

Drivers' attitudes and knowledge regarding motorcycle lane filtering practices

Vanessa Beanland^a, Kristen Pammer^a, Monika Śledziowska^a and Alexander Stone^a

^a Research School of Psychology, The Australian National University, Canberra, ACT 2601, Australia

Abstract

Lane filtering occurs when a motorcyclist moves alongside stationary or slow-moving vehicles, with the motorcyclist sharing the lane or travelling between lanes. The practice is illegal in most Australian jurisdictions, but was recently legalised in New South Wales and Queensland. In February 2015, the Australian Capital Territory (ACT) commenced a two-year lane filtering trial. Prior to this, during December 2014 and January 2015, we surveyed 249 drivers (132 male, 117 female) aged 16-82 years ($M = 41.4$, $SD = 14.5$) regarding their attitudes towards and knowledge of lane filtering. Most drivers (61%) reported witnessing lane filtering at least once per week. Many drivers (28%) mistakenly believed lane filtering was already legal in the ACT, but 70% stated it should be illegal. Drivers were significantly more likely to agree lane filtering should be legal if they believed it was already legal (OR 4.67), rode a PTW themselves (OR 4.87), or were older (OR 1.03). Reasons for endorsing lane filtering varied, but included: easing traffic congestion; improving safety; personal freedom; and difficulty enforcing lane filtering prohibitions. Reasons for opposing lane filtering primarily related to safety concerns and drivers' difficulties in perceiving motorcycles (e.g., in blind spots). Our results provide insight into drivers' attitudes towards lane filtering, which can be used to raise public awareness about motorcycle safety and highlight key areas where empirical evidence is needed, since this is a topic that has historically received relatively little focus among researchers.

Introduction

Powered two-wheelers (PTWs) include motorcycles, mopeds and scooters, all of which differ from other motor vehicles in that they have the physical manoeuvrability to travel between circumscribed traffic lanes. Several different terms have been used to describe this behaviour, including lane filtering, lane splitting, and lane sharing (Sperley & Pietz, 2010), with some PTW riders colloquially referring to the practice as "white-lining" or "stripe-riding". Some road safety researchers and practitioners use these terms interchangeably, whereas others use distinct terms to differentiate whether riders are moving between lanes of stationary or moving traffic. Where this distinction is made, *lane filtering* refers to a rider passing between two lanes of traffic that is stopped or moving very slowly (e.g., slower than 30 km/h; ACT Government, 2014), whereas *lane splitting* refers to a rider passing between two lanes of moving traffic, and *lane sharing* is used as an umbrella term encompassing both filtering and splitting (Sperley & Pietz, 2010).

There are currently very few empirical studies regarding lane sharing (Aupetit, Espié, & Bouaziz, 2015; Mulvihill et al., 2013; Sperley & Pietz, 2010). Some research addresses lane sharing in a limited way, as part of broader investigations into motorcycle safety (e.g., Crundall, Bibby, Clarke, Ward, & Bartle, 2008). Existing research can be classified into three broad categories: crash investigations; self-report studies; and on-road studies.

Crash investigations

In-depth crash investigations have indicated that a small proportion of crashes involve a PTW rider who is lane filtering or splitting, with specific estimates ranging from 0.5% in the European Motorcycle Accident In-Depth Study (MAIDS; ACEM, 2009) to 5% in the United Kingdom (UK; Clarke, Ward, Bartle, & Truman, 2004), where the practice is legal.

In their crash analysis, Clarke et al. (2004) suggested that filtering motorcyclists violate drivers'

expectations by appearing between lanes, where four-wheeled vehicles cannot travel, and as a consequence drivers may fail to look for or “look-but-fail-to-see” filtering motorcyclists. Consistent with this, on-road studies have suggested that drivers’ schemata or mental models when exploring the road environment are focused on detecting other cars at the expense of motorcyclists and cyclists (Salmon, Lenné, Walker, Stanton, & Filtness, 2014; Salmon, Young, & Cornelissen, 2013). It is worth noting that “looked-but-failed-to-see” errors have been proposed as underlying a large proportion of *all* car-motorcycle collisions (ACEM, 2009), particularly right-of-way-violation collisions (Clarke, Ward, Bartle, & Truman, 2007; Hancock, Oron-Gilad, & Thom, 2005) and these errors and inadequate expectations are by no means limited to the context of lane filtering.

