



Cross-cultural effects on drivers' hazard perception



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ABSTRACT

Hazard perception tests are used in several developed countries as part of the driver licensing curriculum, however little research has been done in developing countries where road safety is a primary concern. We conducted a cross-cultural hazard perception study to examine the transferability of hazard perception skills between Malaysia and the UK, using hazard clips filmed in both countries. The results showed that familiarity with both the driving environment and type of hazard facilitated drivers' ability to discriminate hazards in a timely manner, although overall drivers viewed and responded to hazards largely similarly regardless of origin. Visual strategies also appeared to be moderated mainly by the immediate driving environment rather than driver origin. Finally, Malaysian drivers required a higher threshold of danger than UK drivers before they would identify a situation as hazardous, possibly reflecting the more hazardous road environment in Malaysia. We suggest that hazard perception testing, particularly in developing countries, would benefit from a paradigm where performance cannot be confounded with differing thresholds for hazardousness.

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1. Introduction

The hazard perception (HP) skill of a driver refers to the ability to identify potentially dangerous situations on the road. It is typically assessed by showing participants video clips of hazards, and asking them to respond as soon as they detect a developing hazard, with shorter response times reflecting greater levels of HP skill (Chapman & Underwood, 1998; Horswill & McKenna, 2004; McKenna, Horswill, & Alexander, 2006; Sagberg & Bjørnskau, 2006; Wetton, Hill, & Horswill, 2011). According to Horswill and McKenna (2004), hazard perception is one of the only components of driving skill that has been consistently linked to accident involvement across multiple studies (Horswill, Anstey, Hatherly, & Wood, 2010; McKenna & Horswill, 1999; Quimby, Maycock, Carter, Dixon, & Wall, 1986). A prospective study by Drummond (2000) also found that newly licensed drivers' hazard perception performance was linked to their likelihood of being involved in a fatal collision in the subsequent 12 months. Additionally, past research has found that experienced drivers outperform novices in hazard perception tests (Horswill et al., 2008; Renge, 1998; Wallis & Horswill, 2007), with driving experience considered as a proxy for driver safety, although other studies have failed to find this experiential difference (Chapman & Underwood, 1998; Crundall, Underwood, & Chapman, 2002; Sagberg & Bjørnskau, 2006). It has recently been suggested that the lack of replication may stem in part from the particular hazards used in these studies, with certain types of hazard differentiating experience more effectively than others (Borowsky, Shinar, & Oron-Gilad, 2007; Crundall et al., 2012). Nevertheless, the reported predictive

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utility of hazard perception testing has led to the inclusion of a hazard perception component in driver licensing in the UK, Australia and the Netherlands, where there has been some evidence to suggest its efficacy in reducing accidents in new drivers (Wells, Tong, Sexton, Grayson, & Jones, 2008).

Notably, the research cited has been conducted in developed countries where road safety is relatively mature, yet the vast majority of road fatalities worldwide occur in developing countries (Nantulya & Reich, 2002; Peden et al., 2004; Toroyan, 2009). While some cross-cultural research on driving has been conducted comparing developed and developing countries (Lund & Rundmo, 2009; Nordfjærn & Rundmo, 2009; Özkan, Lajunen, Chliaoutakis, Parker, & Summala, 2006; Sivak, Soler, Tränkle, & Spagnhol, 1989), this has primarily examined risk-taking behavior and/or self-reported perceptions of driving skill and traffic risk. Hazard perception has yet to be investigated cross-culturally in depth, even within developed countries, and little is known about the transferability of hazard perception skills between noticeably different countries and cultures; are there crucial underlying skills that can successfully transfer between countries, or are strategies and skills culturally distinct?

Exploring hazard perception cross-culturally can also shed light on how location familiarity impacts on hazard perception skill. Wetton et al. (2010) found novice/experienced latency differences in Australian participants when using footage of both Australian and UK roads, suggesting the advantage of experience endures even in unfamiliar environments and hazard perception abilities contain at least some general component. However, several questions remain unanswered. For instance, the UK and Australian settings used by Wetton et al. (2010) are very similar. Cultures, road laws, vehicles, driving styles, and even architecture overlap considerably between the two countries. Would similar transference of skill occur in vastly differently settings? If a locational advantage does exist, is it due to familiarity with the driving environment itself (which we will term *environmental* familiarity), familiarity with hazards typically encountered in that environment (*hazard* familiarity) or, likely, some combination of the two?

