

## Impact case study (REF3)

<b>Institution:</b> University of Nottingham		
<b>Unit of Assessment:</b> 4 – Psychology, Psychiatry and Neuroscience		
<b>Title of case study:</b> Making Britain's Roads Safe: Translating Hazard Theory into Road Safety Practice		
<b>Period when the underpinning research was undertaken:</b> 2002 - 2019		
<b>Details of staff conducting the underpinning research from the submitting unit:</b>		
<b>Name(s):</b>	<b>Role(s) (e.g. job title):</b>	<b>Period(s) employed by submitting HEI:</b>
Peter Chapman	Associate Professor	1995 – present
David Clarke	Professor of Psychology	1988 – 2015
Geoffrey Underwood	Professor of Psychology	1988 – 2015
David Crundall	Associate Professor	1995 – 2013
Harriet Allen	Associate Professor	2011 - present
<b>Period when the claimed impact occurred:</b> August 2013 - present		
<b>Is this case study continued from a case study submitted in 2014? N</b>		
<b>1. Summary of the impact</b>		
<p>The Accident Research Unit (ARU) at the University of Nottingham (UoN) has influenced practice change in UK driver testing and training. In partnership with the Driver and Vehicle Standard Agency (DVSA), the ARU has provided the critical evidence base to support the introduction of Computer-Generated Image (CGI) clips within the hazard perception test. Since implementation in January 2015, 10,059,951 theory tests have been completed using the CGI clips, preparing trainee drivers for the realities of modern-day driving. The DVSA estimate a cost saving in excess of GBP250,000 between 2015 and 2020, as the use of CGI clips removes the need to regularly refilm video clips on actual roads.</p> <p>The ARU were also instrumental in the creation of a new campaign – ‘See bike, say bike’ – designed to decrease the number of accidents involving motorcyclists at junctions in the UK. A free, online toolkit was published by the ARU in December 2020 to support local authorities in implementing this campaign within their constituencies. Workshops with the DVSA, media appearances on national television and coverage of the ARU's work on the UK government funded ‘Road Safety Observatory’ website, have increased public awareness and informed government policy on how to make British roads safe.</p>		
<b>2. Underpinning research</b>		
<p>The Accident Research Unit (ARU) at the University of Nottingham (UoN) has a long history of applied research employing both experimental studies of driver behaviour and exploratory analysis of accidents on British roads. To improve the safety of road users, the ARU has worked closely with relevant government bodies to co-develop a unique research programme dedicated to enhancing UK driving policy and practice. Since 2002, this bespoke programme of research has explored the reactions of drivers to everyday and hazardous driving situations [1, 2], with a particular focus on driver training and testing [1, 2, 3].</p> <p>Using an extensive range of scientific methods, the ARU has conducted a comprehensive programme of research drawing on questionnaires [4], experimental studies [2], high-fidelity driving simulations [5, 6], detailed analyses of police collision casefiles [7, 8, 9] and second-by-second performance, aggregated over thousands of candidates in actual driving theory tests [3, 10]. Critical findings from this rigorous research programme are, i) that particular forms of hazard perception training and testing developed and evaluated by the ARU are more effective than traditional methods [1, 2, 3, 11], ii) that motorcyclists are blameless in almost half the crashes in which they are involved [4, 7, 9], and iii) that memory errors may be responsible for a significant number of crashes at road junctions [6, 12, 13].</p> <p>Since 2002 the ARU has been conducting research to improve the development of the driving theory test. A significant advancement occurred in 2011, when the Driver and Vehicle Standard Agency (DVSA) and ESRC commissioned the ARU to evaluate the effectiveness of Computer-Generated Image (CGI) clips compared to the standard video-based clips used in the hazard perception component of the driving theory test [10]. In the largest study of its kind, the ARU analysed data from over 80,000 driving test candidates and concluded that CGI clips could be adapted to be just as good as traditional video-based methods, with the</p>		

added advantage that candidates who watched the CGI clips were particularly astute at spotting developing hazards [3].

