23 March 2021

Gabby O'Neill
Head of the Office of Road Safety
Office of Road Safety
Via: RoadSafetyStrategy@infrastructure.gov.au

Dear Ms O'Neill

This is a joint submission made on behalf of leading cycling organisations in Australia in response to the draft National Road Safety Strategy 2021-2030. We welcome the opportunity to comment on the draft.

Cycling thrived during 2020 as millions of Australians pumped up their tyres and explored their cities during the COVID-19 lockdowns. People who were too afraid to cycle pre-COVID exercised with their family on the streets that were safe as fewer people drove their cars. The inclusion of Movement and Place in the draft NRSS is an important step towards achieving safe, liveable communities but it must be accompanied by broader actions to keep people safe on all modes including on their bicycles.

Currently, the draft NRSS will not keep us safe when we ride our bicycles.

The strategy takes an old-school, driver-centric approach to road safety. Priority of safety of people inside their car has resulted in little consideration of the harm drivers can cause to vulnerable road users. Further, there is little provision for meaningful action to protect cyclists. **We strongly encourage the Office of Road Safety to reconsider the entire strategy through the lens of vulnerable road users, in particular, cyclists.**

In the following pages we have provided a full review of the draft NRSS and 19 recommendations on how the draft NRSS can be strengthened to provide a strategy that will protect cyclists and provide a way forward over the next decade to keep people riding safely.

We welcome any opportunity to discuss our recommendations and are available to assist the Office of Road Safety to develop a NRSS for the next decade that includes safety for all cyclists.

Joint contributors

Lead author

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This submission incorporates the views and concerns from the following organisations and individuals.

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Recommendations

1. Update the icons to be more inclusive of all modes to show road safety means everyone. Safe roads can be a road without the inclusion of a car. Safe road use can be a person's face without referring a car or a truck or any mode. People across all modes are responsible for their actions, taking the person out of the car would be more inclusive of all road users.
2. Revise the Strategy at a Glance to remove the duplication of the Movement and Place icons and the "Themes."
3. Delete the blue "Themes" box. While it's pretty, it doesn't make sense and suggests that speed management is not important.
4. Replace photographs, see page 7-8 for details
5. Edit the Strong accountability mechanisms principle to establish an external advisory group to monitor progress.
6. The external advisory group must include a representative who provides input on safety from the cycling perspective.
7. The NRSS includes as clear description within Vulnerable road user safety identifying that the safety needs of cyclists, pedestrians and motorbike riders are different and require different and targeted actions.
8. The NRSS makes a clear connection between infrastructure types and road safety outcomes.
9. Include support for pop-up infrastructure in the Priority actions.
10. Include the need for reduced speed limits to 30km/h in areas identified as M1 and M2 in the Movement and Place matrix
11. The NRSS recommends that the Cycle Aware module be included in all state/territory driver licensing processes to ensure novice drivers are trained to share the road with cyclists safely.
12. The NRSS recommends that Sharing Roads Safely is required for all drivers as part of state/territory government contract requirements.
13. The Office of Road Safety works with the CLOCS-A working group to adopt CLOCS-A as a national standard to improve safety for cyclists, pedestrians and motorbike riders.
14. We strongly recommend that "systems assisting drivers to stay in their lane" be removed as an example of safe vehicle technology.
15. The NRSS clearly states the need for concerted action to ban the importation and sale of motor vehicles that fail the ANCAP safety tests for vulnerable road users.
16. The Office of Road Safety takes a leadership role to prevent these motor vehicles from entering the Australian motor vehicle fleet.
17. Include as an action a review of the road rules with the aim of simplifying the rules to improve safety for vulnerable road users.
18. The NRSS include as an action, the establishment and funding of a national Road Trauma Support Services based on the service in Victoria.
19. The Office of Road Safety co-ordinates an annual information sheet similar to the 2015, BITRE *Information Sheet 71, Australian cycling safety: casualties, crash types and participation levels* Produced on regular (at least annual) basis, this type of tracking will help to monitor important safety outcomes for cyclists.

Road safety for everyone = not just when we're inside a car

We strongly encourage the Office of Road Safety to revise and update the visual language of the draft NRSS, specifically the icons that are used throughout (see below).

Road safety equals car occupant safety.
That's the key message from these icons.

While the reinterpretation of the Safe System to incorporate Movement and Place is an important step forward, particularly recognising the role of speed management across the other pillars. The graphic used to represent road safety are **all** cars.
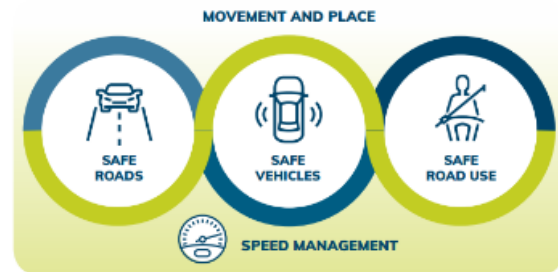
This important document sets the agenda for road safety for a decade.
We hope that this is unintended by the authors or that it is just something that wasn't considered and can be easily rectified as the implications are significant and alarming.

Why does this matter?

What a cyclist is and how cycling is considered in Australian, society does not magically appear from nowhere. In the community, the way we construct our understanding of things is directly contributed to by official documentation including government reports like the NRSS. The words and images convey to the reader what the government thinks is important about the issue by what is and what is not included. The graphic representation is extremely important as a shorthand way to convey a wide range of information including what is prioritised.

The importance of this and the negative impact on cyclists has been reported a recent publication by three of Australia's leading cycling safety and road safety experts, Bonham, Johnson and Haworth (2020). They reported on the way cyclists have been constituted as "hazards" to drivers. This fundamental shift in the middle of the twentieth century that changed drivers from being hazards, to being *perceivers* of hazards has contributed to how vehicle occupant safety is now paramount. Seeing cyclists as hazards to drivers has also further marginalised cyclists as legitimate road users. The full paper is included as Appendix A.

Cyclists need to be portrayed in a positive way in this road safety document. The former President of the Australasian College of Road Safety, Lauchlan McIntosh often referred to the need for a focus on "road safety" not "road **un**safety." We encourage the Office of Road Safety to consider photographs of road safety to complement the text in the NRSS.

Recommendation

1. Update the icons to be more inclusive of all modes to show road safety means everyone. Safe roads can be a road without the inclusion of a car. Safe road use can be a person's face without referring a car or a truck or any mode. People across all modes are responsible for their actions, taking the person out of the car would be more inclusive of all road users.

Graphics

The graphics in the NRSS are confusing. From the Strategy at a Glance, the following points need clarification.

