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Motorcycling experience and hazard perception

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ABSTRACT

Studies of hazard perception skills in car drivers suggest that the ability to spot hazards improves with driving experience. Is this the case with motorcyclists? Sixty-one motorcyclists, split across three groups (novice, experienced and advanced riders) were tested on a hazard perception test containing video clips filmed from the perspective of a motorcyclist. Response times to hazards revealed that the advanced riders (who had completed an advanced riding course) were the fastest, and the experienced riders were the slowest to respond to hazards, with novice riders falling in-between. Advanced riders were also found to make more internal attributions regarding the causes of the hazards than novice riders (though on a general measure of Locus of Control there was no difference between groups). The results demonstrate a link between advanced training and motorcycling hazard perception skill, but raise important concerns about the effects of mere experience on rider safety. This challenges previous conceptions that simply extrapolated from our understanding of the hazard perception skills of car drivers to this particularly vulnerable group of road users.

1. Introduction

Hazard perception (HP) has been described as the only higher-order skill that can predict crash liability (Horswill and McKenna, 2004). It is typically described as the "ability to read the road and anticipate forthcoming events" (McKenna et al., 2006, p. 2). There are a number of components to good hazard perception skills including the detection of the hazard, appraisal of the threat posed, selection of an appropriate response, and the implementation of that response (Grayson et al., 2003). The majority of the research conducted on hazard perception skills focuses primarily on the first and second of these actions, using video clips of car driving containing various hazardous events to which participants must press a button when they perceive a hazard (Quimby and Watts, 1981; Olson and Sivak, 1986; McKenna and Crick, 1991, 1994, 1997; Chapman and Underwood, 1998; Crundall et al., 2002; McKenna and Horswill, 1999; Horswill and McKenna, 2004; Sagberg and Bjørnskau, 2006).

There have been a limited number of studies measuring hazard perception skills in motorcyclists. Three studies have however reported that motorcyclists respond faster to hazards than car drivers (Horswill and Helman, 2003; Rosenbloom et al., 2011; Underwood and Chapman, 1998) using simple push button responses to filmed clips. In all three cases however the clips were filmed from a moving car and were primarily intended for a car-driving audience. The problem with this approach is apparent in the Horswill and Helman study, as they found that motorcyclists were only faster to respond than car drivers if they were told to imagine they were driving a car. If the motorcyclists were asked to view the video clips as if they were riding a motorcycle, they were no quicker to respond to hazards than the car drivers. Horswill and Helman suggested that this was because the video clips did not represent the type of hazards that motorcyclists would typically be looking for when out riding. For instance, motorcyclists engage in different manoeuvres to car drivers (e.g. filtering between lines of slow moving traffic) leading to different types of hazards. In addition, motorcyclists must be more aware of potential road-surface hazards (e.g. oil, potholes, over-banding, etc.) which rarely feature in car-perspective HP tests (Liu et al., 2009).

Despite testing motorcyclists on car-perspective hazards, one might be tempted to argue that these studies demonstrate that improvements in motorcycle hazard perception, due to experience of motorcycling, can transfer to car-perspective hazard perception. However, without assessing the impact of rider experience on motorcycle-perspective hazard perception directly, it is not possible to identify this causal route. One could equally argue that it is those car drivers with good hazard perception skills that then choose to ride motorcycles. This possibility is apparent in the results of Rosenbloom et al. (2011) who reported that, whilst motorcyclists responded faster to the car-perspective hazards than car drivers overall, there was no difference between accident-involved and accident-free motorcyclists in their hazard responses. Conversely,

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accident-free car drivers had superior HP responses than accident-involved car drivers. This reinforces the possibility that increased levels of riding safety and experience are not the cause of better car-perspective hazard perception skills in motorcyclists (via transferral from improved motorcycle-perspective HP skills).

In order to demonstrate that some riders are safer due to improved motorcycle-perspective hazard perception, perhaps gained through experience or advanced training, we must use hazard perception stimuli taken from a moving motorcycle. As Horswill and Helman point out however, it is nonsensical to compare the responses of motorcyclists with responses from car drivers (who have never ridden a motorcycle) on a motorcycle-perspective hazard perception test (though see Shahar et al., 2010, below). Instead, in order to assess whether motorcycling experience does improve motorcycle-perspective hazard perception, one option is to mirror the research on car drivers, which uses experience or advanced training as a between- group factor, on the assumption that participants who have been riding motorcycles for a prolonged period of time will have improved their hazard perception skills more than those who are relatively inexperienced riders.

A recent study by Hosking et al. (2010) addressed this, by comparing three groups of participants: inexperienced motorcyclists who also had little experience of car driving, inexperienced motorcyclists who had a considerable amount of car driving experience, and experienced motorcyclists who also had considerable car driving experience. The riders watched computer-generated hazards whilst sat on a motorcycle simulator, though there was no interactivity; they merely pressed a button to identify hazards in the same way that one might with a video-based hazard perception test. Hazards were generated on the basis of a focus group with experienced riders, and included road-surface hazards and events that are specific to riders (e.g. cars turning off the main carriageway across the path of a filtering rider). Their results demonstrated that car driving experience did improve response times to hazards, but the addition of motorcycling experience further increased the speed of responses to the hazards.