A key goal of the ARU's research has been to understand why fatal accidents occur on UK roads. Motorcyclists are a particularly vulnerable group of road users accounting for approximately 20% of the fatalities on UK roads, despite representing less than 1% of all journeys travelled. Research conducted by the ARU identified specific categories for crashes involving motorcyclists. A key finding was that in half of these cases, the motorcyclist was blameless and could not have taken action to prevent the crash [4, 7]. The most common example of this was found to be the 'looked but failed to see' (LBFTS) crash type, in which a car driver pulls out at a junction into the path of a motorcyclist. Research by the ARU has created new understanding of why these crashes occur. In depth analysis of the LBFTS crash using surveys [4], police reports [7, 9], and a series of experimental studies in a high-fidelity driving simulator [5, 6] has resulted in a new theoretical framework [6] stimulating novel countermeasures [12, 13].

ARU research also demonstrated that interference in short-term memory can prevent drivers retaining key visual information during complex manoeuvres, such as entering road junctions [5, 6]. The research indicated that many LBFTS errors could have been misclassified and are instead instances of a novel 'Saw but Forgot' (SBF) error category. This demonstrated the important role short-term memory plays in driver behaviour which is captured in our Perceive Retain Choose (PRC) model [6] and forms the theoretical basis of a new practical road safety intervention – "See bike, say bike" [6,12,13].

### 3. References to the research

1. Crundall D, Chapman P, Trawley S, Collins L, Van Loon E, Andrews B and Underwood, G (2012) Some hazards are more attractive than others: drivers of varying experience respond differently to different types of hazard. *Accident Analysis and Prevention* 45, 600-609. <https://doi.org/10.1016/j.aap.2011.09.049>
2. Young AH, Chapman P & Crundall, D (2014). Producing a Commentary Slows Concurrent Hazard Perception Responses. *Journal of Experimental Psychology: Applied*, 20(3), 285-294. <http://dx.doi.org/10.1037/xap0000016>
3. Chapman P & Crundall DE (2012). A comparison of learner drivers' responses to hazards presented as videos or 3D animations. Report to the Driving Standards Agency.
4. Crundall D, Clarke D & Shahar A (2011) Car Drivers' Attitudes and Visual Skills in Relation to Motorcyclists. Road Safety Research Report No. 121 for Department for Transport. <https://motorcycleminds.org/virtuallibrary/ridersafety/rsrr121mainreport.pdf>
5. Robbins CJ, Allen, HA & Chapman P (2018). Comparing drivers' gap acceptance for cars and motorcycles at junctions using an adaptive staircase methodology. *Transportation Research Part F*, 58, 944-954. <https://doi.org/10.1016/j.trf.2018.07.023>
6. Robbins CJ, Allen HA, Miller KA, Chapman P (2019) The 'Saw but Forgot' error: A role for short-term memory failures in understanding junction crashes? *PLoS One*, 14(9): e0222905. <https://doi.org/10.1371/journal.pone.0222905>
7. Clarke DD, Ward PJ, Bartle C and Truman W (2007) The role of motorcyclist and other driver behaviour in two types of serious accident in the UK. *Accident Analysis and Prevention*, 39, 974- 981. <https://doi.org/10.1016/j.aap.2007.01.002>

#### Underpinning grants:

8. 1998-2001: GBP299,844 from The Transport Research Laboratory (TRL) / The Department of the Environment, Transport and the Regions ('DETR') for 'In Depth Accident Causation Study of Young Drivers'. PI: David Clarke.
9. 2001-2004: GBP665,764 from the Department for Transport Local government and the Regions (DTLR) for 'In-depth study of motorcycle and work-related accidents' (PPAD 9/31/67), PI: David Clarke.
10. 2011-14 GBP66,000 from DSA/ESRC for 'Understanding and developing hazard perception in filmed and simulated environments'. PI: Peter Chapman.
11. 2009-13 GBP457,000 from EPSRC for 'Developing a simulator-based hazard perception training package' (EP/D035740/1), PI David Crundall.

- 12.2018 GBP4,800 from ESRC IAA, 'Preventing the 'saw but forgot' crash' (ES/M500598/1), PI: Peter Chapman.
- 13.2020 GBP100,000 from DfT, "Enhancing child pedestrian safety by improving visual search and memory," PI: Peter Chapman.