- Why are the three icons in the Movement and Place headline area then repeated as "Themes" but without speed management?
- What is the relationship between the themes and the priorities?
- Is it intended that there will be actions for the priority areas across all three themes? For example, for vulnerable road users, specifically cyclists, will the focus be across all three themes:
  - safe roads means separated, connected bike lanes
  - safe vehicles means supporting and promoting motor vehicle technology that detects and warns drivers of cyclists in their blind spot
  - safe road use means training all novice drivers to share the roads safety with cyclists
- Why are there inconsistencies in the use of the word "safety"? Surely, the word safe or safety could be applied to all these priority areas. It's not clear why there is the inconsistency and whether we should infer that the safety of some of these priorities is important yet for others it's not.
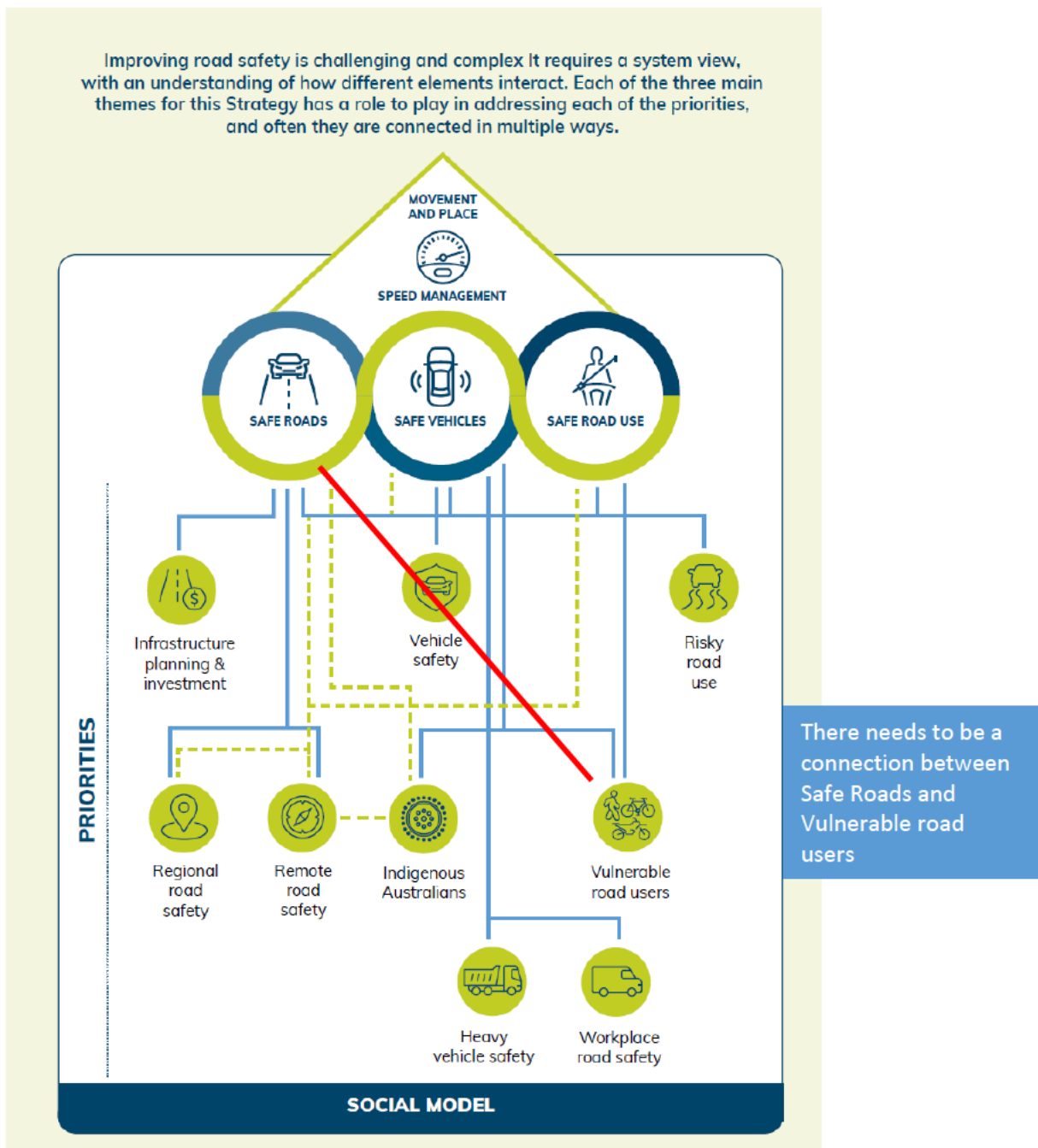

Recommendation

2. Revise the Strategy at a Glance to remove the duplication of the Movement and Place icons and the "Themes."
3. Delete the blue "Themes" box. While it's pretty, it doesn't make sense and suggests that speed management is not important.

Again, the graphics in this document are unclear.

- Aside from the missing full stop in the text (after complex), there is no legend to make sense of the blue or green lines, what is intended by the dashed lines versus the solid.
- Alarmingly, there is no line to connect "Safe Roads" to "Vulnerable Road Users." The continued investment in building safe, separated infrastructure for cyclists is critical for safety.
- The position of Speed Management above the three icons is the reverse of the At a Glance version and needs to be consistent. We suggest that this version is correct and the version on page 2 be updated.

Improving road safety is challenging and complex It requires a system view, with an understanding of how different elements interact. Each of the three main themes for this Strategy has a role to play in addressing each of the priorities, and often they are connected in multiple ways.

MOVEMENT AND PLACE

SPEED MANAGEMENT

SAFE ROADS   SAFE VEHICLES   SAFE ROAD USE

PRIORITIES

Infrastructure planning & investment

Vehicle safety

Risky road use

Regional road safety

Remote road safety

Indigenous Australians

Vulnerable road users

There needs to be a connection between Safe Roads and Vulnerable road users

Heavy vehicle safety

Workplace road safety

SOCIAL MODEL

Photographs

Several photographs need to be replaced. Most importantly, both the cyclists photographs (page 9, page 26). The rationale for the two cyclist images, why this matters and the full review of photographs is below.

Page 9

This photograph looks as if the person is dead.
It reinforces the perception that cycling is a dangerous activity and speaks directly to people's fears about cycling. Particularly as the position of this cyclist is laden with judgement (e.g. torn jeans, cheap bike). Also, the positioning on the road suggests the cyclist was riding across a pedestrian crossing, which is illegal in most states and territories and further reinforces the notion of cyclists as rule breakers.

If a photograph of a crash is required to accompany the text on this page, a photograph of cars after a crash is more appropriate. This is a much more common occurrence than a cyclist fatality and can have the same visual impact without implying that the occupants were killed.

Page 26

This is the only other photograph of a cyclist in the NRSS.
The photograph reinforces the notion that riding bikes is a childhood activity and positions a bicycle to a toy. While of course children do ride bikes, it would be more appropriate to show the boy actually riding.

Further, the absence of any photographs of adults actively cycling marginalises cycling and fails to visually acknowledge that adults ride on the roads for transport or sport.

The full review of the photographs in the draft NRSS, recommended action and the rationale is included on the following page.

Recommendation

Suggested replacements for photographs.