Self-report studies

Self-report studies include interviews, focus groups and surveys that are designed to elicit individuals’ attitudes and perceptions regarding lane filtering, as well as riders’ engagement in the practice. Most self-report research has focused on PTW riders, revealing that riders commonly undertake lane filtering and believe it is relatively low risk (Blackman & Haworth, 2010), helps maintain traffic flow (Huth, Füssl, & Risser, 2014), increases trip efficiency and has the potential to improve rider safety (Regan, Lintern, Hutchinson, & Turetschek, 2009, 2015). However, respondents also note that car drivers sometimes act inappropriately around PTWs because they do not understand or anticipate the full range of manoeuvres that a PTW may undertake, including lane filtering (Huth et al., 2014).

Although filtering is widespread, riders report adjusting their behaviours based on traffic conditions (Regan et al., 2009) and social influences (Tunncliff, Watson, White, Lewis, & Wishart, 2011). For instance, one participant in a Queensland-based focus group study reported that he would not lane split in front of his son (Tunncliff et al., 2011), suggesting that some riders perceive lane sharing has a negative or dangerous image. In the same study, a rider training instructor noted that lane filtering is safe, but they do not tell new riders that because they are less adept at filtering than more experienced riders (Tunncliff et al., 2011).

There is minimal research examining car drivers’ perceptions of lane filtering. In the UK, where filtering is legal, Crundall et al. (2008) found that most drivers correctly identified that motorcycle riders were permitted to filter through stationary or slow-moving traffic. When asked to rate their agreement with the statement “*When in slow moving traffic I am often surprised by motorcyclists filtering through the traffic*” on a 7-point scale, average ratings for both males and females were close to the midpoint (Crundall et al., 2008). These findings suggests that UK drivers have reasonable awareness of lane filtering; however, different results may be obtained in jurisdictions where filtering remains illegal.

On-road studies

On-road studies using motorcycles are relatively new. These include both instrumented vehicle studies where riders are monitored while completing a prescribed route, and naturalistic studies where participants’ daily travel is recorded via cameras and data loggers. In recent years, two published on-road studies have explicitly focused on lane filtering (Aupetit et al., 2015; Mulvihill et al., 2013).

In an instrumented vehicle study of 25 motorcyclists in Melbourne, Australia, Mulvihill et al. (2013) found that riders engaged in lane filtering on 27% of occasions where it was physically possible. Filtering on approach to intersections was associated with diminished situation awareness, as measured by concurrent verbal protocols provided during the ride. Motorcyclists who filtered through the traffic queue focused more on their own actions and less on perceiving the broader road environment (Mulvihill et al., 2013). A limitation of this study was that participants completed a

single 15 km test route, in which they were exposed to a small number of intersections and therefore had few opportunities to engage in lane filtering.

Aupetit et al. (2015) conducted a longer-term naturalistic study, in which 11 motorcyclists from Paris, France, rode an instrumented motorcycle for a month. Lane sharing is illegal but is tolerated and widely practiced in Paris. During the study participants spent approximately 72% of their time riding between lanes (Aupetit et al., 2015). The authors did not differentiate between filtering and splitting, but their results indicate that participants engaged in both, since they explicitly referred to travelling at speeds in excess of 30 km/h. Follow-up interviews with the riders indicated that lane filtering and splitting are cognitively demanding tasks, requiring riders to accurately perceive and interpret the behaviour of other road users in order to safely negotiate traffic and know when lane sharing would be unsafe or might impair other road users' ability to detect the PTW (Aupetit et al., 2015).

Legality of lane sharing

Whereas lane splitting at high speeds is typically illegal, the legality of lane filtering through stationary or very slow traffic varies between jurisdictions. Filtering is legal in several European countries, but is illegal throughout most of the USA. Even in jurisdictions where it remains illegal lane filtering appears to be relatively common, with riders arguing that it should be legal because it would improve both safety and traffic congestion (e.g., Blackman & Haworth, 2010; Huth et al., 2014; Regan et al., 2009). Some researchers have also recommended that governments consider legalising lane filtering, given that prohibitions are difficult to enforce and legalising filtering has the potential to confer safety benefits. For instance, Aupetit et al. (2015) noted that lane splitting demands skills that motorcyclists do not learn in formal training, and therefore riders must acquire these skills through trial and error during daily riding. If it were legalised, filtering skills could be taught during training, which could potentially improve safety and reduce crash risk (Aupetit et al., 2015). Legalising lane filtering would also mean that driver training could be adapted to include recognition and awareness of filtering PTWs.

