

## **Hector VR®: Harnessing Co-Design Principles to Build A Mixed Reality Driving Simulator for Older Drivers**

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### **Abstract**

Driving is key to independence for many older people. However, ageing-related declines in processing, attention and cognition can impact driving competence. This project is the first of its kind in Australia to use a “mixed reality” solution to develop a driving simulator specifically with, and for, older drivers. As a decision assistance tool, the Hector VR® driving simulator provides older drivers with objective information about their driving competence including reaction time and compliance with road rules. Evaluation results confirm the utility of a co-design approach in developing a fit-for-purpose driving simulator with a high degree of user acceptance.

### **Background**

Research consistently highlights that accident risk increases for the older driver population (Langford and Koppel, 2006). A number of factors are likely to contribute to this increased risk, including age-related changes in sensory and perceptual processing, attention, and cognitive ability (Ni, Kang and Andersen, 2010).

However, mobility is key to independence for many community-dwelling older people and driving cessation is associated with a number of negative outcomes. These include marked declines in quality of life and general health (Edwards, Lunsman, Perkins, Rebok and Roth, 2009), increases in clinically significant depression (Mezuk and Rebok, 2008), reduced social networks (regardless of the ability to use public transport) (Mezuk & Rebok, 2008) and premature entry to residential aged care (Edwards, Perkins, Ross and Reynolds, 2009).

The question of how to support older people to maintain their driving competence; or to relinquish their drivers licence based on an objective assessment of their ability is therefore an increasingly pressing policy issue in many developed countries with ageing populations.

Driving simulators are recognised as a useful means of conducting driving-related research in a low-risk environment with ease of data collection and standardisable results (Michaels et al., 2017).

### **Method**

This project used a co-design method to create a driving simulator with, and for, older drivers. Co-design is a participatory research approach that involves a partnership between researchers and stakeholders, with collaboration right from the outset (Goodyear-Smith, Jackson and Greenhalgh, 2015) to test designs to improve implementation and effective uptake (Peters, Adam, Alonge, Agyepong and Trang, 2013).

User evaluations were undertaken across three development phases (alpha, beta and final release) by a total of 63 individual participants aged 64 and above, with the two eldest participants both aged 93 years old. With the exception of one, all participants held a current Australian drivers licence with 57% of all participants being female and 43% male. All participants resided in regional NSW.

The phased development approach enabled feedback by participants to inform and guide subsequent development stages in an iterative co-design process. Each participant undertook at least one virtual driving experience, answered a series of driver behaviour questions and completed pre- and post-surveys based on a modified Technology Acceptance Model 2 (TAM-2) standardised evaluation tool (Vankatesh & Davis, 2000). Likert-scale questions were used to elicit feedback on the level of user acceptance, ease-of-use and attitudinal information relating to future intention to use the technology. Focus groups were also held at the completion of testing to provide further detail.



*Figure 1. Hector VR<sup>®</sup> driving simulator in use.*

**Results**

*Fit-for-purpose simulator design*

As demonstrated in Table 1 below, the aggregate results show positive end-user feedback and acceptance with more than 75% of participants indicating they would use the driving simulator in the future if they wanted to know more about their driving competence.

**Table 1. Results Summary**

	<b>Strongly Disagree (%)</b>	<b>Disagree (%)</b>	<b>Neutral (%)</b>	<b>Agree (%)</b>	<b>Strongly Agree (%)</b>	<b>Total Positive Response (%)</b>
<b>Combining VR technology with the shell of a real car enhanced the overall design.</b>	0	0	17	66	17	83
<b>The driving simulator is easy to use.</b>	0	5	14	73	8	81
<b>The results from the driving simulator are useful.</b>	0	0	3	73	24	97
<b>I found it easy to understand the simulator test results.</b>	0	0	0	81	19	100
<b>If I wanted to know more about my driving competence I would use the simulator.</b>	0	8	14	59	19	78

## Conclusions

This project demonstrates that a co-design approach is effective in engaging older drivers in the development of a mixed reality driving simulator. Older drivers involved confirm an intention to use the Hector VR<sup>®</sup> driving simulator to gain information about driving competency and found the results produced by the simulator of use. Overall, the driving simulator is fit-for-purpose for its intended older driver user group and may make a useful contribution to dignified decision making about driving cessation for older drivers.

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