Institution: University of Reading

Unit of Assessment: 4 Psychology, Psychiatry & Neuroscience

Title of case study: Improving road safety by developing a hazard perception test for drivers.

1. Summary of the impact

Professor McKenna and his team demonstrated that it was possible to assess the ability to detect potentially hazardous events, by producing and testing a hazard perception test. They showed that new drivers have relatively poor hazard perception skills (are slower to detect hazards) than more experienced drivers, and that hazard perception skills can be improved by training. After discussions with and presentations to key stakeholders, McKenna's hazard perception test was introduced into new driver testing in the U.K., and subsequently the Netherlands and Queensland, Australia. The introduction of this test has improved road safety for drivers and other road users and is associated with a reduction of certain types of road traffic accidents by 11%. The research has also led to increased public awareness of the importance of hazard perception among drivers and the general public.

2. Underpinning research

Road casualties are the leading cause of death for young people in industrial countries (Organisation for Economic Co-operation and Development, 2006). Despite the existence of driver training and testing programmes for many years, the risk of injury has remained high. There is therefore a need to develop methods of assessment and interventions that can improve the driving skills that are most directly relevant to preventing road collisions. Through carefully conducted laboratory research, the team at the University of Reading demonstrated the importance of hazard perception (the anticipation of potentially hazardous situations) in safe driving behaviour and developed a test of hazard perception for drivers. Moreover, they showed that experience and training can improve this skill.

Prior to the REF period of assessment, McKenna and Crick (1991, 1992) developed a test of drivers' hazard perception training that is portable and requires minimal hardware. The test requires subjects to react to the presence of road hazards while viewing driver's-eye video recordings of a representative sample of hazardous traffic scenarios. The test was found to distinguish expert (police) and novice drivers, with experts being faster to react to the presence of hazards (McKenna & Crick, 1991). As the differences in performance could be accounted for by group differences in experience and training, McKenna and Crick (1991) then assessed the relative merits of experience and training by comparing novice, experienced and expert drivers (who had similar levels of experience but had received more training than the 'experienced' group). Expert drivers were faster to respond than experienced drivers, who were in turn faster to respond than new drivers.

These findings suggest that training can influence hazard perception. This was tested directly in 1994 by comparing hazard perception ability before and after advanced driving training. As expected, drivers showed significant improvements on hazard perception after advanced driving training [1]. These findings indicated that this hazard perception test is an appropriate and sensitive instrument for the measurement of hazard perception, and that there is potential to improve drivers' hazard perception with appropriate training. Indeed, subsequently, McKenna and colleagues developed a hazard perception training programme that successfully reduced (a) the time taken for drivers to detect hazards (with hazard response latencies improving by about 0.5 seconds after hazard perception training) [2] and (b) driver risk taking [3]. The research identified that the key to improving a driver's safety is the ability to predict what will happen next on the road.

Key researchers: Frank McKenna, 1986-2012, Lecturer-Professor; Jeff Crick, 1988-1997, Research Fellow; Mark Horswill, 1991-2002, PhD student then Research Fellow

3. References to the research

1. McKenna, F., & Crick, J. (1994). Hazard perception in drivers: a methodology for testing and training. *Transport Research Laboratory Report, CR313*; Transport Research Laboratory,

Crowthorne. *Contracted research report; can be supplied on request or accessed via* http://www.trl.co.uk/library/reports_publications/

Web of Science citations (November 2013): 104. Research funded by competitive application to Transport Research Laboratory (TRL); 'Hazard Perception' £74,461 (PI: McKenna). Report independently reviewed by TRL and Department for Transport prior to publication.

2. McKenna, F. & Crick, J. (1997). Developments in Hazard Perception. *Transport Research Laboratory, 297;* Transport Research Laboratory, Crowthorne. *Research report prepared for Road Safety Division, Department of the Environment, Transport and the regions; can be supplied on request or accessed via* http://www.trl.co.uk/library/reports_publications/

Web of Science citations (November 2013): 41. Research funded by competitive application to Transport Research Laboratory (TRL); 'Developments in Hazard Perception' £81,071 (PI: Mckenna). Report independently reviewed by TRL and Department for Transport prior to publication.