Page	Photo	Recommended action	Rationale
6, 7	Almost empty streets	Replace with images of a busy local street with pedestrians and cyclists Also, a street that shows infrastructure that supports all road users (e.g. separated bike lane, pedestrian refuge etc.)	There is a disconnect between the text and the image. The text says everyone drives, yet the road is almost empty. Rather than reinforce the undesirable status quo, recommend replacing with an image that celebrates the local streets element of Movement and Place.
8	Two women, one in a wheelchair	Replace with pedestrians crossing the road	Footpaths are outside the remit of the NRSS so this location is not relevant to the strategy. It would be much more powerful to show these two women crossing the road, particularly at a signalised intersection where the light phase was long enough for someone with mobility restrictions to cross safely.
9	Cyclist on a pedestrian crossing	Replace with an image of two cars crashing	This image reinforces the perception that cycling is a dangerous activity and reinforce people's fears about cycling. Particularly as the position of this cyclist is laden with judgement (e.g. torn jeans, cheap bike) and the body position means this person could be dead. Cars crashing is a much more common occurrence and can have the same visual impact without the occupants being killed.
10 or 11	Street scape	Replace one or both to show a street with a separated bike lane	Inclusion of streetscapes with separated bike lines in the NRSS shows that this type of infrastructure is an important part of road safety. Current risk: the absence of separated bike lanes says this infrastructure is not important for safety.

Strong accountability mechanisms – represent all road users in external advisory group

The guiding principles for the next decade includes (p11):

> **Strong accountability mechanisms**
> Continuation of the Office of Road Safety, establishment of a National Data Hub and consideration of an external advisory group to monitor progress under the Strategy and Action Plan.

The NRSS needs an external advisory group to monitor progress. This principle needs to be strengthened to not just consider, but to create this advisory group.

Further, this group needs to include representation from all road user groups, including cyclists to ensure that the actions taken to improve safety for one road user group does not result in an unintended decrease in safety for others.

Recommendation

- Edit the Strong accountability mechanisms principle to establish an external advisory group to monitor progress.
- The external advisory group must include a representative who provides input on safety from the cycling perspective.

Vulnerable road user safety

It is important that cyclists, pedestrians and motorbike riders are considered separately within the NRSS. Clustered together as "Vulnerable Roads Users" minimises the widely varied needs of each group. Greater guidance and leadership is needed for the NRSS to make a meaningful difference to actions taken to improve safety for everyone on the road.

Recommendation

- The NRSS includes as clear description within Vulnerable road user safety identifying that the safety needs of cyclists, pedestrians and motorbike riders are different and require different and targeted actions.

On page 15 of the draft NRSS, it states:

"… we must prioritise the changes that will achieve the greatest reductions in trauma."

The four actions lists for vulnerable road users are not the changes required to achieve this aim.

Draft NRSS Actions	Our response
Implement Movement and Place frameworks to support best practice speed management and tailored safe system road treatments	We support this approach and agree that lower speed zones, particularly in local streets, city places and activity street and boulevards are essential for vulnerable road user safety. However, this approach also requires a clear pathway for action so that it can be enacted at the state/territory and local government level. To defer this action to the state/territory and local government without adequate funding will not achieve road safety outcomes of this NRSS. For more detail, please see the Issues Paper that details the need for greater investment in safe road treatments for cyclist.
Strengthen graduated licensing arrangements for motorbike riders.	These three actions seem to be targeted at motorbike riders and are not relevant for cyclists nor pedestrians.
Promote consumer information about protective clothing and helmets.	
Adopt best practice coordinated enforcement of key behavioural issues including speed limits and drug and alcohol laws.	Does this relate to drivers in terms of how their behaviour when speeding or impaired by drugs/alcohol impacts vulnerable roads? If yes, then this is an important change for vulnerable road users. But if not, this is not the major issue for cyclists, motorbike riders nor pedestrians.

If the Movement and Place approach results in a reduction of the default urban speed limit to 30kph then the first action is definitely the change that needs to be prioritised to achieve the greatest reduction in trauma.

However, none of the other actions will achieve the "greatest reductions in trauma" for vulnerable road users. In the following pages, we have detailed the actions that need to be prioritised for vulnerable road user safety.

Separated protected infrastructure for cyclists

Reference to the importance of protected infrastructure for cyclists is lacking. While the Movement and Place alludes to the creation of safe places, the NRSS needs to clearly state the separated, protected infrastructure is needed for people to be able to ride safely.

Recommendation

- The NRSS makes a clear connection between infrastructure types and road safety outcomes.

Pop-up infrastructure

Lockdowns due to COVID has seen quick build, pop-up infrastructure implemented in cities internationally. Light, inexpensive infrastructure has been rolled out to fast-track road safety improvements as a first step before committing the investment required for permanent infrastructure. The NRSS is an opportunity to recognise the validity of these approaches that will help to ratify their use. This will give state/territory and local government employees licence to test and trial new designs.

This tactical urbanism/iterative design approach, while new in Austrlaia, is a well-established approach internationally and often used to test the location before investment. A high-level strategic document like the NRSS can really amplify the need for new, innovative, impactful changes to how we build streets.

Recommendation

- Include support for pop-up infrastructure in the Priority actions.

Source: Transport for New South Wales, Pop-up transport

Speed limits

While the overarching inclusion of Speed Management in the NRSS is encouraging, it is not stated clearly enough. This NRSS is an opportunity to send a direct message to the state and territory governments that speed limit policy plays a huge role in road safety, especially for people who cycle but also when we walk or scoot.

We support the United Nations #Love30 campaign as part of the Decade of Action for Road Safety 2021-2030. #Love30 calls for policymakers internationally to act for low speed streets to save lives and make our local streets healthy, green and liveable.

We recognise that the speed limits of local roads is largely the responsibility of local government, however, there is an important role for the Office of Road Safety to play through the NRSS, to provide national guidance to local governments that safe streets are 30km/h.

Source: United Nations #Love30

Recommendation

- Include the need for reduced speed limits to 30km/h in areas identified as M1 and M2 in the Movement and Place matrix

Driver licensing

Novice drivers

Urgent and immediate action is needed to revise and update the way novice drivers are taught and tested about sharing the road with cyclists.

Cycle Aware, a major research project funded by the Australian Research Council, reviewed all government produced driver licensing documentation and testing and reported that cyclists are often represented as being problematic or hazards to drivers. This needs to be addressed nationwide as it directly contributes to the (negative) attitudes about cyclists in Australia.

We urge the Office of Road Safety to visit the Cycle Aware website at cycleaware.org and review the findings of the study and the new online training module that is ready to be implemented into the driver licensing process nationally.

- New learner driver training module
- Online interactive
- Video based learning situations
- Evidence based
- Tested and evaluated

Recommendation

- The NRSS recommends that the Cycle Aware module be included in all state/territory driver licensing processes to ensure novice drivers are trained to share the road with cyclists safely.

Heavy vehicle drivers

Like novice drivers, drivers of heavy vehicles do not receive training about sharing the roads with vulnerable road users. The Amy Gillett Foundation delivers Sharing Roads Safely, a training program for heavy vehicle driver based on the international best practice.

