THE VALIDITY OF SIMULATORS IN STUDYING DRIVING BEHAVIOURS

Hossein Rouzikkah, Mark King, Andry Rakotonirainy
Centre for Accident Research and Road Safety – Queensland (CARRS-Q), QUT
email: h.rouzikkah@qut.edu.au, m.mark.king@qut.edu.au, andry.rakotonirainy@qut.edu.au

INTRODUCTION

Driver simulators provide safe conditions to assess driver behaviour and provide controlled and repeatable environments for study [1]. They are a promising research tool in terms of both providing safety and experimentally well controlled environments. There are wide ranges of driver simulators, from laptops to advanced technologies which are controlled by several computers in a real car mounted on platforms with six degrees of freedom of movement. Simulators can be classified into three levels: low, medium and high fidelity [2]. In addition, the cost of simulators significantly varies. The applicability of simulator-based research in a particular study needs to be considered before starting the study, to determine whether the use of a simulator is actually appropriate for the research. Given the wide range of driver simulators and their uses, it is important to know beforehand how closely the results from a driver simulator match results found in the real world. Comparison between drivers’ performance under real road conditions and in particular simulators is a fundamental part of validation [4]. It should be noted that even the most advanced simulators, which provide the most realistic driving environments possible, are not able to make an exact copy of the real world [1], however the important question is whether the results obtained in a simulator mirror real world results.

Validity “refer[s] to the degree that the simulator evokes the same behavior as would be shown in reality under similar circumstances” [2]. Broadly, two kinds of validity can be defined: absolute validity is demonstrated “if the absolute size of the effect is comparable to the absolute size of the effect in reality”; relative validity, is defined as “effect of the measure is the same as in reality” [2]. The following review presents the results of the most recently conducted research into absolute and relative validity of simulators when used to study behaviour.

VALIDITY OF SIMULATORS

A diverse range of studies that used simulators to research driving behaviour was reviewed. It was found that although simulators demonstrated relative validity in most studies, absolute validity could not be confirmed. It is believed that validity of driver simulators is task dependent [2], so the synopsis of the review is structured according to six categories as follows.

Speed: validity studies on speed received the most attention. Among speed validity studies, a majority found relative validity for simulators [5-7]. The main reason for lack of validity is low risk perception in simulators. Only McAvoy, Schattner, & Dafta [8] found absolute validity for their portable moving base driving simulator.

Driving errors: Shechtman, et al. [11] investigated the number and type of driving errors when participants negotiated a right and a left turn in a high-fidelity driving simulator and on the road. Relative validity of the simulator was found for several types of driving error.

Cognitive and visual performance: Santos, et al. [9] stated simulators and field studies are better approaches finding differences among various levels of visual searches than instrumented vehicles. Relative rather than absolute validity has been demonstrated in this area. Bédard, et al. [10] used neuropsychological testing. They found a relationship, but not absolute, between the simulator data and neuropsychological tests which forecast crashes and safe driving.

REFERENCES