

Online Training in Situation Awareness, Hazard Perception and Risk Management for Drivers in New Zealand

Robert B. Isler #
Traffic and Road Safety Research Group (TARS)
University of Waikato
Private Bag 3105
School of Psychology
New Zealand

Nadine M. Isler
eDrive Solutions Ltd.
176 Great South Road
Ohaupo, 3803
New Zealand

Abstract

This paper will describe the psychological and educational rationales behind the development of the online interactive training system 'eDrive' (www.edrive.co.nz). Many drivers lack crucial higher-order driving skills such as visual search, situation awareness, hazard anticipation and risk management. More than 100 live-action and video-based traffic scenarios allow drivers to practice these skills from the safety of their own homes - and to have fun at the same time. The evidence-based online interactive programme has a user-friendly interface and gives instant feedback on the learner's performance. There are pre- and post-training trials to allow the monitoring of any improvements of these important driving skills. There is a user-pay facility; however, it is free of charge for 16-19 year old learner drivers who register with the Practice programme (www.practice.co.nz), developed by the Accident Compensation Corporation and the New Zealand Transport Agency.

#Corresponding author:
Tel: ++64 7 838 4455 ext. 8401
E-mail: r.isler@waikato.ac.nz

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Introduction

Higher-order driving skills such as visual search, hazard perception, risk management, self-control and self-evaluation are considered as more important than vehicle control skills when it comes to preventing crashes, as outlined in the 'Goals of Driver Education' (GDE) model (Hatakka et al., 2002). In fact, the sole focus on car handling skills training can lead to so-called 'poor calibration', due to the drivers' inflated level of confidence in their driving skills and underestimation of the complexity of the driver task (Kuiken & Twisk, 2001).

On the other hand, recent research showed that training in higher-order driving skills can lead to a statistically significant improvement of visual search behaviour during on-road driving (Isler, Starkey & Sheppard, 2011). This was accompanied by an improvement in hazard perception, safer attitudes to close following and dangerous overtaking and a decrease in driving related confidence. In support of these findings other research showed that more effective visual search patterns can be trained off road and there is evidence that these new skills transfer to real driving behaviour (Chapman, Underwood & Roberts, 2002). Hazard perception training can be significantly improved via road commentary and video-based simulations (Isler & Starkey, 2009) and at the same time, such training can reduce risk-taking behaviour in regard to speeding and close following (McKenna, Horswill & Alexander, 2006). Improving hazard perception is a particularly useful goal of any training as it directly relates to the crash risk of the learner (Horswill & McKenna, 2004).

The eDrive training program (www.edrive.co.nz) was developed by taking the above research findings into account. It consists of more than 100 video-based traffic simulations within five training modules. It requires the learners to show good situation awareness in order to detect and anticipate immediate hazards (module Visual Search), to respond to them (Hazard Anticipation), and to select the appropriate responses in order to minimise risks (Risk Assessment). The learner also has the opportunity to practice road commentary techniques (Road Commentary) and practice adapting their speeds to different road conditions (Speed Choice). The programme has a user-friendly interface and simulates a drive from the bottom of the South Island to the top of the North Island ('The Great New Zealand Roadie') where they can enjoy some stunning New Zealand scenery and collect souvenirs, which in the future, may translate to tangible rewards. There is a user-pay facility on the eDrive website. However, it is free of charge for 16-19 year old learner drivers who register with the Practice programme at www.practice.co.nz. Practice is an online resource for learner drivers that was developed by the Accident Compensation Corporation and the New Zealand Transport Agency.

Background

Our approach builds on the success of earlier PC and video-based training programmes developed by the AAA Foundation for Traffic Safety, USA (Blank & McCord, 1998) and Monash University Accident Research Centre, Australia (Regan, Deery, & Triggs, 1999). Recent research has shown that learner drivers

who practiced PC-based hazard detection and risk management skills, behaved differently to untrained drivers in simulated driving conditions and more importantly, in ways that would decrease their exposure to risk (Fisher, Pollatsek & Pradhan, 2006). However, most of these programmes are only available in DVD format and are therefore limited in their distribution range and in regard to data collection for evaluation purposes.

New and advanced digital video and web technologies allowed us to deliver the eDrive programme on the internet, which not only facilitates immediate mass distribution but also enables the gathering of performance data from the users. Tangible incentives (prizes) for good performance can also be easily built into the system. We also included a substantial number of self-evaluation exercises in order to combat the development of an unrealistic sense of achievement which could lead to 'poor calibration'. We included a number of night-driving scenarios in the eDrive programme, which we believe is an important feature, given the risks involved in night-driving. The live-action videos of the real traffic scenarios cover a large field of view and are of high-resolution quality that allows the user to detect real and potential hazards as far as up to 400 meters away.

Content

All simulations are provided with a fully functional 3D-dashboard and a near 360 degrees of vision around the virtual car through the inclusion of side and rear-view mirrors (see Figure 1 below).