Sharing Roads Safely was designed for the Australian context in collaboration with the Victorian Government and in consultation with the heavy vehicle sector. The Amy Gillett Foundation regularly deliver the course in Melbourne and recently received support from the Australian Government through the Road Safety Awareness and Enablers Fund to deliver demonstration projects in Brisbane, Sydney and Perth. More details about Sharing Roads Safely.

Safe road use is about the safe behaviour of drivers to minimise the harm that they can cause to vulnerable road users.

Recommendation

- The NRSS recommends that Sharing Roads Safely is required for all drivers as part of state/territory government contract requirements.

CLOCS-A

We trust that the Office of Road Safety are familiar with the world leading approach to heavy vehicle safety developed in the United Kingdom, through the two approaches FORS (Fleet Operator Recognition Scheme) and CLOCS (Construction Logistics and Community Safety). This international best practice approach was co-designed by the UK Government through Transport for London and the heavy vehicle industry and covers regulation and industry including driver training, vehicle standards, site and route planning. There is currently a Memorandum of Understanding between the State Government of Victoria and Transport for London.

Discussions are underway to develop an Australian version of CLOCS, currently being referred to as CLOCS-A. Lead by the National Road Safety Partnership Program (NRSPP), the working group includes the representatives from state government (Major Transport Infrastructure Authority, Department of Transport (Vic), Transport Equip, Transport for New South Wales), the heavy vehicle sector (Australian Trucking Association, Truck Industry Council), research (Monash University) and the cycling sector (Amy Gillett Foundation).

There is an urgent need to improve standards of the heavy vehicle fleet in Australia. An analysis of coroners' recommendations for 140 cyclist fatality crashes that involved heavy vehicles, reported that the main vehicle-related recommendations made by the Coroner related to driver visibility. Specifically the need for cameras but also to the vehicle design and the limitations of the current heavy vehicle fleet.[1]

Recommendation

- The Office of Road Safety works with the CLOCS-A working group to adopt CLOCS-A as a national standard to improve safety for cyclists, pedestrians and motorbike riders.

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[1] Johnson M and Bugeja L. (2018) Review of coroners' recommendations following fatal cyclist crashes involving heavy vehicle. Australasian Road Safety Conference. 3-5 October, Sydney, Australia

Vehicle safety

Actions:

- Prioritise and adopt proven technological improvements for all vehicle types through new Australian Design Rules as quickly as possible (e.g. ~~systems assisting drivers to stay in their lane, and~~ systems that provide warnings when drivers are drowsy or distracted).

Recommendation

14. We strongly recommend that "systems assisting drivers to stay in their lane" be removed as an example of safe vehicle technology.

Lane keep assist technology is not a safety measure for cyclists.

In 2018, the Amy Gillett Foundation, in their submission to the New South Wales Parliamentary Inquiry into heavy vehicle safety and the use of technology to improve road safety detailed why this technology has the potential to reduce safety outcomes for cyclists. We have included an excerpt from that submission below.

Example of unintended consequences

From the perspective of driver and occupant safety, Lane Keep Assist technology provides breakthrough technology to help prevent motor vehicle crashes, in particular, run-off-road crashes. However, Lane Keep Assist technology is one example where the intended outcome of the technology (keep motor vehicles central to the lane) has unintended consequences.

Figure 3 below is an example from Mazda of their Lane Keep Assist System, it clearly shows that the steering assist begins when the driver veers away from the central lane position.
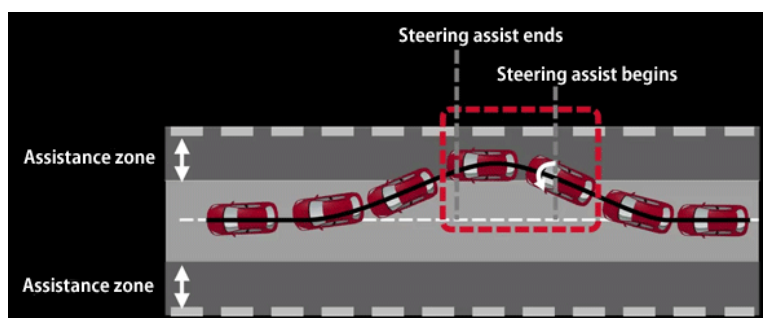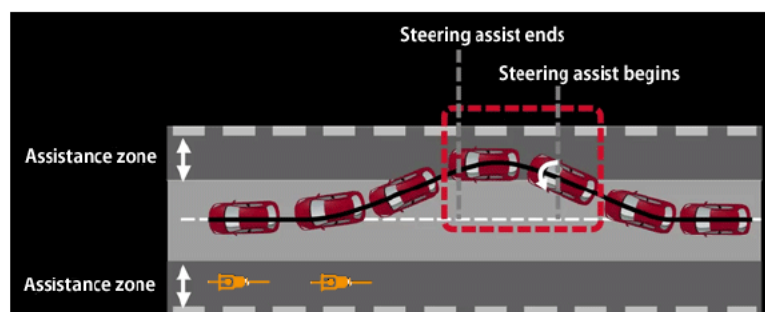

Illustration of Lane Keep Assist technology (Lane Departure Avoidance)

Current technology relies on cameras detecting the lane edge lines and positioning the vehicle central to those two outer lane markings.
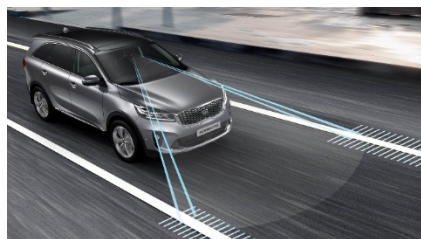
Illustration of camera detection used in Lane Keep Assist technology

However, if we consider this technology from the perspective of a cyclist, this 'safety' technology is less clear. The figure below shows the same image, this time with cyclists. If the driver moves out of their lane to provide a cyclist with more lateral distance when passing (which as of April 2021 will be law nationally in Australia), some versions of Lane Keep Assist technology will activate and 'assist' the driver back into the centre of the lane which may not provide a safe lateral passing distance.

Illustration of Lane Keep Assist technology with other roads users (cyclists)

As mentioned above, an incremental extension to the technology by the manufacturing industry can remove the risk the current Lane Keep Assist technology creates for cyclists. A camera aimed to the left of the vehicle that detected the presence of a cyclist to the left and used in conjunction with the Lane Keep Assist would ensure that the motor vehicle maintains a safe passing distance.

From a driver/occupant perspective, the benefits of this technology are clear. However, the risks are equally clear to vulnerable road user experts. We recommend that as part of this Inquiry, the Committee consider including a recommendation to Government that all new technologies introduced in to the heavy vehicle fleet are reviewed by vulnerable road user experts with the aim to reduce safety risks being introduced to non-occupant road users (e.g. cyclists and pedestrians).

Safeguarding the Australian motor vehicle fleet

The Australian government have a critical role to play in protecting the Australian public from the importation and sale of motor vehicles that do not meet the highest safety standards. Specifically, there is an urgent need for the safety of non-occupant road users or vulnerable road users that is, motorbike riders, cyclists and pedestrians to be a priority.

