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The role of experience and advanced training on performance in a motorcycle simulator

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ABSTRACT

Motorcyclists are over-represented in collision statistics. While many collisions may be the direct fault of another road user, a considerable number of fatalities and injuries are due to the actions of the rider. While increased riding experience may improve skills, advanced training courses may be required to evoke the safest riding behaviours. The current research assessed the impact of experience and advanced training on rider behaviour using a motorcycle simulator. *Novice* riders, *experienced* riders and riders with *advanced* training traversed a virtual world through varying speed limits and roadways of different curvature. Speed and lane position were monitored. In a comparison of 60 mph and 40 mph zones, advanced riders rode more slowly in the 40 mph zones, and had greater variation in lane position than the other two groups. In the 60 mph zones, both advanced and experienced riders had greater lane variation than novices. Across the whole ride, novices tended to position themselves closer to the kerb. In a second analysis across four classifications of curvature (straight, slight, medium, tight) advanced and experienced riders varied their lateral position more so than novices, though advanced riders had greater variation in lane position than even experienced riders in some conditions. The results suggest that experience and advanced training lead to changes in behaviour compared to novice riders which can be interpreted as having a potentially positive impact on road safety.

1. Introduction

For the last decade, motorcycles on UK roads have accounted for only 1% of the 300 billion vehicle miles travelled in any single year (Department for Transport (DfT), 2012a), yet in 2011 they accounted for 18.5% of the 1901 fatalities that occurred, and 21.5% of collisions that resulted in a Killed or Seriously Injured (KSI) outcome (Department for Transport (DfT), 2012b). Many such fatalities and serious injuries are likely to arise from the vulnerable nature of the motorcyclist: without the relative protection afforded to car drivers by the vehicle shell, ostensibly innocuous collisions at relatively slow speeds can still result in injury or death. However, motorcycles are also involved in 9.5% of all recorded collisions regardless of severity (Department for Transport (DfT), 2012b) suggesting that, not only are riders more likely to be severely injured compared to other road users following a collision, but they are also more likely to be involved in a road collision. While many of these crashes may actually be due to the behaviour of other road users (Clarke et al., 2007; Crundall et al., 2012a), a sizeable number of motorcycle crashes are due to rider error. These may be due to losing control of the motorcycle on a bend (Clarke et al., 2007), or an inappropriate choice of speed or manoeuvre (Carroll and Waller, 1980; Lynham et al., 2001; Mannering and Grodsky, 1995).

A number of recent studies have attempted to understand and ameliorate the heightened crash risk of motorcyclists (Hosking et al., 2010; Liu et al., 2009; Shahar et al., 2010; Vidotto et al., 2011), often focusing on trying to identify what advantages motorcycling experience or specific training might convey. It is generally hoped that studies of this sort might lead to successful interventions, by either distilling the most pertinent benefits of experience or by identifying the most successful elements of advanced training. It is the aim of the current paper to contribute to this literature by identifying measures of motorcycling behaviour that improve with increased experience and/or advanced training.

1.1. The role of experience and training on crash risk

It is reasonable to expect that both experience with a particular vehicle and advanced training in use of that vehicle should reduce

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the crash liability of individuals. For instance, in regard to car driving many researchers point to the fact that newly-qualified drivers (usually classified as being within 12 months of passing their driving test) tend to be over-represented in traffic collision statistics (e.g. Braitman et al., 2008; Maycock et al., 1991; Underwood, 2007). During this first year of driving, novices consolidate and build upon the driving skills and strategies they have been taught, tuning them to a range of situations that are likely to extend beyond the rarefied events that one might encounter during formal tuition (Groeger and Banks, 2007). Increases in driving experience have been linked with improved situation awareness (e.g. Jackson et al., 2009); better vehicle handling skills (e.g. Quenault and Parker, 1973), more appropriate visual search strategies (e.g. Crundall and Underwood, 1998; Underwood et al., 2003), attention switching (e.g. Arthur et al., 1994; Crundall, 2009), hazard perception skill (e.g. Horswill and McKenna, 2004), and greater peripheral vision (e.g. Crundall et al., 1999, 2002).

Similarly, studies of advanced training techniques have noted improvements in car driver behaviour. For instance Crundall et al. (2010) found that drivers who had been given a course in commentary driving devised by the police, responded more appropriately to hazards in a driving simulator. Certain advanced training courses have also been related to reductions in crashes (Divey, 1991; Hoinville et al., 1972), while other courses or interventions have demonstrated improvements in eye movements to hazardous areas of the scene and an increase of anticipatory scanning (Chapman et al., 2002; Pollatsek et al., 2006); more sensitive risk perception (Rosenbloom et al., 2008), and decreased latencies on hazard perception tests (e.g. Horswill et al., 2010).