#### 4. Details of the impact

Research from the ARU has been instrumental in shaping driver testing and training, and increasing public awareness of road safety issues through:

- Introduction of CGI as part of the Hazard Perception Test.
- A new public safety campaign to prevent 'LBFTS' crashes: 'See Bike, Say Bike'.
- Increased public awareness of road user safety issues and translation of research into policy.

#### The introduction of CGI as part of the Hazard Perception Test

Users of British roads are confronted with a range of hazards. Preparing road users for the range of hazards they may encounter through the introduction of the hazard perception component within the theory test has reduced accidents among newly qualified drivers by 11% ([gov.uk](http://gov.uk)). Hazard perception testing was initially introduced into the UK driving test by the Driver and Vehicle Standard Agency (DVSA) in 2002. All drivers in the UK are required to pass this test prior to examination of their practical driving skills. Research by the ARU provided evidence to update the theory test by introducing CGI clips into the hazard perception component [a]. The [DVSA announced](#) 'a modern makeover' to the theory test in December 2014, acknowledging the contribution from University of Nottingham, with the new CGI clips replacing the traditional 'old filmed clips' [a], as illustrated in Figure 1. This practice change to UK driver testing was implemented on 12<sup>th</sup> January 2015 [a]. By 30<sup>th</sup> June 2020, 10,059,951 theory tests had been completed using the new CGI-based hazard perception test in Great Britain [b].



Figure 1: An old filmed clip (left) and an updated CGI clip (right) [a]

The Head of National Standards and Accreditation (DVSA) commented, "The introduction of the hazard perception test has been effective in reducing the number of crashes involving newly qualified drivers [...] The CGI clips have allowed us to present clearer, more up-to-date situations, ensuring the test fully reflects the realities of modern day driving. A significant benefit of the new CGI clips is that they can be edited solely through a computer. This means that they can be updated and manipulated quickly and with ease. Furthermore preparation of the clips now has no associated danger, as previously we had to commission on-road filming in order to capture evolving hazards in real-time to film the video clips. We

*estimate that between 2015 and 2020 we accrued cost saving in excess of [GBP]250,000 due to the redundant need to refilm the hazard perception video clips on actual roads” [c].*

Dr Chapman also evaluated the precise wording of instructions used in the test for the DVSA [c]. *“Dr Chapman presented these results to the Agency in May 2013 and aspects of the new hazard definition were incorporated into the revised test in January 2015” [c].*

Driving instructors have also acknowledged the benefits on the new CGI images in the hazard perception test. A Nottingham-based driving instructor commented, *“I make sure that my pupils pass their driving tests, but more importantly, I want to make them safer drivers. I have found that having the hazard perception test as part of the theory test helps to focus my learners' minds on the kind of dangerous event that any driver might experience. I'm really pleased that the University of Nottingham has been involved in developing the hazard perception test and the updated CGI version of it. Keeping the test relevant and up to date is critical to keeping Britain's roads safe” [d].*

External providers of theory test training have also adopted the CGI clips into their training materials. Head of Customer Experience for Theory Test Pro stated, *“I do believe the CGI clips help prepare learners on a broader scale for real life driving because they provide the ability to create all types of hazards and situations for practice that may not otherwise be captured in recorded clips” [e].*

#### **‘See Bike, Say Bike’: a new public safety campaign to prevent ‘LBFTS’ crashes**

Between 2012 and 2018, on average 1763 deaths occurred each year on Britain's roads; in 2018 motorcyclists accounted for 20% of these deaths ([Reported road casualties in Great Britain: 2018 annual report](#), Department for Transport, DfT). In 2019 the average value of prevention in fatal accidents was estimated by the DfT at GBP2,029,237 per casualty ([Accident and casualty costs \(RAS60: RAS60001\)](#)). As a result, motorcyclists have been identified as a particularly vulnerable group of road users by the DfT ([Reported road casualties in Great Britain: 2018 annual report](#), DfT).

Over 50% of people killed on British roads are vulnerable road users, including motorcyclists, cyclists and pedestrians. Research by ARU identified that over 25% of fatal motorcycle crashes involved another road user moving into the path of the motorcyclist, typically at a junction [1]. This type of crash is commonly referred to a ‘LBFTS’ error, and accounts for approximately 88 motorcyclist deaths per year with an estimated total value of prevention of GBP178,572,856. Further research by the ARU indicated that ‘LBFTS’ errors arise from car drivers failing to remember that they have seen an oncoming motorcycle [4]. This novel research has been translated into a new public safety campaign: ‘See bike, say bike’.

