the driver must also be able to switch between tasks and allocate cognitive resources accordingly.

There are few models of wayfinding in the driving context, however, the processes involved in pedestrian wayfinding described by Passini and colleagues offer a useful model for understanding wayfinding in the broader road user domain (Arthur and Passini, 1992; Passini, 1984). The model describes wayfinding in terms of three components: decision making, decision execution and

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information processing. Decision making involves planning the route and recording directions in terms of what actions need to occur at which location (Arthur and Passini, 1992; Passini, 1984). Decision execution involves executing the actions at the correct locations. Information processing involves the collection of all the information needed to perform decision making and decision execution, using environmental information and internal processes (Arthur and Passini, 1992). Environmental information includes access to maps or directions and identification of landmarks or street signs. Internal processes include cognitive abilities such as planning ability, decision making, map reading, scanning and memory (Arthur and Passini, 1992).

Passini's model has been used as a basis for understanding wayfinding whilst driving (Burns, 1998). Burns found that drivers tend to report difficulties with wayfinding at the information processing stage, especially with identification of environmental information. While Burns focused on the influence of environmental factors, Passini's model (Arthur and Passini, 1992) suggests that decline in cognitive processes can also affect wayfinding. Using Passini's model in a driving context, it is possible to predict that difficulties with wayfinding would be associated with age-related cognitive decline.

There is well documented evidence for declines in several domains of cognition which occurs as a consequence of normal aging (Christensen et al., 2004; Park et al., 2003; Rabbitt et al., 2004). These domains include processing speed, some aspects of attention, visuospatial skills, memory and executive functions, with little or no changes to knowledge based skills such as vocabulary and semantic memory (Rabbitt et al., 2004; Salthouse, 2004). All of these skills are hypothesized to be involved in complex driving situations such as wayfinding whilst driving. Hence, it follows that people with age-related cognitive decline may experience more difficulty with wayfinding and driving generally than those who are cognitively intact.

Studies have shown that older drivers are more likely to report wayfinding difficulties when compared with younger drivers and these difficulties are associated with avoidance of unfamiliar areas and reduced mobility (Burns, 1998, 1999). Burns also found that female drivers reported more difficulties with wayfinding than male drivers. Performance of older people (aged in their sixties, seventies and eighties) is also poorer than younger drivers (aged in their twenties and thirties) on route learning tasks and self-directed driving tasks using road signs (Kirasic, 1991, 2000; Mallon and Wood, 2004; Pick, 2010). There is also evidence that the increases in driving safety errors found on self-directed driving tasks compared to instructor-directed driving tasks are greater for older than younger drivers (Mallon and Wood, 2004). These difficulties are not only age related, but have also been shown to be associated with declines in cognitive abilities (Anstey and Wood, 2011; Mallon and Wood, 2004). These findings are consistent with Passini's wayfinding model, and suggest that some older drivers, particularly those with cognitive decline, have difficulty with wayfinding in unfamiliar areas.

There is a range of strategies available to assist drivers with wayfinding including use of maps, reliance on memory, using passenger guidance and use of navigation systems. These approaches are likely to place different demands on cognitive abilities and as a consequence, may impact driving performance and crash risk associated with wayfinding. If some strategies are found to be safer and more effective than others, then it may be useful to recommend the use of these strategies over other less effective or more cognitively demanding strategies. More information, however, is needed about what strategies older drivers are currently using.

Of particular interest is the prevalence amongst older drivers of reliance on passengers and navigation systems to help them find their way in unfamiliar areas. Both passengers and navigation

systems have been shown to reduce the driving errors of older drivers (aged 65 and over) whilst wayfinding in unfamiliar areas compared to following signs or using a paper map (Dingus et al., 1997; Mallon and Wood, 2004). This reduction in driving errors may be explained by the use of these strategies freeing up cognitive resources of the driver to allow more focus on driving safely. Before the drive, assistance can be provided about the best route to follow by both passengers and navigation systems. During the drive, both passengers and navigation systems can give verbal directional information which reduces the need for the driver to remember directions or look at a map. Passengers can help to search for information in the environment, and navigation units can provide clearer spoken or visual information about streets than driver monitoring of the environment.

However, there are potential drawbacks with both passenger guidance and navigation assistance. Passengers may be distracting to the driver, potentially increasing crash risk (McPhee et al., 2004). Moreover, this approach relies on good wayfinding ability of the passenger and good communication with the driver. Current research into reduction of driving errors (Mallon and Wood, 2004) has focussed on passenger guidance by driving instructors, who may have superior skills compared to passengers in the general community. Navigation systems also have the potential to cause visual distraction, particularly where information is only available on a screen without spoken directions (Liu, 2001). The advised route may not be optimal for the driver (e.g. chooses high speed roads which the driver is not comfortable driving), and directions may be incorrect, unclear or inappropriately timed.

This study examines the perceived wayfinding skills, avoidance of unfamiliar areas and navigational strategies used by older drivers. In particular, the study addresses gaps in knowledge about wayfinding by focusing on the role of cognitive abilities and demographic characteristics of older drivers who report difficulty with wayfinding. This will provide important evidence for the application of Passini's model of wayfinding for driving. The study also examines the association between avoidance of unfamiliar areas and drivers' perceived wayfinding difficulties, providing important insights into the role of wayfinding in limiting mobility. Finally, the research addresses strategies used by older drivers to find their way to unfamiliar locations to determine which strategies are preferred by older drivers and whether their adoption is motivated by the need to compensate for wayfinding difficulties.

2. Materials and methods

2.1. Participants and recruitment

Community-dwelling current drivers aged 65 years and over ($n = 534$) were recruited from membership of an Australian motor-club. Participants were selected using stratified random sampling based on age and residential location of the Victorian population (Australian Bureau of Statistics, 2007) and were contacted by mail and invited to complete and return a survey using a postage-paid envelope. Participation was voluntary and there was no financial incentive to participate in the study. Monash University Human Research Ethics Committee approval was obtained. Of the 558 participants who responded (response rate = 18.6%), 24 were excluded because they did not meeting criteria (presence of self-reported dementia or Parkinson's disease, or were aged under 65 years) or because of excessive missing data.

2.2. Materials and procedure

Participants completed a 20-min self-report survey including a total of 87 items. This paper reported on the results of a subset of

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