On the basis of these studies one might be forgiven for expecting something akin to a linear improvement with increased experience, with an additive benefit for advanced training. However, the literature does not universally endorse experience and advanced training as beneficial. For instance, there is evidence that enduring expectations may be built up with years of driving experience that may have a negative impact on one's ability to respond to highly infrequent hazards. This has been noted in drivers' tendencies to pull out from side roads into the path of oncoming motorcycles, where the driver often reports having looked but failed to see the motorcycle. Crundall et al. (2012a) have found oculomotor evidence that suggests experienced car drivers may be more prone to look-but-fail-to-see errors with motorcycles at T-junctions (compared to novice drivers and experienced drivers who also ride motorcycles). We argue that this is due to reduced expectancies for motorcycles that are built up over years on the basis of limited exposure. Simply put, the more often that one pulls out of a junction without there being an approaching motorcycle, the less likely one is to expect an approaching motorcycle in similar future situations. This effectively reduces the cognitive conspicuity of approaching riders. Similar negative expectancy effects have been reported in relation to bicycles (Summala et al., 1996) and in one documented case of a UK driver using visual strategies based on left-hand driving, on arrival in France (where cars drive on the right; van Elsland and Faucher-Alberton, 1996), though both of these examples are failures to look, rather than true look-but-fail-to-see errors. All of these studies demonstrate how enduring expectations built up over time can lead to highly experienced drivers being susceptible to extremely infrequent but dangerous events.

Other studies have suggested that advanced training might also increase specific crash risk. Gregersen (1996) found that training in vehicle handling during a skid increased confidence more than it increased skill, and a number of other Norwegian studies have related such increased confidence to a rise in collisions (cf. Katila et al., 2004). These results have been linked to theories that suggest drivers adapt behaviour towards an optimal level of risk, potentially increasing risky behaviour as their confidence rises (e.g. Risk Homeostasis: Wilde, 1982, 1988; and Risk Allostasis, Fuller et al., 2008).

In perhaps the most pertinent study, Duncan et al. (1991) compared novice drivers' on-road performance with that of a group of experienced drivers and a group of advanced drivers who had undertaken an advanced driver training course with the Institute of Advanced Motorists (IAM): a UK charity focussed on improving road safety. They identified a number of tasks where novices appeared to perform better than the experienced drivers, including mirror checks, appropriate visual checks at roundabouts, and appropriate braking on approach to a junction. In some cases the novice and advanced drivers performed similarly, while the experienced drivers did not perform so well. They argued that the experienced drivers tended to perform poorly on those tasks where negative feedback was rare: while a poor gear change may give immediate feedback in terms of noise and judder, a failure to check a mirror will only give negative feedback if a hazard arises (causing a collision, near collision, or at least the audible response of another irate road user). As hazards are less common than the immediate feedback of poor vehicle control, and the mapping is less consistent between action and outcome, Duncan et al., argued that certain skills may not improve or may even decline for experienced drivers. Novice and advanced drivers however benefit from recent explicit feedback given by instructors that maintains certain behaviours (e.g. blind spot checks) and allows improvement in skills that might otherwise languish.

In the Duncan et al. (1991) study, the car drivers with advanced training did not seem negatively affected by an increase in confidence, perhaps because the training contained a significant focus on awareness of hazards and management of risk (cf. Katila et al., 2004). Indeed the advanced training ostensibly allowed these drivers to overcome any negative problems of accrued experienced, suggesting that this type of continuous training might not only impart new skills, but might also remediate some bad habits that have developed over the years. Does this translate to motorcyclists? Certainly the current advanced motorcycle training offered by IAM claims to focus on both progression and safety, trying to balance improvements in skill with improvements in risk management. In recently published data we have noted advanced trained riders to have faster response times to hazards in a motorcycle-specific hazard perception test than merely-experienced riders, with novice riders falling non-significantly in-between (Crundall et al., 2013b). The same group of experienced riders were also found to take a more pronounced racing line on a particular S-bend than advanced and novice riders while on a motorcycle simulator (Crundall et al., 2012b). The advanced riders took a line that favoured visibility through the curve rather than the 'racing line' which would have taken them closer to the apex of the curve, suggesting that their training had not evoked the sort of risky behaviour that might be expected from an unwarranted increase in confidence. This however was a very specific situation (an S-bend with poor visibility) and it remains to be seen whether these effects of experience and advanced training generalise to more generic situations.

The current study aimed to address the question of whether experience and training are beneficial in regard to two safety-relevant measures: speed maintenance across a varied range of road types (within 40 and 60 mph zones), and bend navigation across a range of bends of varying curvature. Following from Duncan et al's (1991) study of car drivers, we anticipated that mere motorcycling experience in itself might not be beneficial on all measures, though advanced training should show a more consistent advantage. Specifically we predict that safety-related measures of speed, braking and lane position may actually be more prevalent in novice and advanced riders, than in riders who merely have experience to support the development and maintenance of skills.