A safe vehicle is not safe if it protects the occupants but **kills motorbike riders, cyclists and pedestrians.**

Australasian New Car Assessment Program (ANCAP) provides important information for consumers about the safety of a motor vehicle, as referenced on page 26.

In recent years there have been several motor vehicles have failed the vulnerable road user test for cyclists, yet are available for sale, including some that were given an overall score of 5 stars, despite failing the cyclist test including:

Motor Vehicle	ANCAP rating	AEB (Cyclist) result
Mazda BT-50	5 stars	3.87 out of 9
Isuzu D-Max	5 stars	3.87 out of 9
Kia Seltos	5 stars	0.0 out of 9 The system detects pedestrians but not cyclists.

Ban the importation of unsafe motor vehicles

To achieve the stated aim of "uptake of safer vehicles" (draft NRSS, p16), there needs to be a concerted effort across the federal government to stop the importation of unsafe motor vehicles. Recent examples of motor vehicles that failed the ANCAP safety tests are the Mitsubishi Express and the Renault Trafic. Both vehicles rated as "not recommended" by ANCAP tests of commercial vans (Dec 2020).

Recommendation

15. The NRSS clearly states the need for concerted action to ban the importation and sale of motor vehicles that fail the ANCAP safety tests for vulnerable road users.
16. The Office of Road Safety takes a leadership role to prevent these motor vehicles from entering the Australian motor vehicle fleet.

Road rules

There is a disconnect between the road rules and the road design and the public are left to "work it out" there needs to be a stronger investment in road rule review, harmonisation and clarity to make understanding road rules simpler.

Minimum passing distance
At the time of writing, the Victorian Government is planning to amend the road rules to require drivers to provide minimum passing distance in early April 2021. This marks the final jurisdiction for this law change to occur in Australia.

The process to provide this simple change to provide a safe space for cyclists to ride was a major campaign championed by the Amy Gillett Foundation that took over a decade to achieve. This timeline is far too long and required excessive duplication. A more streamlined approach to revising the road rules to protect cyclists is urgently needed.

Turning left
One of the road rules that the community are confused about is who needs to give way when a cyclist is going straight and a driver wants to turn left. After over two years of research by researchers at Monash University (Dr Robbie Napper, Dr Marilyn Johnson) and RMIT University (Dr Vanessa Johnston) there is a clear need for this road rule to be reviewed. Their studies, including observations of ten different signalised intersection designs, identified a high level of variation at many intersections, particularly where the bike lane discontinued on approach to the intersection – which is typical at most intersections.

Recommendation

17. Include as an action a review of the road rules with the aim of simplifying the rules to improve safety for vulnerable road users.

Post-trauma

Crashes on the road are sudden, unexpected and violent.

Beyond the people directly killed or injuries, the wide-reaching ripples impact family, friends, other road users involved, bystanders – often an entire community – is devastated. Yet there are few support services available to help them deal with the aftermath of the sudden and unexpected death or serious injury.

An excellent model operating in Victoria is the Road Trauma Support Services Victoria. Funded by the TAC, their road crash focused counselling and support provides a unique service to people impacted by trauma. This type of support needs to be available nationally.

Recommendation

18. The NRSS include as an action, the establishment and funding of a national Road Trauma Support Services based on the service in Victoria.

Measuring success

Few details are provided on how success will be measured.

National cyclist safety data is essential to monitoring change yet is difficult for any cycling organisation or state/local government to generate. When the federal government has previously generated this type of resource, it provided an important benchmark from which change can be measured.

Recommendation

19. The Office of Road Safety co-ordinates an annual information sheet similar to the 2015, BITRE *Information Sheet 71, Australian cycling safety: casualties, crash types and participation levels* Produced on regular (at least annual) basis, this type of tracking will help to monitor important safety outcomes for cyclists.

Appendix A
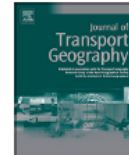
On constituting cyclists as 'hazards'

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ARTICLE INFO

ABSTRACT

'Hazard perception' has become an integral part of novice driver education and training. Cyclists are often identified as one of many 'hazards' to look out for. We speculate that constituting cyclists as 'hazards', something that presents a danger or threat, may foster negative attitudes toward cyclists. Rather than accepting cyclists as 'hazards', our study examined the conditions that have made it possible to identify cyclists as 'hazards' in novice driver preparation. Informed by Michel Foucault's work on discursive practices, the analysis focused on the 'road safety' literature (1900–2017), the changing context in which road safety knowledge has been produced and the implications for the production of road space. This literature is important given the authority of scientific knowledge in western societies and its role in managing and governing populations. We found a shift in the middle of the twentieth century from drivers being identified as 'hazards' to drivers being identified *as perceivers of 'hazards'*. At this time, researchers began studying drivers for their ability to recognise hazards: cyclists were routinely listed among the 'hazards' drivers should perceive. Out of 200 articles published on drivers' 'hazard perception' since the 1960s, one third categorised cyclists as 'hazards'. Such research has informed the development and implementation of 'hazard perception' tests and, following Foucault, it participates in producing road space and shaping how drivers can think about themselves and other road users. While 'scientific' studies constitute cyclists as potential threats or sources of harm they lend authority to negative views of cyclists. We suggest 'traffic participation' as a more inclusive approach to driver education and training.

1. Introduction

Identifying and responding to *hazards* has become an integral part of Graduated Driver Licensing systems and Goals for Driver Education frameworks across the globe. The catalyst for 'hazard perception' training and testing was the observation that experienced drivers were less likely to be involved in crashes than inexperienced drivers (Soliday, 1974). Experienced drivers, it was reasoned, were better able to identify and respond appropriately to potential crash situations so that developing this ability in novice drivers could reduce their crash rates (McKenna and Crick, 1994). And so, around the world, novice drivers are now informed of, trained in and tested on their ability to identify and correctly respond to traffic 'hazard cues' (Genschow et al., 2014: 19). As this practice has been implemented, researchers have not yet paused to reflect on the effects of thinking about traffic interactions in terms of 'hazards',[1] the norms such thinking constitutes and the

mobility culture it might foster.[2]

Our interest in hazards emerged from an analysis of cyclist-related content in Australian graduated driver licensing systems (Bonham and Johnson, 2018). Each jurisdiction has a two stage licensing system comprising a learner and probationary/provisional period. Prospective drivers must pass a knowledge test to obtain a learner permit. South Australia and the Northern Territory have a compulsory cyclist related question in these tests. Once they have a permit, learner drivers must be accompanied by a supervising driver for a specified number of practice hours before they can apply for a provisional/probationary licence. Supervising drivers must hold a valid driver licence and parents usually perform this role. Novice drivers in all jurisdictions, except the Northern Territory, must pass a Hazard Perception Test before advancing from Learner to Probationary/Provisional licence or Provisional 1 to Provisional 2 licence. Education and training materials assist novice drivers in preparing for hazard perception tests and all jurisdictions

