

# Practical Low-Cost Augmented Reality Research into Group Car Driving Behaviour

ROBERT H BARBOUR  
Department of Computing  
Faculty of Creative Industries and Business  
Unitec, NEW ZEALAND  
bbarbour@gw.unitec.ac.nz

**Abstract** - People enjoy car driving. As driving speeds have increased and more people use vehicles the consequence of loss of control is often a crash. Safer cars and better-engineered roads and road environments all help reduce the effects of crashes. Studies of individual car/driver interactions often use driving simulators. However, there is little reported research on group driving behaviour. Serious driving games using desktop computers are widely available. Together with low cost virtual reality aids, a local area network formed the basis for this study. Early results, from twenty adult drivers, show a strong sense of reported presence over three one-hour sessions. Younger adult males quickly lost control, in group driving sessions, when the sounds of engine noises of other drivers were very close. Findings confirm the efficacy of the hardware and software combination and that replication of the study is accessible and cost-effective.

**Keywords:** Serious games, presence, networked driving simulation, group virtual reality

## 1 Introduction

Real Life (RL), Augmented Reality (AR) and Virtual Reality (VR) are, philosophically speaking, both aspects of lived experience. People enjoy driving cars and share that experience with other people on the nation's roads. Driving is a group activity requiring well developed social behaviour described in traffic law and policed by traffic enforcement agencies. VR driving experiences reported in the literature employed a number of different technologies but research systems usually involve a single participant and a single computer based VR system. Experiences in single systems can be extended in a variety of ways. Networking computers either with a LAN or through the Internet removes the tyranny of distance allowing people to interact in virtual worlds as if they were face-to-face (f2f). The rapid growth in Second Life, Facebook and associated systems indicate people seek extensions to normal interactions. While nobody is pretending that a simulation is the same as the real (f2f) thing, virtual experiences offer many advantages. The most important advantage is that virtual experiences come from digitally sourced data in a graphical and sound world where the physical consequences of mistakes are

trivial in comparison to the consequences of similar actions in the real world. Thus, the research described here more closely mirrors actual driving experience because of the many people that can interact with each other using the system at the same time. The systems described below are best described as Augmented Reality systems since the physical wheels, pedals and other input devices mimic RL devices and have a physical reality.

In the first section previous work is briefly outlined. The second and third sections introduce the research software and hardware providing brief descriptions and some technical information. The fourth section describes the experimental context and the tasks carried out by participants. The fifth section describes some findings from the experimental research and the sixth section summarises the overall research and the last section suggests possible future work.

### 1.1 Research Context

Real world loss of control of a vehicle at 100 kph may be fatal, but in a driving simulator only pixels are bent. Globally the current range of road fatalities is from 360 per 100,000 to 10 per 100,000 [1]. In the UK the Guardian reported a cost (Feb 2007) of road fatalities exceeding 8 billion UK pounds per year. Researching driving behaviour in a simulated social context may provide information that could contribute to reducing the rate of vehicle crashes resulting in damage to person and property. Driving simulators have been used to study many aspects of driving behaviour [2]. Despite a driving 'wiki' being established [3], there is, as yet, no standard and replicable VR for driving research because each vendor and research establishment has built its own software system essentially independently of other systems. The conventions of left and right hand drive mean at least two systems would be needed. Such is the variety of systems that comparative and cumulative studies of human behaviour in simulations becomes very difficult because each VR is essentially a separate possible world. For findings from VR to have acceptable application to RL, the possible worlds of VR must plausibly intersect by being replicable, one system in relation to another system and engender in the participants' minds a strong sense of 'presence'. There