Building upon the nationwide ‘THINK! Bike’ campaign, and to help prevent ‘LBFTS’ crashes, ‘See bike, say bike’ calls on drivers to say “bike” out loud when they see a motorcyclist at a junction. The ‘See bike, say bike’ campaign and underpinning research was discussed by the Chair of the Transport Select Committee on 5<sup>th</sup> June 2019 at a Parliamentary roundtable on improving road safety. The event was attended by members of the House of Commons, House of Lords, DfT, British Motorcyclists Federation, Driver & Vehicle Licensing Agency, London Borough of Lewisham Council and Road Safety Trust [f]. A Principal Research Officer at the Road User Licensing, Insurance and Safety team at the DfT stated, *“The research described in this meeting gave us new insight into how these crashes occur and highlighted ‘See bike, say bike’ as a simple intervention we could support to help reduce the rate of these types of crashes” [g].*

To further disseminate the ‘See bike, say bike’ campaign and underpinning research Dr Chapman also attended the Sense about Science ‘[Evidence Week](#)’ in Parliament on 26<sup>th</sup> June 2019, which was attended by more than 100 MPs. In September 2019 the ARU also hosted visits to the research facilities at UoN by the Policy advisor for Vulnerable Road

Users, Principal Research Officer for Road User Licensing, Insurance and Safety and a member of the THINK! Bike team from the DfT. This led to a new collaboration between the ARU and the DfT with funding for further research provided by the DfT in 2020 [g, 13].

Public awareness of the 'See bike, say bike' campaign and underpinning research was increased through media articles appearing in, Daily Mail Online, Science Daily and the Telegraph for example [h] and coverage by ITV1 Central East evening news on 29<sup>th</sup> September 2019 [h]. To support local authorities in implementing the 'See bike, say bike' campaign within their constituencies the ARU produced a freely available [online toolkit](#) with video examples and practical tips for reducing 'LBFTS' errors. The launch of the toolkit was delayed through Covid-19 but was published on 18<sup>th</sup> December 2020.

### **Increased public awareness of road user safety issues and translation of research into policy**

To enhance public awareness of road safety issues and improve driver behaviour, Dr Chapman and other members of the ARU have discussed their work nationally on television programmes, such as *Countryfile* (December 2015, [approximately 7,200,000 viewers](#)) and *Crimewatch* (6<sup>th</sup> March 2017, [approximately 3,000,000 viewers](#)).

The ARU's work has also been cited by the UK government-funded '[Road Safety Observatory](#)' website, which provides easy access to independent road safety research and information for anyone working in road safety and members of the public. Between August 2013 and February 2017, the ARU's research [e.g. 4] and reports for the DfT were referenced on the website under the subtopics "Motorcyclists", "Driving for work", "Older drivers" and "Speed" [i].

Research findings and recommendations by the ARU have also been disseminated to the DVSA's Head of Policy through a workshop held at the DVSA in January 2018 facilitated by Dr Chapman [c]. The combination of these activities has translated the ARU's comprehensive research programme into practice and policy change designed to make British roads safe.

### **5. Sources to corroborate the impact**

- a) DVSA press release, '*Hazard Perception gets a modern make over*', 18<sup>th</sup> December 2014 [PDF] accessed 2<sup>nd</sup> May 2020
- b) Number of driving theory tests conducted (car & bike) between February 2015 and June 2020, data compiled from DfT and DVSA [website](#) [PDF]
- c) Letter of support from DVSA's Head of National Standards and Accreditation December 2020 [PDF]
- d) Email from driving instructor, January 2021 [PDF]
- e) Testimonial from Head of Customer Experience for Theory Test Pro, December 2020 [PDF]
- f) Attendees of Parliament roundtable 28<sup>th</sup> January 2020 [PDF]
- g) Letter of Support from a Principal Research Officer at the Road User Licensing, Insurance and Safety team at the DfT, December 2020 [PDF]
- h) News articles on 'See bike, say bike' research and ITV broadcast [PDF]
- i) Summary of relevant references from [www.roadsafetyobservatory.com](http://www.roadsafetyobservatory.com) [PDF]