LC EIC Inquiry into the Increase
in Victoria's Road Toll
Submission 149

Solomon Birch

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Road Toll Inquiry special submission:

This submission will look only at issues relating to point 7 of the terms of reference in specific relation to the use of simulation technologies in driver training:

(7) adequacy of driver training programs and related funding structures such as the L2P program;

The utility of simulation systems for driver training is dependent on the target skills and the characteristics of the specific simulator. If the characteristics of a simulation system are unsuitable for the target skills then negative training value is incurred – learners acquire behaviours which must be unlearned prior to development of the target skills. The threshold for negative utility is not broadly generalisable but involvement in a number of trials has left me with a number of heuristics:

1. VR (not AR) simulators nearly always incur negative training value. (I think this is because users cannot see their hands or the controls and the range of their peripheral vision is substantially altered, which all seem to be important for situational awareness in driving in ways that aren't immediately obvious.)
2. Desktop simulators often negative training value. In instances where they do not incur negative training value it is because they have very strictly constrained scope in terms of validity and training goals such that they are procedural trainers with no further aspirations.
3. The negative effect of bad simulators is more pronounced for less experienced learners but it seems to be non-zero for more experienced learners. (I think this is because as they have more plasticity in the target skills and so their rate of learning on the undesired behaviours is higher.)
4. More experienced learners can be a valid user group for bad simulators if and only if the rate of learning for the target skills is higher than the rate of skill loss for other skills and additional training is scheduled to offset the loss.
5. Vendors for simulators *always* overpromise and *all too often* do not have a product that is fit for the uses they describe.

These heuristics make me sound like I'm not a fan of simulation and gamification for training. This could not be further from the truth. Simulation is an exciting area of development that will necessarily be an important part of the future of training generally, and specifically relating to driver training. Widespread adoption of technology will fundamentally change how we train drivers for the better. But. This does not mean that it is the panacea that people often want it to be – caution must be applied in its implementation.

Driver training is an attractive candidate for simulated training because there is an enormous training burden of new drivers, the capital costs of cars are not trivial and the labour, fuel and maintenance costs to supervise learner drivers are high. Conversely, driver training is an extremely challenging field for simulation because regular driving conditions are relatively hard to simulate; even great AI doesn't behave like real traffic, trying to emulate human fields of view and depth perception is difficult and feedback from the vehicle and its controls is difficult to simulate cheaply.

The use of simulation for basic driver training is also not very well understood – there have been no long term and well powered studies of the effect of incorporating simulation in driver training outcomes in specific or general populations. There have been smaller studies and trials – I have been

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involved in some and aware of others – they paint a complex picture about where and how low validity or low fidelity simulators can be integrated in training.

A simple example of this is in head and mirror checking. Learner drivers must develop the habits necessary to maintain situational awareness while driving. This has been looked at. What was found was that learners who received prior training on non-immersive simulators (desktop or VR enabled) were subsequently more confident but much worse driving real vehicles than those who received no training at all. Those who had used desktop trainers had severe problems moving their head to gain better view while maintaining course (they swerved more often and more severely) and were less able to use their peripheral vision to detect hazards. Those who trained using VR enhanced desktop trainers had poorer peripheral vision hazard detection and significantly worse ability to hold lane position even while not moving their head. These sorts of findings replicated well across multiple systems and iterations, with similar results in other skill domains. Perversely, correcting these faults required the part of training that is labour and capital intensive – driving with real trainers and vehicles – to be longer due to the addition of simulation. (I would also note that we conducted some of these trials with a view to investigating the feasibility of reducing the training duration prior to license acquisition (ie the equivalent of reducing the L plate period), but L plate driving is the safest period for a driver in their first 10 years – if there are any safety gains at all in pre-L plate driver training then they are miniscule because the absolute risk at that period of driving is also miniscule and the whole period is so long, but I digress).

The point here is that we don't have a very clear idea what the technical specifications of a simulator need to be for a variety of driver training target skills, or what the effect of deficiencies might be on other skills. We don't know what the effect of simulation on a cohort of drivers would be over their driving years. We don't know at what point in training a driver simulation what type of simulation is appropriate; we know a little, for example that professional racing drivers can do track familiarisation on certain types of simulators but that's just not very helpful for our problem. What study there has been in this field has either been very specific and fundamental or proprietary and unavailable.

If not for general driver training, then for what? Simulation vendors often claim that simulation is good because it lets you replicate situations that are too dangerous or expensive to replicate in the course of real training. This is true, but it is also almost never relevant to the training of basic driving skills or applicable to anything other than very expensive and high-end full immersion simulators. This is because the queues for extreme situations almost always fall outside the margins of inexpensively designed simulators. An excellent example of this is in the area of vehicle rollovers which have been an area of concern for the Army for a number of years, including unwanted COMCARE scrutiny. Vehicle rollover avoidance is, superficially, an excellent candidate for rectification with simulator training – it is prohibitively dangerous – the problem is that after looking at the problem it became clear that the feedback an operator requires to determine that they're at risk of rollover when driving a vehicle require you to have a six axis simulator with extraordinary freedom of movement and associated extraordinary expense. The extraordinary risks associated with driving just don't translate well to simulation.

My key takeaway is simple and it's this: Do not include simulation in driver training until you are very confident that the department comprehensively understands it. If you are considering implementing driver training in part of your driver training continuum then instead implement the actions required for the regulator to gain an understanding of it. If there is a specific solution you have in mind, then very comprehensively and rigorously trial it first. More generally however, until Vicroads is in a position to produce an equivalent of CASA's Manual of Standards – Part 60 Synthetic Training

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Devices (whether they choose to publish an equivalent or not, there are arguments both ways) they are not in a position to administer a training system that includes simulation. It is probable that they require a few years of capacity building before they could be at that point and when they are they can advise you on best ways forwards. The good news is that simulation technology isn't getting worse or more expensive in the mean time.