The eDrive programme consists of five training modules:

- The *Visual Search* module begins with information on the limitations of central and peripheral vision including a practical demonstration. Novice drivers inherently have inefficient visual search behaviour and do not turn their heads often enough to make blind spots visually accessible. They concentrate their search in a smaller area closer to the front of the car, have longer fixation times in hazardous situations, and have a smaller spread of search. Early 'landmark' research found that eye movements of drivers can influence their steering wheel movement as 'they steer in the direction where they look' (Land and Lee, 1994). This module was designed to make young drivers more aware that they need to move their eyes and head frequently in order to be able to gather important traffic information and to develop effective situation awareness. There are 25 video simulations, each about 20 seconds long. The learner is required to carefully scan the traffic environment in front of and around the virtual car (via the mirrors) in order to detect immediate and potential hazards. After the video stops, a multi-choice question is displayed and the user needs to click on the correct answer. If they have got it right, there is positive feedback and the user can move to the next trial. If they have got it wrong they get a chance to review the video simulation again.



Figure 1. Video screenshot of the virtual eDrive (Suzuki) dashboard

- The *Hazard Anticipation* module involves two variations of training. In some trials, the simulation stops after 20 to 40 seconds and the user needs to click on all key hazards they can identify on the static image. In the other trials, the user needs to click on the hazards while the video keeps playing. There is immediate visual and auditory feedback.
- For the *Risk Management* module, the user is required to first identify a risky situation and then choose to take action before it is too late. That means they have to choose the correct time to act and what to do. For each of the 25 trials, the task for the user is to identify the risky situation as it develops and to take action before it is too late by clicking the mouse. Options of different possible responses are then given depending on the situation and the user needs to select the most appropriate response, i.e., when to act and what to do.
- The *Road Commentary* module consists of 4 trials (about 20 seconds each) of driving simulation. There is one demonstration trial with an expert giving a road commentary so that the novice driver can learn how to perform the commentary correctly. For the remaining three simulations, the user gives their own commentaries first, followed by the expert commentaries.
- The *Speed Choice* module addresses the main causes of crashes in young drivers. For each trial, the learner needs to evaluate the road condition and decide on the appropriate speed.

Look and feel

The development of the 'look and feel' was an extremely important aspect to the project. It was known from the outset how important the visual elements were, that the website must appeal to the target group (in the first instance, teenagers of both genders, all cultures and all backgrounds, and then adult drivers in the second), while also being easy to navigate, and professional. It had to have an enduring appeal, and avoid being designed to the 'flavour of the moment'.

Users arrive at the website and see an interactive image of a table top, on which are laid out items in preparation for their 'road-trip' - the visual metaphor the site follows. A drivers licence, car keys, and map set the scene, and the programme begins when the user enters through opening up the map. Here begins the chosen navigation: a hand-drawn map which represents New Zealand (see Figure 2). It is friendly and clean in appearance, while being generic enough to appeal to young people, and can be expanded should further modules be added. It shows users' progress, performance and rewards and allows them to navigate through the modules.

Each module is represented on the map by a different region of the country, and an image of a postcard from that region shows the user where they are travelling through. This connects users with the New Zealand landscape, and encourages progress, as each region only becomes unlocked when the last module has been successfully completed. To continue the metaphor of the road trip, 'souvenirs' are hidden throughout the programme, which can be collected and stored in a souvenir cabinet. This is optional, but adds interest if users choose to participate.

A modern, dynamic website was designed to provide a stylish, streamlined environment in which users can easily access the facilities of the project. The eDrive programme creates a fast learning curve with an intuitive navigation, and follows the educational principle that visual design and level of engagement are important ingredients for effective learning.

Evaluation

As eDrive is delivered via internet, we can gather performance data from the learners and store them into a database for evaluation purposes. We are monitoring and recording almost every 'mouse' movement of the users, but in particular, how long it takes them a) to answer a multi-choice question, b) to click on the hazards and c) to decide if they need to respond to a risky situation. There are four pre- and four post- training hazard anticipation trials in order to evaluate any improvements in hazard anticipation times of the learners after they have completed the eDrive programme. These trials are swapped after each user in order to balance out the

different levels of difficulty. We are currently accumulating the user data and will report on them as soon as we reach a sample size with appropriate statistical power.



Figure 2. The user-friendly 'look and feel' design, including one of the five navigational maps, 'The Northern Gateway' and the road trip map.

Distribution

In New Zealand, there are about 60,000 new drivers each year on a learner license, who are our first target audience. However, the programme is also relevant to many other drivers who wish to improve the higher-order driving skills, such as fleet drivers, older drivers, tourists, and drivers who experienced near-misses or are unsure about their level of hazard perception and risk management skills. They only need a reasonably fast computer and a broadband internet connection in order to engage in the comprehensive eDrive training system. Young learner drivers aged 16-19 years who are registered on the Practice programme are invited to join eDrive from practice.co.nz (it is free to them).

Discussion

The eDrive programme has been developed in response to a call for a more holistic approach to driver training and education (HERMES, 2008), which needs to follow rigorous psychological learning principles (McKenna, 2010) and should include computer-based instructions (Lonero, 2008) and simulations. There is

much potential to further extend the eDrive curriculum to include exercises relating to higher-order life-skills as outlined in the GDE matrix, using the Cognitive Behavioural Therapy approach (CBT) to teach a variety of techniques to enhance life-skills, which in turn leads to changes in thinking and behaviour. It is currently the preferred and scientifically most endorsed intervention for emotional and psychological issues. In future versions of the eDrive programme, underlying lack of self-control, lack of emotion regulation, low frustration tolerance, low mood, distractibility and impaired cognitive processing will be addressed at the same time that specific skills like visual search, hazard anticipation and risk management are taught.

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