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[1] Scare quotes are used to signal the term is under question. To assist reading, they have not been used throughout the document.
[2] In this context, and adapting Bacchi and Goodwin (2016), mobility culture refers to the materiality (physical movement, context) and meanings attached to everyday travel, including the practices which bind meaning and materiality together.

identify cyclists as hazards by virtue of their presence on or near the road[3] (Bonham et al., 2018). Hazards can also include turning or reversing cars, parked vans, broken-down trucks (lorries) and buses halted at stops (e.g. Roads and Maritime Services, 2014: 2; VicRoads, 2014: 39). Importantly in these latter instances it is the *vehicle* – the car, truck, van or bus – rather than the driver or driver behaviour that is identified as the hazard. The driver is effectively made 'invisible' in hazard scenarios when the 'hazard cue' is a motor vehicle-driver assemblage (Dant, 2004: 61). By contrast the cyclist/bicycle rider is foregrounded as a hazard. The issue is not to extend the term hazard to include 'drivers' but to interrogate the term 'hazard' and its possible effects. These effects include how road users can think of themselves and others and the relationships (harmful, threatening, considerate) being formed between road users.

In undertaking this analysis, we have drawn on the work of Michel Foucault and post-structuralist informed scholars. Foucault's conceptualisation of a discursive practice provides a framework for examining taken-for-granted subjects, objects, and concepts thereby opening up new ways of thinking about social 'problems' (1972/2002, 1978). Using this critical form of enquiry, the following paper examines how road crashes are problematized in terms of 'hazard perception', the relationships enacted (see below) and knowledge enabled by this concept, and the objects (such as cyclists) constituted as 'hazards'. It proceeds to interrogate the effects of producing road users as 'hazards' and speculates on the potential for this categorisation to foster poor driver-cyclist interactions. Finally, we reflect on whether alternative concepts could better serve road safety researchers. Before commencing our analysis, we provide a brief outline of key theoretical points that inform our work.

2. Theoretical underpinnings

Our first theoretical point concerns how knowledge is produced as explained in Foucault's theorisation of a discursive practice. Foucault refers to knowledge as 'what can be accepted as truth' (1972: 224). With Foucault, we hold that in each society ordered procedures, or 'rules', delimit the knowledges (discourses) produced (Foucault, 1972: 216). These 'rules' are not principles of organization or structures, but sets of routinized relationships that link disparate elements across society. A discursive practice refers to a specific set of relationships (Bacchi and Bonham 2014: 180). Foucault's description of a *dispositif* (the term later used for a discursive practice[4]) captures this heterogeneity:

> What I'm trying to pick out with this term is, firstly, a thoroughly heterogeneous ensemble consisting of discourses, institutions, architectural forms, regulatory decisions, laws, administrative measures, scientific statements, philosophical, moral and philanthropic propositions – in short, the said as much as the unsaid. Such are the elements of the apparatus. Secondly, what I am trying to identify in this apparatus is precisely the nature of the connection that can exist between these heterogeneous elements (1980: 194).

The term discursive practice emphasises the enactment of relations between these elements. The Field of Transport, mapped in Diagram 1 and discussed below, is an example of a discursive practice. It identifies elements at both a macro scale (as sites) and micro-scale (as myriad items within each site) and the relationships enacted within and between these sites. For example, a transport researcher collecting a completed travel survey from a household enacts a relationship

between the department of transport (or research institute) and the place of residence. These relationships are routinized and appear commonplace. The theoretical point being made here is that if relationships are enacted in specific sites they can also be changed.

Our second theoretical point is that both subjects and objects are constituted within these relations. That is, subjects (e.g. judges, medical doctors, parents, university professors) are constituted and conferred with authority to speak, and objects (e.g. trips, road users) and concepts (e.g. accident proneness, situation awareness) form, deform, appear and disappear (Foucault, 2002: 53).[5] As new social difficulties (e.g. 'crashes') 'enter the field of thought' (Foucault, 1984: 388) as 'problems', their formation as objects of study (and concomitantly as objects) is enabled by and aligned within existing knowledges or modes of thinking. In challenging the pre-social status of subjects and objects, Foucault is not denying materiality but acknowledging the historically contingent nature of these subjects and objects – that is, they could have been formed otherwise (van Winsen et al., 2015). For example, in his work on 'madness' Foucault does not deny the existence of characteristics or behaviours identified as 'madness' but notes that at different times and places these characteristics or behaviours were either not objectified (i.e. not thought of as objects) or were formed as different objects (e.g. mania, refusal of reason) (Foucault, 1988). 'Madness' is an object produced within the enactment of relations within a discursive practice of psychiatry. Departing from a progressivist view of knowledge, Foucault directs attention to the conditions of emergence (Bacchi and Bonham, 2016) of specific knowledges and the subjects, objects and concepts produced. That is, he is interested in the conditions that made it possible to produce objects, such as madness or sexuality, at all. His work also directs attention to the sites across society (e.g. households, courtrooms, research institutes and government departments) activated within a discursive practice. The concept of a discursive practice, stretched as it is across society, assists in understanding how particular ways of thinking become pervasive and even naturalised.

As noted, the field of 'transport' mapped in Diagram 1 provides an example of a discursive practice (Bonham and Bacchi, 2017). It is especially relevant in the current context as it indicates the forms of possible thinking and practices produced in the field of 'road safety'. In the late nineteenth-early twentieth century 'traffic' and 'travel' were problematized within disciplines such as engineering, architecture/planning, and economics. By the mid-twentieth century, these 'problems' were located within the broader, emergent field of 'transport', where mobility was conceptualised as a by-product of origins and destinations and, therefore, something to be overcome or accomplished as quickly as possible (Schumer, 1955). Problematizing mobility as transport enables the 'governing' (Foucault, 1991b) of mobility and (almost) forecloses other ways of thinking about travel, for example as an activity fundamental to physical and mental health in an industrial/post-industrial world (Bonham, 2006). The concept of 'transport' is formed within a network of sites (Bussolini, 2010) including departments of transport, university research centres, households, parliament house (inquiries, debates and statutes), and the media, to name a few. Statements[6] produced in these sites (household travel surveys, parliamentary reports, metropolitan strategies) participate in the ongoing formation of 'transport' along with related *objects* (trip distance, purpose, and frequency) and *subjects of travel* (drivers, pedestrians, public

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[3] This paper focuses on cyclists but it is equally relevant for pedestrians, children and other small wheeled vehicle users.

[4] Dispositif is often translated into English as 'apparatus' (e.g. Foucault, 1980: 194–197) and according to Gilles Deleuze (1997), Foucault replaced the term discursive practice with *dispositif* to overcome the discursive/non-discursive divide and the mistaken view that the term discursive refers to language.

[5] See Bacchi and Goodwin, 2016, chapters 5 and 6 for full and accessible explanations of the formation of objects and subjects.