The state of New South Wales was the first Australian jurisdiction to legalise lane filtering, in July 2014, followed by Queensland in February 2015. The legalisation of lane filtering in NSW followed a two-month trial of lane filtering within Sydney central business district from 1 March 2013 to 30 April 2013. Trial outcomes were evaluated with respect to safety, traffic congestion, and the behaviour and attitudes of road users (Centre for Road Safety, 2014). Evaluation of the trial found no measurable impact on congestion; this was likely due to the fact that filtering motorcycles comprised only 1% of traffic (motorcycles overall constitute approximately 4% of Sydney traffic, but observational data indicated only 20-30% of motorcycles engaged in filtering during the trial period). There were no motorcycle crashes and only one near-miss recorded during the trial period, which was interpreted as indicating that lane filtering is not associated with safety disbenefits for PTW riders (Centre for Road Safety, 2014); however, this finding should be interpreted with caution given that it was a relatively short trial in part of one city. In summary, it appears that there was no change in either traffic congestion or motorcycle crash rates during the short-term trial of lane filtering in central Sydney. Observational data suggested that filtering has the potential to increase PTW-pedestrian collisions and for this reason the NSW Centre for Road Safety (2014) recommended that 30 km/h was the optimal maximum speed that should be permitted for filtering, in order to minimise the likelihood of a fatal pedestrian/motorcycle collision.

ACT lane filtering trial

In June 2014 the Australian Capital Territory (ACT) Standing Committee on Planning, Environment and Territory and Municipal Services tabled a report on their Inquiry into Vulnerable Road Users (Standing Committee on Planning, Environment and Territory and Municipal Services,

2014). The parameters of this inquiry were to examine best practice approaches to protecting vulnerable road users, including PTW riders, and to make recommendations for improving the safety of vulnerable road users. The report contained 28 recommendations, including a recommendation that the ACT conduct its own trial of lane filtering (Standing Committee on Planning, Environment and Territory and Municipal Services, 2014).

In response to this recommendation, the ACT government initiated a two-year trial of lane filtering, which commenced on 1 February 2015. Legalising lane filtering within the ACT would maintain consistency with NSW, which is valuable since the ACT is completely enclaved within NSW and many ACT residents drive regularly in NSW. Noting that the NSW trial was of relatively short duration, and therefore did not yield conclusive evidence regarding any potential benefits or disbenefits of lane filtering, the ACT government sought to conduct a longer trial in order to undertake more comprehensive evaluation of the safety consequences of lane filtering.

Since traffic densities are considerably lower in the ACT compared to Sydney, the trial is expected to have negligible impact on congestion. Formal evaluation of the trial will therefore focus on safety outcomes, examining changes in the rate of same direction, lane change and side-swipe collisions involving PTWs (which are proposed as proxy measures of filtering crashes, since lane filtering and lane splitting are not coded in crash records; ACT Government, 2014). A major motivation for legalising filtering is the potential to reduce collisions in which other road users rear-end or side-swipe PTW riders, and to increase drivers' awareness of PTWs more generally (Standing Committee on Planning, Environment and Territory and Municipal Services, 2014). However, it is worth noting that these hypothesised benefits are merely conjecture, since no previous research has systematically investigated whether lane filtering impacts motorcyclists' safety.

The aim of the current study was to explore drivers' knowledge of and attitudes towards lane filtering. As noted above, there is limited research investigating drivers' attitudes towards lane filtering, despite the fact that drivers have an integral part to play. If drivers do not endorse lane filtering, then they may behave in a hostile, aggressive, or otherwise unaccommodating manner towards riders who attempt to filter through traffic queues (e.g., positioning their vehicle so that there is insufficient room for motorcyclists to pass between lanes). The current analysis presents data on drivers' general attitudes to lane filtering, particularly focusing on their opinions regarding whether it should be legalised and why. The sample included Canberra region residents and visitors to Canberra. Data was collected before the commencement of widespread media campaigns intended to raise drivers' awareness of lane filtering specifically and motorcycle safety more generally.