While response times benefited in the Hosking et al. (2010) study, they did not find a difference in the time taken to first spot the hazard (as indicated by eye movement data). Following the suggestion of Wallis and Horswill (2007) for two hazard processes (detection/discrimination, and a criterion judgment regarding whether something is actually hazardous), Hosking et al., argued that the failure to find differences in the time taken to fixate the hazards suggests that the response time (RT) differences must be due to criterion differences across groups. It remains possible however that novice riders might have had longer RTs due to the discriminative processing of the hazard, rather than the evaluation of the level of hazard posed.

Cheng et al. (2011) also assessed the time taken to first fixate a motorcycle-perspective hazard, using an interactive simulator with accident-involved and accident-free motorcyclists. They found that the accident-free riders were faster to fixate the hazard, but this appeared to be predicted by the riders' reduced propensity to engage in traffic violations compared to the accident-involved group. This suggests that the accident-involved riders might have been slower to fixate the hazard because their riskier riding style required attention to be focussed elsewhere when the hazard occurred.

Two other simulator studies have also demonstrated that finding a simple benefit of experience in the detection of motorcycle-perspective hazards is not straight forward. Liu et al. (2009) tested riders of varying motorcycle and car-driving experience on an interactive motorcycle simulator. Their results showed that the group with limited experience of both motorcycling and car driving had the most crashes, while an inexperienced motorcycling group (but with considerable driving experience) had no more crashes than riders with more motorcycling experience. Similarly, Shahar et al. (2010), using the same simulator hardware and software, compared experienced riders with non-riders on their ability to avoid pre-programmed motorcycle-perspective hazards. Even though previous video studies have demonstrated that motorcyclists outperform car drivers on car-perspective hazard tests (Horswill and Helman, 2003; Rosenbloom et al., 2011; Underwood and Chapman, 1998), Shahar et al. could not find an advantage for the motorcyclists in this study. Both of these studies raise the issue once again of whether the benefits of motorcyclists over car drivers in car-perspective hazard perception tests have any basis in improved motorcycle-perspective hazard perception skill with increased experience of riding. It must be noted however that both Liu et al. (2009) and Shahar et al. (2010) reported problems with the particular simulator used in these studies. An inability to change predetermined hazards, many of which appeared intentionally unavoidable, resulted in higher than expected collision rates and frustration amongst experienced riders. While this simulator has been used with some success in other studies as a training aid (Di Stasi et al., 2011; Vidotto et al., 2011), it remains a possibility that the failures of Liu et al., and Shahar et al., to identify differences due to riding experience, have more to do with the limits of the simulator than the underlying reality.

On the basis of the reviewed research, there is very little evidence for a motorcycle-specific form of hazard perception skill that increases with experience of riding. The current study attempted to demonstrate whether such riding experience does indeed lead to improvements in motorcycle-perspective hazard perception skill. Using video-based hazard perception clips, and three groups of riders (novice, experienced and advanced riders), it was possible to directly investigate the hypothesised development of motorcyclists' hazard perception skills through exposure, practice, and further training (in the case of the advanced group). Motorcycle-perspective hazards were filmed from a moving motorcycle and were classified according to three of the top four reasons for motorcycle collisions (cf. Clarke et al., 2004, 2007), with RTs to the hazard onsets as the primary dependent variable. It was predicted that, if experience and advanced training do improve motorcycle-perspective hazard perception skills, then novice riders should perform worst in the task, with the experience and advanced training of the other two groups leading to faster responses.

In addition to RTs, several other measures were taken. First, we also recorded a verbal report of what the rider thought the hazard was. Typical hazard perception tests do not collect accuracy data, therefore some button presses might be made at the correct time (e.g. just when a pedestrian is stepping into the road), even though the rider was pressing to register a completely different hazard (e.g. a parked car further ahead). In order to remove erroneous responses a measure of accuracy was taken: every time the participants pressed the button, the screen went black (the video clip was paused) and the experimenter asked the participant what they thought the hazard was. While this disrupted the natural flow of the video clip, the measure of accuracy was very useful for refining the resultant data set.

Following this question the experimenter also asked why the participant thought the hazard had (or would) occur. Each clip had one or two points attached to it regarding the deep structure of the hazard. For instance, in one clip, a car pulls out in front of the approaching motorcycle from a side road. Immediately prior to this, a car approaching from the opposite direction flashes its headlights to encourage the driver in the side road to pull out. If participants identified this related activity, they received the extra attributed point. It was predicted that the experienced and advanced riders would identify more of these deep-structural elements of the hazardous situations.