[6] Foucault refers to statements as events. They are 'more than' a 'speech act' in that they are specific written or spoken traces (a phrase, diagram, classificatory table, genealogical tree, population pyramid) that activate an entire field of knowledge (2002: 31, 89–98). For example, origin-destination matrixes, household travel surveys, drivers' licences, road cross-section diagrams, are some of the statements which signal or activate the field of transport and the authority of the 'subject' (e.g. traffic engineer, licensing officer, transport planner, social scientist) producing the statement.
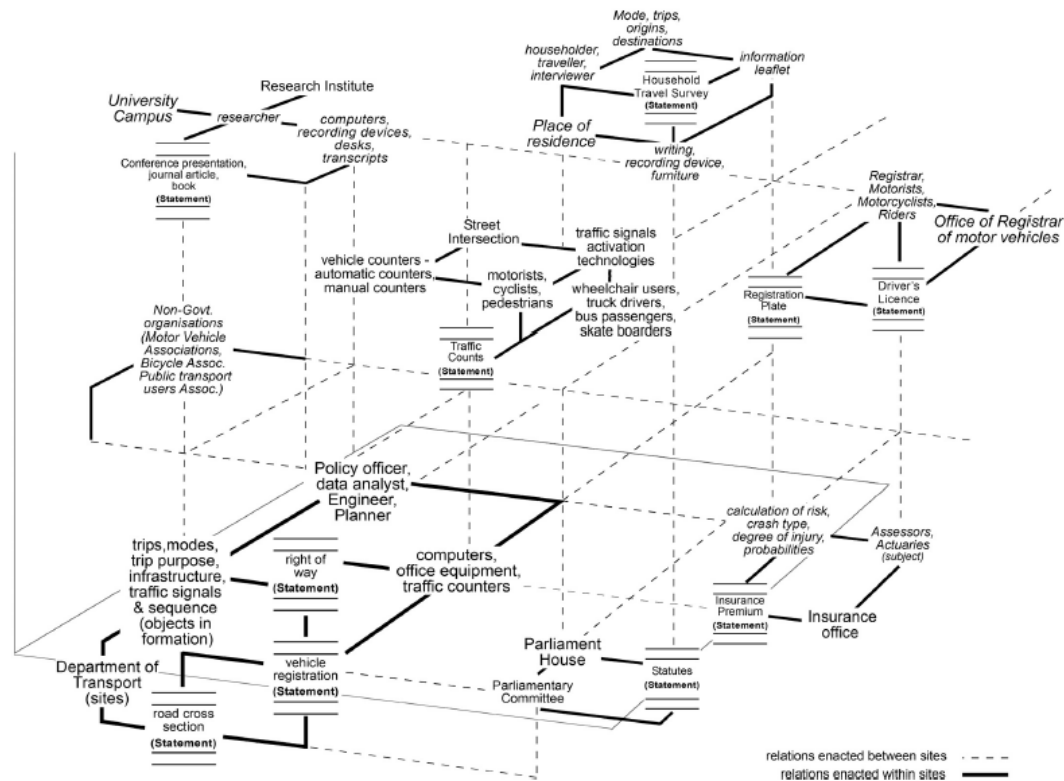
Diagram 1. Discursive Practice of Transport
(Source: Bonham and Bacchi, 2017).

transport users, and cyclists). As a discursive practice, transport includes multiple disciplines from psychology and human geography to engineering and urban design. While it is beyond the scope of the current paper, a similar discursive practice could be mapped for the field of 'safety' identifying sites in which categories such as hazards/not-hazards and objects of study, such as hazard perception, are formed.

While 'transport' (and 'safety') and its associated *subjects*, *objects*, and *concepts* appear as solid, self-evident phenomena their continual formation within a network of relationships leaves them fundamentally unstable and open to change (Bonham and Bacchi, 2017).

Our third theoretical point relates to power and knowledge. Aside from tracing the specific relations within a discursive practice, Foucault foregrounds the operation of power and its relation to the production of knowledge. While he distinguishes different forms of power (1991a) his studies of sexuality and punishment focus on the productive nature of power (1982). In this understanding, knowledge is not related to power in the sense of knowledge being a resource to influence or control decision-making nor in the sense that those 'with power' produce knowledge to further their own interests. Rather, power is immanent in the production of knowledge (Foucault, 1978). For example: the researcher is a vector of power as s/he incites research participants to respond to questions or speak about their life experiences; the process of dividing and categorising populations (mad/sane, criminal/law-abiding, safe/unsafe) brings particular types of individuals or 'subjects' (e.g. homosexual/heterosexual, sick/healthy, driver/cyclist) into effect,

and programs, policies, and protocols are devised and implemented to guide the conduct of these individuals (Foucault, 1978, 1991a). This production and elaboration of knowledge enables new ways of managing populations.

The analytic task therefore becomes reflecting on the forms of managing or governing enabled in specific discursive practices. Rather than accepting *hazards* and *hazard perception* as pre-social phenomena, we are interested in the conditions which enabled the emergence of hazard perception as an object of study and the processes of differentiation and categorisation that form *hazards/not-hazards*. Further, we are interested in the possible effects of these categorising processes including the road spaces they participate in normalising and the relations they foster between road users.

3. Method

The research method comprised a two-stage process designed to capture the introduction and interrogate the production of *hazards* and *hazard perception* in road crash/road safety literature. The first stage involved gathering letters, opinion pieces and research articles published in psychology, medical, science, engineering, ergonomics and traffic journals from 1900 to 2017. Although this 'expert' literature can be understood as representing 'one site' (i.e. research institutes) in a discursive practice it is an important site given the considerable authority conferred on 'expertise'. Further, both research practices and dissemination of findings link the 'expert' literature into a range of

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other sites including households, government departments, hospitals and non-government organisations. The date range covers the intensive problematisation of 'safety' in general (Dekker, 2019) and road safety in particular. It allows us to identify any changes in how road crashes, road users and the relations between road users were constituted. These can then be linked to broader societal and intellectual conditions.

Articles were gathered using manual and online database searches. Manual searches were used to locate journal articles and abstracts published in the pre-WWII period not available or accessible to us online (e.g. early issues of the Medical Journal of Australia, The Human Factor and Psychological Abstracts). Data base searches using Scopus and Google Scholar were followed up by searches of individual journals (e.g. The Lancet, BMJ, Accident Analysis and Prevention, Traffic Injury Prevention). Searches were conducted of titles, abstracts and keywords using combinations and re-combinations of the keywords 'road accidents', 'accident prone', 'motor traffic', 'danger', 'perception of danger', 'hazard', 'hazard perception', 'driver', 'pedestrian' and 'cyclist'. Different search terms were required for different periods through the twentieth century. For example, 'motor traffic', 'accident prone' and 'danger' were required to locate literature in the early decades of the twentieth century while 'accidents', 'perception' and 'hazards' captured articles from the later decades. The search process confirmed the 1960s as a key moment in the use of the term *hazard perception* in relation to traffic. Over 70 articles were identified for the pre- to early post- WWII period (1900–1950s) and 200 articles that explicitly referred to *hazard perception* in the title, keywords or abstract were identified for the post 1960s period. Articles which examined impacts of drugs, alcohol, and disease on hazard perception were excluded as they were outside the core aim of the exercise. The approach was designed to be indicative rather than exhaustive. All articles were uploaded to NVIVO to facilitate analysis.