Method

Participants

Overall 250 participants completed the survey, but data from one participant was excluded because they did not possess a driver's licence. The remaining 249 drivers (132 male, 117 female) were aged 16-82 years ($M = 41.4$, $SD = 14.9$). All provided informed consent and participated voluntarily. Ethical aspects of the research were approved by the ANU Human Research Ethics Committee.

Most participants (63%) ordinarily resided in ACT or NSW, with the remainder residing in Victoria (12%), Queensland (9%), South Australia (6%), other Australian states/territories (3%), New Zealand (3%), or other overseas countries (4%). Among the 155 participants residing in ACT and NSW, 73 lived in the Canberra region (ACT and nearby NSW including Queanbeyan, Sutton, Jerrabomberra) and 82 lived in Sydney or other regional areas of NSW.

Materials

The survey contained three sections: demographic information; transportation use; and lane filtering. In the *demographic information* section, participants reported their age, sex and location of residence. In the *transportation use* section, participants reported the type of driver's licence held, jurisdiction in which they obtained their licence, their preferred transportation mode, and whether they or anyone close to them rode a PTW.

In the *lane filtering* section, participants were asked whether they had heard of lane filtering (noting that the practice was also referred to as lane splitting, white-lining or stripe-riding). If they had heard any of these terms, they were prompted to provide a definition of what the practice entailed. For participants who had not heard of lane filtering, a researcher provided a verbal definition. Participants were then asked to report how frequently they witness motorcyclists engaging in lane filtering and whether filtering was legal at that time in the ACT. Finally, participants were asked to indicate whether they believed that lane filtering should be legal or illegal, and to explain their position.

Procedure

Participants were recruited to complete a short road safety study conducted on-site at Questacon, the National Science and Technology Centre, which is a public museum located in Canberra, ACT. The study was conducted over a one-month period between 16 December 2014 and 13 January 2015. This time period was chosen because it was shortly before the commencement of the ACT lane filtering trial, which began on 1 February 2015, and preceded television and radio broadcast campaigns publicising the trial, which began on 23 January 2015.

The study comprised two computer-based tasks: an experiment examining attention and hazard perception in road scenes, followed by the survey. The current paper reports only the survey results. The survey was programmed using Qualtrics Online Survey Software. Participants completed the survey on computer with a researcher present to assist and clarify any questions if necessary. On average, the survey took 8-10 minutes to complete.

Results

Transportation use

Nearly all respondents (91%) held a full driver's licence, with relatively few being on a provisional licence (5%) or learner's permit (4%). The average duration of licensure was 26 years ($SD = 14.1$; range 1-65) for fully licensed drivers and 1.9 years ($SD = 1.1$; range 1-4) for provisional drivers.

The majority of participants (86%) reported their preferred transport mode was driving a car. Riding a bicycle and public transport were each nominated by 5% of participants, with 3% nominating riding a motorcycle as their preferred transport mode and only 1% nominating travelling on foot. Nearly four-fifths indicated that they used their preferred transport mode 5-7 times per week (78%), with 14% travelling 2-4 days per week and 6% using their preferred transport mode less than once a week.

Most participants (90%) did not ride any form of PTW. Motorcycles were the most common PTW used, with 9% of respondents reporting that they ride a motorcycle. One participant reporting riding a moped, and none reporting using a motorised scooter. Although very few participants reported riding a PTW themselves, 32% had a first-degree relative, partner or close friend who rides a PTW.

Lane filtering

Approximately two-thirds of the sample reported that they had not previously heard of any of the terms used to describe lane filtering (66%) and were unable to define what it entailed (67%).

Most respondents who provided a definition of lane filtering conveyed an accurate understanding of the practice. The amount of detail provided in their descriptions varied, but responses were coded as correct if they made reference to motorcyclists passing slower-moving cars and/or moving between lanes. A small proportion of respondents (4%) provided an incorrect definition, with most incorrect definitions focusing on situations in which two lanes of traffic merged. Two participants provided responses that indicated they possibly understood the concept of lane filtering, since they indicated that it involved undesirable or potentially dangerous behaviour by motorcyclists (and later affirmed it should be illegal), but did not describe it properly.