3. McKenna, F.P., Horswill, M.S., Alexander, J.L. (2006). Does anticipation training affect drivers' risk taking? *Journal of Experimental Psychology, 12* (1), 1-10, DOI: 10.1037/1076-898X.12.1.1
Web of Science citations (November 2013): 45. Research funded by ESRC grant; 'Risk taking: the participant's perspective' £99,208 (PI: McKenna). This article was submitted to RAE 2008 and has been assessed as of at least 2 quality.*

4. Details of the impact

The team's research has had three main impacts:

1. The introduction of the hazard perception test in statutory driver testing.

The identification of key factors related to hazard perception, including effective ways to assess and develop this skill, led the authors to campaign for hazard perception to be used by government agencies to set a minimum standard of hazard perception for safe driving and an agenda for training. For example, prior to 2002, McKenna gave presentations to key stakeholders such as the Department for Transport, the Parliamentary Advisory Committee on Transport Safety, the Transport Select Committee (Westminster and Scotland), Members of Parliament, and parties who would be affected by any implementation, including the Driving Standards Agency, driving instructor associations, and the Automobile Association (AA) [1]. This resulted in the team's hazard perception test being adopted by the Department for Transport as part of all new driver assessments in November 2002 [1, 2]. The test used by the Department for Transport uses the same methods as the one that was originally developed by McKenna and Crick and this remains a core component of the driving test today [1]. Over a million hazard perception tests are taken as part of the statutory driving test in the U.K. every year (e.g. 1.3million hazard perception tests were taken in 2012 [3]). As the test is a requirement for all new drivers, the proportion of drivers on the road who have taken the test will increase year-on-year [4].

The research team has also actively and widely promoted their findings and their implications for road safety to international audiences [5, 6]. When hazard perception was introduced into driver licensing in Queensland, Australia (since 2009 [7]), the procedures based on the team's test were used following lobbying by one of McKenna's PhD students at the University of Reading, Mark Horswill. The team's hazard perception test has also been included in driver licensing in the Netherlands since 2009 following the success of the test's introduction in the U.K. [8, 9]. The international application of the test highlights the widespread impact of the research on policy and road safety beyond the U.K.

The introduction of a statutory hazard perception test has led to changes in driver training in the U.K., with the development of a wide range of hazard perception training packages now available for use on PCs, mobile phones and tablets [10] and hazard perception practice becoming a part of the training delivered by major driving schools (e.g. the British School of Motoring, Automobile Association) [11]. Thus, an indirect effect of McKenna's work, via the introduction of the hazard perception test in U.K. driver licensing, is an increase in the availability of training in hazard perception, particularly for learner drivers.

2. A measurable decrease in road accidents.

As the ability to detect hazards has been identified as one of the most important factors in reducing casualties among young drivers, setting a criterion for passing the hazard perception test would be expected to reduce road accidents and resulting casualties. Indeed, independent reports published by the Department for Transport indicate that the introduction of the hazard perception test has reduced accident liability for certain types of accidents in the first year of driving [12, 13, 14], for example, introduction of the test has been associated with an 11% reduction in all reported non-low-speed public road accidents. Higher hazard perception scores were also found to be associated with lower accident liability, both for non-low-speed public road accidents generally and for those non-low-speed public road accidents in which the driver accepted some blame. That is, drivers with better hazard perception skills were less likely to be responsible for accidents [12, 13, 14]. These independent findings verify the impact of McKenna's work on all road users by increasing road safety.

3. Increased public awareness of road safety.

The research and its application have led to McKenna being recognised as a leading expert in hazard perception, in particular, and road safety in general. McKenna advises leading councils across the U.K. (e.g. the Royal Society for the Prevention of Accidents (RoSPA) [15]) and internationally, about young drivers (including their hazard perception, risk taking behaviour and speed) and promotes evidence-based decision making for road safety. To exemplify the scope of this impact, McKenna has (within the impact period) spoken at a conference on Child Cyclist Safety (2011) [16], co-authored a major report for the Department for Transport on education and training for novice drivers [17], lead a discussion at a major Royal Automobile Club (RAC) Foundation seminar (2010) [18], and was invited to serve as an expert for the Safer Roads Partnership Board to develop speed awareness training courses for drivers who had been penalised for breaking the speed limit across the Thames Valley [up to 2011; 19]. This large scale application of self-funding speed awareness training encouraged 13 other regions to apply speed awareness training across the U.K. [19]. The team's research and their hazard perception test have also been featured in a variety of media outlets including television (e.g. BBC Breakfast (2010), 'How Safe are Britain's Roads' (2012)) and printed press (e.g. New Scientist (2011)) which has increased public awareness of the importance of hazard perception.