The current study aims to investigate the extent to which hazard perception skills transfer cross-culturally, using the typical reaction time paradigm, across two highly different settings: the UK and Malaysia. This will reveal similarities and differences in hazard perception performance between drivers from two very different driving cultures, and will hopefully identify whether these are specific to the context (i.e. can UK drivers perform well on both UK and Malaysian HP clips?).

Hazard perception performance of experienced and novice drivers from both the UK and Malaysia will be compared using the reaction time paradigm described earlier with video footage from both the UK and Malaysia. As a former British colony, Malaysia shares several commonalities with the UK that make it a suitable comparison point; namely, similar road rules and left-hand driving environment. It is also a middle-income country with a high percentage of car ownership. However, Malaysia has drastically higher accident rates; in 2010 its road fatality rate was 24 per 100,000 people (Sarani, Syed Mohamed Rahim, Mohd Marjan, & Wong, 2012), while the UK's was 3 per 100,000 (Kilbey, 2011), suggesting many more dangerous events and a generally more hazardous road environment. While many factors likely contribute to this discrepancy, given an eightfold difference in fatality rates we expect to see at least some difference in hazard perception skills between the populations. By comparing Malaysia and UK drivers' hazard perception abilities in Malaysian and UK road environments, we should obtain further insight into hazard perception transferability across cultures. Wetton et al. (2010)'s findings certainly suggest some amount of transferability, although this was seen in the UK and Australia where accident rates are very similar. In a more hazardous environment, hazard perception skills are arguably even more critical, although it is also possible that in more disparate driving environments, location familiarity may play a bigger role than Wetton et al. (2010) found.

While we expect to see the typical effect of experience in both locations, similar to Wetton et al. (2010), we also expect location familiarity to confer a significant advantage in these two distinct cultures, and we therefore hypothesize superior performance in the form of shorter reaction times and higher response rates when participants view clips from their home country. Furthermore, while Malaysian drivers certainly experience more hazards than UK drivers, this effect could play out in either direction: they may be quicker to detect hazards due to their greater exposure to them, or equally, they may be desensitized to hazards and have a higher criterion for hazard identification compared to UK drivers.

Additionally, we can break down pure location familiarity and infer its subcategories of environmental and hazard familiarity, as mentioned earlier. Half of the clips from both the UK and Malaysia were matched for hazard content. For example, in one matched pair of clips, a car on the highway overtakes the camera car on the inside lane. The other half of the clips consisted of unmatched hazards that are more representative of the different countries. For instance, motorcycle and scooter riders are relatively infrequent hazards in the UK, while in Malaysia powered two-wheelers make up a significantly greater proportion of the traffic. Similarly, zebra crossings are relatively common in the UK, but extremely rare in Malaysia compared to pelican crossings. We expect both environmental and hazard familiarity to confer an advantage, and hypothesize that all drivers will exhibit superior performance when viewing matched hazards in their home country, compared to matched hazards in their non-home country (environmental familiarity), and also when viewing matched non-home country hazards compared to unmatched non-home country hazards (hazard familiarity). Furthermore, we hypothesize the greatest performance difference between Malaysian and UK drivers when viewing unmatched hazards, as these presumably confer both environmental and hazard familiarity.

Finally, the current study also investigates visual strategies by using eye tracking measures for all participants. This provides a greater insight into hazard perception skill than a measure of response time can provide. For instance, we expect participants to have shorter fixation durations in their home environment, indicating greater processing efficiency (Crundall & Underwood, 1998). We also expect to see the typical effects of attentional capture across all clips, i.e. longer fixation durations upon hazard onset, although this should be less pronounced in experienced drivers (Chapman & Underwood, 1998). It

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