Over half the sample reported that they witnessed motorcyclists engaging in lane filtering on average at least once per week. This was fairly evenly divided between participants who reported seeing lane filtering 5-7 days per week (20%), 2-4 days per week (23%) and once per week (17%). A further 12% reported seeing filtering motorcyclists 2-3 times per month, 8% see filtering on average once per month, 9% see it less than once a month, 4% almost never see lane filtering and 5% had never seen it at all. For the purposes of subsequent analyses, frequency of witnessing lane filtering was dichotomised as “at least weekly” (61%) and “less than weekly” (39%).

When asked whether lane filtering was currently legal in the ACT, overall 28% of respondents erroneously indicated that it was legal. Chi-square tests indicated that beliefs about the legality of lane filtering did not differ depending on where the respondent usually lived, $\chi^2(8) = 5.50, p = .726$, Cramer's $V = .15$. Specifically, 26% of ACT residents, 31% of NSW residents and 23% of Queenslanders and Victorians believed lane filtering was already legal in the ACT. This finding suggests that respondents were not biased by the laws in their own state of residence.

Finally, when asked to indicate whether they thought lane filtering should be legal, only 30% agreed. Again, chi-square tests indicated that opinions did not differ depending on where the respondents normally lived, $\chi^2(8) = 3.32, p = .923$, Cramer's $V = .12$. The proportion indicating that lane filtering should be legal ranged from 23% in Victoria to 34% in NSW. (The Northern Territory was an outlier, in that no respondents indicated that lane filtering should be legal, but this sample consisted of only three individuals so no conclusions can be drawn from this data.)

Among respondents who believed that lane filtering should remain illegal, the predominant reason for this opinion was safety. Respondents expressed concern that it would be difficult for drivers to perceive motorcyclists (and cyclists) who engaged in lane filtering, which could lead to drivers hitting riders if they opened their car door or changed lanes suddenly. Several respondents noted that motorcyclists are hard to see, and that filtering motorcyclists would violate drivers' expectations and catch them off guard. A small proportion indicated filtering should be illegal because all motorists should be bound by the same rules.

Some respondents who suggested that filtering should not be legal noted that there may be some circumstances in which it could be permissible, specifically if the cars were completely stationary, traffic lights were red and there was sufficient room between lanes. However, one respondent expressed concern that it would be too complex for the road rules to fully capture the conditions in which it would versus would not be safe to filter and thus concluded that it should be prohibited.

Whereas respondents opposed to lane filtering focused predominantly on safety, those in favour of legalising lane filtering offered up a more diverse set of responses. Respondents suggested that filtering could ease traffic congestion and improve safety, by allowing motorcyclists to effectively separate themselves from other vehicles at intersections (i.e., moving to the front of the queue and then crossing quickly when the lights turn green). Others argued that riders filter regardless of the

laws, so it might as well be legal. Another theme that emerged was personal freedom: that is, even if lane filtering poses a slight risk, individuals should be entitled to take some risks on the road. Finally, some respondents believed that legalising lane filtering would raise drivers' awareness of PTWs on the road, and noted that (to their knowledge) there are no obvious safety concerns in jurisdictions where the practice is legal and/or widespread.

Many respondents in favour of lane filtering qualified this by saying that lane filtering should only be done under specific circumstances, but in general they considered it was a safe practice. One respondent suggested that it should be permitted for experienced riders, but not learners.

Predictors of attitudes towards lane filtering

To explore factors that were associated with attitudes towards lane filtering, we ran a logistic regression. The dependent variable was opinions regarding whether lane filtering should be legal, a binary variable. Six variables were selected as possible predictors: age in years; sex (female vs. male); riding a PTW (no vs. yes); having a close relative or friend who rides a PTW (no vs. yes); frequency of witnessing lane filtering (less than once a week vs. at least weekly); and belief that lane filtering is already legal in the ACT (currently illegal vs. currently legal). Age was entered as a continuous variable; all other variables were entered as categorical with the first listed category used as the reference group. The full model with all predictors was significantly different to the constant-only model, $\chi^2(6, N = 249) = 47.02, p < .0005$, Nagelkerke $R^2 = .26$.

