Chapter 11
Intelligent Transportation Systems for Older Drivers:
A Systems Approach to Improving Safety and Extending Driving Longevity

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ABSTRACT

This chapter covers current and future technologies relevant to older drivers. It does this using a systems framework, reviewing research and issues relating to older adults and technology at the level of the road user, the transport infrastructure and the vehicle. While most Intelligent Transportation Systems (ITS) currently exist at the level of the vehicle (technologies such as satellite navigation, collision avoidance, and hazard alerting systems), research and development at the infrastructure level also holds promise of significant improvements in automotive safety through the exchange and coordination of digital information between vehicles and the roads upon which they are driven. At the individual level, there are also increasingly sophisticated technologies being developed that aim to accurately identify potentially unsafe drivers, and to maintain and even enhance cognitive capacities that are critically important to safe driving. This chapter begins with a review of salient characteristics of older drivers, before discussing current and future technologies at each level of the adopted framework: the road user, the road, and the vehicle.

INTRODUCTION

In just over 100 years since the first Model T Ford rolled off the production line, there have been huge changes in all aspects of automotive transportation. Cars have become increasingly sophisticated, road networks have proliferated (from 230km of sealed road in the US in 1904, to over 9.2 million km today; Berger, 2001) and most of the Western population has come to rely on private vehicles for their everyday transportation needs. This century of change has had a profound impact on every aspect of society and culture, and it is likely that the continuing evolution of automobiles and automotive transport will have an even greater impact in the decades to come. This

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evolution will occur on two main fronts. On the one hand, the next 20 to 30 years will likely see a comprehensive shift towards environmentally friendly vehicles, with a majority designed for no or low emissions (Van Mierlo, Maggetto, & Lataire, 2006). On the other, and within the same time frame, there will be a growing technological revolution, with increasing incorporation of Intelligent Transportation Systems (ITS) into both vehicles and transportation networks enabling ever greater levels of driver convenience and safety. Reflecting on the probable future, US auto industry elder statesman Bob Lutz predicted that by the mid 2020s, there would be wide-spread implementation of fully autonomous vehicles (Lutz, 2004). The science-fiction future of clean, green self-driving cars may almost be here.

For this prediction to come to pass, however, the next 15 years will necessarily involve very rapid and very significant changes in vehicle design, technology and usage. These changes will naturally affect drivers of all ages, but for two reasons, the first and probably greatest impact will be felt by older drivers. First, older adults are the fastest growing segment of the driving population (NHTSA, 2006), with current and future cohorts of retirees driving more frequently and for more years than ever before (Molnar & Eby, 2008). In the face of age-related physical, sensory and cognitive declines, incremental advances in technology hold perhaps the greatest promise for enabling an extension of safe and independent automotive mobility that millions of aging baby boomers desire (Arentze, Timmermans, Jorritsma, Olde-Kalter, & Schoemakers, 2008). Second, technological innovations usually make their first commercial appearance in fully-featured or luxury model vehicles for which the largest market has always been older drivers (Choo & Mokhtarian, 2004; Coughlin, 2005). Together, these factors highlight the importance of understanding the nature of older adults' interactions with, and requirements for, ITS. Only with this understanding will policy makers and automotive technologists and designers be able to optimise future vehicles and transportation networks to maximise their safety, convenience, and usability for older drivers.

This chapter sets out to analyse issues surrounding older drivers and technology from a systems perspective, specifically, a system comprising three elements: the road user, transport infrastructure, and the vehicle. Research, issues, and current and future technologies will be examined at each level, before the concepts and discussions are drawn together with recommendations for consumers, researchers and policy makers regarding current technologies and the way forward. The analysis begins with an introduction to the characteristics of older adults as drivers of cars.

BACKGROUND

Older Drivers

Older drivers, typically but arbitrarily classified as those aged 65 and over, are the fastest growing component of the road user population (OECD, 2001). For instance, the number of licensed older drivers in the US increased by 17% between 1995 and 2005, in contrast to a rise of only 14% across other age groups (NHTSA, 2006). This growth is a result of several factors including population aging, increasing car ownership and usage rates, and a move towards increased social engagement and aging-in-place for many retirees (Smiley, 1999).

Whilst there is enormous variability between older adults across all aspects of ability and function, as drivers they do have several distinguishing characteristics. First, most of the sensory, physical and cognitive abilities that are required to safely operate a vehicle tend to decline with increasing age (Anstey, Wood, Lord, & Walker, 2005). For example, age-related structural changes in the eye result in a reduction of up to 90% in visual sensitivity and resolving power over a lifetime (Klein, 1991). However in other areas, age may be associated with improvements in abilities