Cognitive Predictors of Driving Ability in Older Adults

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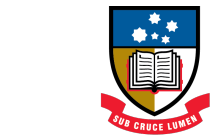

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List of Acronyms

ABS	Australian Bureau of Statistics
ACTIVE	Advanced Cognitive Training for Independent and Vital Elderly
AIC	Akaike Information Criterion
ATCQ	Attitudes Towards Computers Questionnaire
BITRE	Bureau of Infrastructure, Transport and Regional Economics
CALTEST	California Test
CI	Confidence Interval
df	degrees of freedom
DMV	Department of Motor Vehicles
GP	General Practitioner
GRIMPS	Gross Impairment Screening Battery of General Physical and Mental Abilities
HR	Hazard Ratio
IADL	Instrumental Activities of Daily Living
IT	Inspection Time
logMAR	logarithm of the Minimum Angle of Resolution
ms	milliseconds
MAB	Medical Advisory Board
MMSE	Mini Mental State Examination
MOMSSE	Mattis Organic Mental Syndrome Screening Examination

MSSQ Motion Sickness Susceptibility Questionnaire

MVPT Motor-Free Visual Perception Test

NHTSA National Highway Traffic Safety Administration

OECD Organisation for Economic Co-operation and Development

OR Odds Ratio

PASE Physical Activity Scale for the Elderly

ProPerVis Proficiency of Peripheral Visual Processing

RT Reaction Time

SDLP Standard Deviation of Lane Position

SS Simulator Sickness

SSQ Simulator Sickness Questionnaire

TMT-A Trail Making Test Part A

TMT-B Trail Making Test Part B

UFOV™ Useful Field of View Test™

UN United Nations

VIF Variance Inflation Factor

VMI Visualisation of Missing Information

Abstract

The main aim was to investigate functional predictors of driving ability in older adults. The principal focus was on cognitive predictors, but visual and physical function measures were also included. The cognitive assessments reflected domains identified as most relevant to driving outcomes, including visual attention, processing speed, and general cognitive functioning. The specific cognitive tests included the Useful Field of View Test™ (UFOV™), which is notable for its consistent relationship with a broad range of driving outcomes; and Inspection Time (IT) and ProPerVis, assessments of processing speed and crowding across the visual field, respectively, which have not previously been investigated in relation to driving outcomes but have potential as screening tests. A secondary aim of the thesis was to investigate methodological issues concerning use of driving simulators.

Five studies formed a sequential program of research. Study 1 examined factors contributing to performance on the UFOV™; although the UFOV™ has been extensively used in past research, its psychometric properties are not yet well understood. The results from Study 1 showed that UFOV™ Subtest 1 primarily reflected low-level visual function; UFOV™ Subtest 2 reflected change detection, processing speed (as assessed by IT), and general cognitive function; and UFOV™ Subtest 3 reflected crowding (as assessed by ProPerVis), processing speed (as assessed by IT), contrast sensitivity, and general cognitive function. These results suggested that IT and Crowding may be useful in predicting driving performance, based on their importance for UFOV™ Subtests 2 and 3, which have been consistently linked to important driving outcomes. Studies 2, 3 and 4 investigated methodological issues related to driving simulators, including simulator sickness, validity, reliability, and usability. The results from Study 2, which investigated risk factors for simulator sickness, showed that older adults in general are a high-risk group, as are females and those with a history of motion sickness. Studies 3 and 4 used a variety of methods to show that the simulator demonstrated reliability, face validity, content validity, and convergent validity, and was perceived by participants as providing an acceptable method of assessing driving skills.

Study 5 investigated functional predictors (cognitive, visual, and physical) of simulated driving performance on two tasks: a Brake Reaction Time (RT) task and a Traffic Participation Task. The results from Study 5 showed small but significant correlations between cognitive test performance (IT, Crowding, and UFOV™ Subtest 2) and Brake RT. For the Traffic Task, only Crowding was significantly correlated with driving performance. Physical activity and visual function were not associated with driving performance. These results have implications for current assessment procedures. They suggest that visual function measures are not generally useful for determining fitness-to-drive, a conclusion that has important implications for practices at present widespread in many jurisdictions responsible for driver licensing. Regarding the cognitive measures, it is suggested that the IT and Crowding measures may be useful as screening measures for older drivers, especially those who are most at-risk. Further research with a broader range of participants would be needed to establish appropriate test cut-points. Limitations and further implications of the results are discussed.

Signed Statement

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Dedication

This thesis is dedicated to my parents

Susan and Anthony

and my grandparents

Ivan and Audrey