As shown in Table 1, three variables significantly predicted opinions regarding whether lane filtering should be legal, when including the full sample. Specifically, respondents were more likely to agree that lane filtering should be legal if they were older, rode a PTW themselves, and believed that lane filtering was already legal in the ACT. Frequency of exposure to motorcyclists engaging in lane filtering and having a relative or close friend who rides a PTW did not predict opinions regarding whether lane filtering should be legal.

There was a trend where males were more likely to endorse legalising lane filtering than females, but sex was not a significant predictor when PTW-riding status was entered in the model because males were significantly more likely than females to be PTW riders (14% vs. 4%), $\chi^2(1) = 6.49, p = .015$, Cramer's $V = .16$.

Table 1. Results of binary logistic regression predicting opinions regarding whether lane filtering should be legal

Variable	B	SE	Wald χ^2	Odds Ratio	95% CI OR
Age	0.03	0.01	7.82**	1.03	[1.01, 1.05]
Sex	0.51	0.34	2.24	1.66	[0.86, 3.22]
Ride a PTW	1.58	0.55	8.40**	4.87	[1.67, 14.22]
Friend/relative rides a PTW	0.45	0.36	1.58	1.56	[0.78, 3.14]
See lane filtering frequently	-0.14	0.33	0.18	0.87	[0.45, 1.67]
Believe filtering is already legal	1.54	0.34	20.06***	4.67	[2.38, 9.18]

** $p < .01$, *** $p < .001$

A second logistic regression was run including only participants who resided in the Canberra region. Since this sample was smaller ($n = 73$), predictor variables were only included if they showed statistically significant relationships in the original analysis. (Note that all variables demonstrated the same trends in both the Canberra region subsample and the full sample.)

The Canberra-specific model with three predictors (age, ride a PTW, believe filtering is already legal) was significantly different to the constant-only model, $\chi^2(3, N = 73) = 8.90, p = .031$, Nagelkerke $R^2 = .16$. Age remained a significant predictor of attitudes towards lane filtering, OR 1.03, 95% CI OR [1.001, 1.07], as did belief that lane filtering was already legal, OR 3.36, 95% CI OR [1.06, 10.69]. However, riding a PTW was not a significant predictor in the Canberra subsample: OR 2.42, 95% CI OR [0.34, 17.07]. This was due to small sample size, since only five Canberra-based respondents rode PTWs.

Discussion

The current study indicates that over two-thirds of drivers do not support legalising lane filtering. Three factors were significantly associated with opinions of lane filtering: age of the individual surveyed, whether they rode a PTW themselves, and whether they believed lane filtering was already legal in the ACT. The fact that dual driver-riders were more likely to support lane filtering is consistent with previous research, which has reliably found that PTW riders believe that lane filtering is safe and should be legalised (e.g., Blackman & Haworth, 2010; Huth et al., 2014; Regan et al., 2009, 2015). The fact that age predicted attitudes was also consistent with UK research surveying drivers' attitudes towards motorcyclists, which found that more experienced drivers held more positive and sympathetic attitudes towards riders (Crundall et al., 2008).

Overall it appears that attitudes towards lane filtering and especially opinions regarding its safety are divergent between PTW riders and non-riders. Whereas surveys of riders consistently reveal a belief that filtering should be legalised to improve safety, our results indicate that drivers believe that lane filtering is unsafe and should remain illegal. At present, these opposing views cannot be reconciled since there is insufficient evidence regarding the safety of lane filtering. Although there are no demonstrated safety disbenefits of lane filtering, there is also no evidence to conclude that it improves safety (Regan et al., 2015). If lane filtering does indeed impact motorcyclist safety, then crash analyses from the current ACT lane filtering trial may provide useful evidence, but given the relatively small population of the ACT, even two years' worth of data may provide insufficient numbers to demonstrate a meaningful effect.

This highlights a challenge for road safety policy in Australia, especially given that lane filtering has recently been legalised in two jurisdictions. If lane filtering proves to be safe and is therefore legalised in the ACT and other Australian jurisdictions, then conclusive evidence will need to be presented to drivers to persuade them that lane filtering is safe (given that drivers' most common objection *against* lane filtering was that they perceive it to be unsafe) and that they should behave respectfully towards PTW riders who engage in legal filtering.