In summary, the main beneficiaries of this research are all new drivers in the U.K., and some other parts of the world, who now can access training and are required to pass a statutory assessment on their ability to detect potentially dangerous situations on the road. All other road users (the majority of the population) will also benefit from safer roads. Anyone who wishes to obtain a driving license in the U.K., the Netherlands and Queensland, Australia, has to demonstrate that they have met a minimum standard for detecting potentially hazardous events on the road on the basis of the test developed at the University of Reading. It is likely that the impact of this research will continue to extend globally; a number of European countries, such as Germany and the Czech Republic, are currently considering implementing hazard perception testing within new driver licensing, based on the success of the test in the U.K [20, 21].

5. Sources to corroborate the impact *Contact details provided

1. To confirm that McKenna presented to stakeholders and adoption of McKenna's test by Department of Transport: Head of Social Research and Evaluation, Department for Transport*

2. To confirm adoption of McKenna's test by Department of Transport:

http://tinyurl.com/pv54gjw

3. To confirm number of driving theory tests (which includes Hazard perception Test) taken:

https://www.gov.uk/government/publications/car-driving-theory-test-operational-statistics

4. To confirm ongoing commitment to inclusion of HPT in U.K. driving test: Head of Policy and Research, Driving Standards Agency*

5. To confirm promotion of the team's findings to international audiences: Chair of organising committee, International Conference on Traffic and Transport Psychology*

6. To confirm promotion of the team's findings to international audiences: Workshop on hazard perception run by The International Commission for Driver Testing (CIECA)

http://www.cieca.eu/template_news.asp?nws_id=1198&lng_iso=EN

7. To confirm inclusion of HPT in Queensland driving test: Queensland Department of Transport and Main Roads: http://tinyurl.com/pxfogb9

8. To confirm inclusion of HPT in Netherlands driving test: The Dutch Driver's Licence Authority *(*CBR*),* www.cbr.nl

9. To confirm inclusion of HPT in Netherlands driving test: SWOV Institute for Road Safety Research, The Netherlands- fact sheet:

http://www.swov.nl/rapport/Factsheets/UK/FS_Hazard_perception.pdf

10. Examples of hazard perception practice programmes:

http://tinyurl.com/omrgfcg
http://tinyurl.com/p36g2ks

11. Examples of hazard perception practice offered by major driving schools:
http://tinyurl.com/ovmyvvo

12. To confirm reduction in accidents following introduction of HPT:

Wells, P., Tong, S., and Sexton, B., Grayson, G. & Jones, (2008). Cohort Study II. A study of learner and new drivers Volume 1 – Main Report. Crowthorne, Transport Research Laboratory. Available on request or via http://www.trl.co.uk/library/reports_publications/

13. To confirm reduction in accidents following introduction of HPT: Helman, Grayson & Parkes (2010). How can we produce safer new drivers: A review of the effects of experience, training and limiting experience on the collision risk of new drivers: Crowthorne, Transport Research Laboratory. Available on request or via http://www.trl.co.uk/library/reports_publications/

14: To confirm reduction in accidents following introduction of HPT: Sexton, B (2010). Has the introduction of hazard perception testing produced safer drivers: evidence from the Cohort II study? In *Behavioural Research in Road Safety 18.* Department for Transport.

15: To confirm McKenna's work with RoSPA: http://safetygonesane.wordpress.com/tag/professor-frank-mckenna/

16: To confirm McKenna's seminar on cyclist safety:

http://www.capt.org.uk/who-we-are/news/book-now-child-cyclist-safety-seminar

17: Report on education and training novice drivers: http://tinyurl.com/pjjlyap

18. To confirm McKenna's work with RAC Foundation:

http://www.racfoundation.org/research/safety/education-in-road-safety

19. To confirm McKenna's role in the development of speed awareness training: The Safer Roads Partnership ceased operations in March 2011, but the work has been continued by the Safer Roads Scheme. The claim can be verified by the Marketing and Communications Director, Road Safety Analysis Limited.*

20. To confirm interest in introduction of HPT in Germany: http://tinyurl.com/omjlgr3

21. Email on file to confirm Czech Republic are considering using McKenna's test within driver licensing; available upon request.