Alternatively, if the current ACT trial (or other evidence not yet available) demonstrates that lane filtering has safety disbenefits, then the challenge is to communicate this finding to PTW riders in a way that is sufficiently compelling to dissuade them from undertaking filtering. Although there is limited evidence regarding the safety of lane filtering, on-road studies have suggested it has the potential to negatively impact safety since it is cognitively demanding and reduces riders' situation awareness (Aupetit et al., 2015; Mulvihill et al., 2013).

A further potential challenge, if lane filtering remains illegal in some jurisdictions, lies in addressing the inconsistency in road laws. In particular, our results suggest that road users who endorse lane filtering perceive its legality in other jurisdictions as evidence that it is safe, despite the fact that there is no conclusive evidence to support either view. Thus the fact that filtering is already legal in NSW and Queensland may create resistance if, at the conclusion of the current ACT trial, legislators ultimately decide that lane filtering should not be permanently legalised. If this occurs, then compelling evidence would need to be presented to those road users who supported the legalisation of lane filtering, particularly PTW riders.

The common concern expressed by drivers that they may fail to detect motorcyclists is consistent with empirical research indicating that drivers do indeed possess inadequate schemata for detecting motorcyclists (e.g., Clarke et al., 2004; Salmon et al., 2013, 2014). This is challenging to remedy, since schemata are formed and reformed through years of experience. However, it is encouraging that drivers are aware of their perceptual limitations when searching for motorcyclists. This highlights another area where greater education and awareness could be beneficial, by making PTW riders more “cognitively salient” to drivers and ultimately reducing the likelihood that drivers will “look-at-but-fail-to-see” motorcyclists. Road users who support lane filtering have suggested that legalising the practice could be one way to make drivers more aware of motorcyclists. Thus one avenue for future research could include examining whether changes in the legality and/or prevalence of lane filtering have any impact on drivers’ perceptual abilities to detect PTWs on the road.

A minority of drivers appear to oppose lane filtering on ideological grounds. Specifically, a number of drivers believed that laws should be consistent between different classes of road users to maintain consistency and fairness. This includes the idea that PTW riders should just be patient and wait their turn. Although this appears to be a minority opinion, in jurisdictions where lane filtering is (or may become) legal, it would be worthwhile attempting to identify ways in which lane filtering could benefit drivers in order to minimise the potential for aggressive and hostile interactions between road users. Given that the effects of lane filtering on traffic congestion are negligible, more research would be required in order to identify evidence-based benefits.

Whereas safety was a reason for most drivers opposing lane filtering, it was also provided by many as a reason for supporting the legalisation of lane filtering. This paradox is interesting, in that it highlights that drivers may have divergent opinions about the risks and benefits of a given traffic manoeuvre or practice based on their unique accumulated experience. Again, this highlights the need for ongoing communication with the public regarding safe vs. unsafe road use, based on reliable empirical evidence, in order to minimise situations in which road users hold conflicting opinions about the safety consequences of engaging in a particular behaviour.

Overall, the current study adds to the existing motorcycle safety literature by providing insight into how drivers view lane filtering. In a context where lane filtering was illegal at the time, a substantial minority of drivers believed that it was legal, indicating confusion in the community over its status. However, more importantly, most drivers believed it should not be legalised, despite the fact that many of the drivers reside in jurisdictions where filtering is already legal (i.e., NSW, Queensland). This highlights that widespread public opinion does not necessarily support the recent move to legalise lane filtering in several Australian jurisdictions. Given that the predominant reason for opposing lane filtering was rider safety, there is considerable scope for changing drivers’ attitudes through awareness campaigns highlighting that lane filtering is not dangerous, and can potentially improve rider safety in some situations.

Acknowledgements

This research forms part of an Australian Research Council (ARC) Linkage Project (LP130100181). VB is supported by an ARC Discovery Early Career Researcher Award (DE150100083).

References

- ACEM (Association des Constructeurs Européens de Motocycles). (2009). *In-depth investigations of accidents involving powered two-wheelers (MAIDS)*. Retrieved from <http://www.maids-study.eu/pdf/MAIDS2.pdf>
- ACT Government. (2014). *ACT Lane Filtering Trial: Questions and Answers*. Canberra, Australia:

ACT Government Justice and Community Safety. Retrieved from http://cdn.justice.act.gov.au/resources/uploads/JACS/Road_Safety/PDFs/Q_and_A_trial_2014.pdf

- Aupetit, S., Espié, S., & Bouaziz, S. (2015). Naturalistic study of riders' behaviour in lane-splitting situations. *Cognition, Technology & Work*, *17*(2), 301-313. doi: 10.1007/s10111-014-0293-z
- Blackman, R. A., & Haworth, N. L. (2010). A qualitative exploration of the attitudes and experiences of moped and scooter riders. In: *TRB 89th Annual Meeting*, 10-14 January 2010, Washington DC.
- Centre for Road Safety (2014). Motorcycle lane filtering trial: Summary of trial results. Sydney, Australia: Transport for NSW. Retrieved from <http://roadsafety.transport.nsw.gov.au/downloads/motorcyclists/lane-filtering-results.pdf>
- Clarke, D. D., Ward, P., Bartle, C., & Truman, W. (2004). *In-depth Study of Motorcycle Accidents* (Road Safety Research Report No. 54). London, UK: Department for Transport.
- Clarke, D. D., Ward, P., Bartle, C., & 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. doi: 10.1016/j.aap.2007.01.002
- Crundall, D., Bibby, P., Clarke, D., Ward, P., & Bartle, C. (2008). Car drivers' attitudes towards motorcyclists: A survey. *Accident Analysis and Prevention*, *40*, 983-993. doi: 10.1016/j.aap.2007.11.004
- Hancock, P. A., Oron-Gilad, T., & Thom, D. R. (2005). Human factors issues in motorcycle collisions. In I. Noy & W. Karwowski (Eds.), *Handbook of Human Factors in Litigation* (pp. 18:11-20). Boca Raton, FL: CRC Press.
- Huth, V., Füssl, E., & Risser, R. (2014). Motorcycle riders' perceptions, attitudes and strategies: Findings from a focus group study. *Transportation Research Part F: Traffic Psychology and Behaviour*, *25*, 74-85. doi:10.1016/j.trf.2014.05.004
- Mulvihill, C. M., Salmon, P. M., Filtness, A., Lenné, M., Walker, G. H., Cornelissen, M., & Young, K. L. (2013). Lane filtering and situation awareness in motorcyclists: An on-road proof of concept study. In: *Proceedings of the 2013 Australasian Road Safety Research, Policing & Education Conference* (pp. 1-12). Canberra, Australia: Australasian College of Road Safety.
- Regan, M. A., Lintern, G., Hutchinson, R., & Turetschek, C. (2009). *Using Cognitive Work Analysis to Derive Recommendations for Improving Motorcycle and Scooter Rider Safety* (Deliverable 21 of 2-Wheeler Behaviour and Safety Project). Brussels, Belgium: European Commission.
- Regan, M. A., Lintern, G., Hutchinson, R., & Turetschek, C. (2015). Use of Cognitive Work Analysis to for exploration of safety management in the operation of motorcycles and scooters. *Accident Analysis and Prevention*, *74*, 279-289. doi: 10.106/j.aap.2014.07.009
- Salmon, P. M., Lenné, M. G., Walker, G. H., Stanton, N. A., & Filtness, A. (2014). Exploring schema-driven differences in situation awareness between road users: an on-road study of driver, cyclist and motorcyclist situation awareness. *Ergonomics*, *57*(2), 191-209. doi: 10.1080/00140139.2013.867077
- Salmon, P. M., Young, K. L., & Cornelissen, M. (2013). Compatible cognition amongst road users: The compatibility of driver, motorcyclist, and cyclist situation awareness. *Safety Science*, *56*, 6-17. doi: 10.1016/j.ssci.2012.02.008
- Sperley, M., & Pietz, A. J. (2010). *Motorcycle Lane-Sharing: Literature Review* (Report No. OR-RD-10-20). Salem, OR: Oregon Department of Transportation.
- Standing Committee on Planning, Environment and Territory and Municipal Services. (2014).

Inquiry into Vulnerable Road Users (Report Number 5). Canberra, Australia: ACT Government.

Tunnickliff, D., Watson, B., White, K. M., Lewis, I., & Wishart, D. (2011). The social context of motorcycle riding and the key determinants influencing rider behavior: A qualitative investigation. *Traffic Injury Prevention, 12*(4), 363-376. doi: 10.1080/15389588.2011.577653