The second stage involved a four step analysis of the documents. The first step clarified the use of the term *hazard* in road crash/road safety literature and when *hazard perception* and *perception of danger* emerged as objects within this literature. The literature was then split for analysis pre- and post- the introduction of *hazard perception*, that is 1900 – 1950s and after 1960. In the second step, we analysed the letters and articles published in the earlier period using the following set of questions: which road users (pedestrians, motorists, cyclists, horse riders or others) were discussed; what qualities, characteristics and behaviours were attributed to these road users; which, if any, of these attributes were constituted as hazards (including danger, threat, nuisance); and who endangered whom.

The third step focused on the hazard perception literature. Of the 200 articles located, we examined the methods researchers used in differentiating hazards from not-hazards and whom or what was sorted into each category. In the final step, we analysed articles that referred to bikes, bicycles, bikeriders, bicyclists, and cyclists. The articles were analysed to determine whether and how the vehicles and/or riders were constituted as hazards. Articles were sorted according to the following criteria:

- Vehicle Bike/Bicycle: identified as hazard
- Cyclist/Bicyclist: Hazard by virtue of presence on the road; behaviour/action
- Cyclist/Bicyclist: Hazard by illegal behaviour
- Cyclist/Bicyclist: Hazardous movement of cyclists (avoidance) attributed to behaviour of another road user
- Cyclist/Bicyclist: Cycling is risky
- Cyclist/Bicyclist: Traffic conflict, encounter or situation where cyclist is not identified as a hazard

The next section relates our analysis of the early literature to the work of mobility historians, geographers and safety science theorists. We describe the use of the term *hazard* and the conditions that enabled *hazard perception* to become an object of road crash/road safety study.

We then focus on the later literature to discuss the production of *hazards/not hazards* and the representation of cyclists in *hazard perception* studies and commentaries.

4. Analysis and discussion: hazard perception and the production of hazards

4.1. From the driver as hazard to the driver perceiving hazards

Through the twentieth century a shift is evident in the use of the term hazard in relation to road crashes and their associated road users. In the early years, the significant rise in fatalities and injuries that accompanied motorization saw motorists and motor vehicles problematized as hazards (Mom, 2014) with restrictions placed on *who* could drive (Bonham, 2006). Over subsequent decades, road users of all types were constituted as problems as arguments over who had the right to use the road, how the road should be used and who threatened harm to whom were played out in newspapers, parliamentary debates, courtrooms, schools and so on (e.g. Norton, 2008). Our analysis shows the divisions evident across society were also evident in the letters and articles published by 'experts' in psychology, medical, science and engineering journals. These articles commonly focused on motorists and/or pedestrians producing one or the other (sometimes both) as wayward, reckless, a threat, nuisance, danger or hazard (e.g. Williamson, 1925; Toop and Haven, 1938).

The progressive exclusion of groups such as children and the vision impaired from driving did not resolve the issue of road crashes. Attention turned to other sub-populations as crashes were problematized, particularly by psychologists, in terms of the hazard created by 'accident prone' drivers (e.g. Miles and Vincent, 1934; McKenna, 1982). Statistical analyses were used to determine the prevalence of accident proneness 'so that [accident prone drivers] may in some fashion be prevented from endangering the lives of others' (Forbes, 1941: 52). The study of 'accident proneness' was critiqued from the 1930s–1950s for diverting attention from 'accident hazards' in the 'remainder of the driving public' (Forbes, 1939: 471; Allgaier, 1950: 59). Importantly, through this time 'experts' continued to identify drivers along with other road users as hazards (or dangers). However, by the 1960s there was a shift from the *driver as (potential) hazard* to the *driver as perceiver of (potential) hazards*. We proceed to examine two conditions that enabled this shift.

Through the early twentieth-century, problematizing drivers as hazards (nuisances, dangers) occurred alongside the problematization of disqualifying people from driving (e.g. Forbes, 1941). Mobility is fundamental to the concept of freedom in liberal democracies (Cresswell, 2006: 742) so that the enhanced range of movement afforded by motor vehicles quickly put its use beyond question. The only reasonable grounds for authorities to intervene in the use of motor vehicles has been on the basis of efficiency (Bonham, 2006) and safety (Packer, 2003). Indeed, motor vehicles (whether public or private) and their drivers have proven especially amenable to technologies of combination and orchestration (multi-lane roads, traffic light programming etc.) by which authorities govern (i.e. conduct the conduct of) urban journeys. Arguably, in the post-WWII period, as national and urban governments around the world invested heavily in motorised futures, disqualifying people from driving would impinge on the 'freedom of choice' at the heart of liberal rationalities of government (Dean, 2010).

This commitment to widespread use of motor vehicles was a condition of possibility for road crashes to be problematized, and consequently knowledge to be produced, in new ways.[7] For example, road crashes were scrutinized from the early years of motorisation with an

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[7] We might reflect on the type of road crash knowledge enabled if transport investments were weighted heavily in favour of public rather than private freight and passenger transport.

ever-expanding range of 'elements' being excised from the crash environment and recorded (Bonham, 2002). In the 1960s computer technologies facilitated faster analysis of these large volumes of crash data to determine locations with high crash rates (Edwards, 1963) which, in turn, enabled the re-engineering of roads to better align with the affordances of cars, buses and lorries (Jorgensen, 1963). McKenna's (1982) overview of road crash research demonstrates the scale and diversity of knowledge being produced from the 1960s.

The second condition of possibility for *hazard perception* is the interior/exterior dualism enacted by the Cartesian subject and the belief that the interior – the mind – produces a more-or-less accurate representation of an exterior world (Dekker, 2013). It also relies on the belief that knowledge that counts as truth can be created about both the interior processes and exterior context of the subject (Dekker, 2013). Spatial disciplines have long produced authoritative knowledge about this external world. Extrapolating from Annemarie Mol (2002), measuring, mapping and calculative techniques borrowed from spatial sciences, mathematics and physics have become the gold standard of truth claims about the road environment and the physical process of road crashes. But as van Winsen et al. (2015) argues, cognitive disciplines that objectivise interiority with any degree of authority only emerged in the post-WWII era. This claim is borne out in our analysis of the road crash literature as 'perception of danger' and 'hazard perception' only begin appearing in this literature in the 1960s. *Hazard perception*, like Situation Awareness,[8] fundamentally maps what vehicle drivers see, comprehend and do against what they 'should' see, comprehend and do (van Winsen et al., 2015).

Setting aside the debates about the very possibility of the interior/exterior divide (see Dekker, 2013) the externalisation of *hazards* in the hazard perception literature constitutes the driver as someone who enters situations where hazards exist and s/he is called on to respond to those hazards. The driver is active in looking for (perceiving) and responding to hazards but, under 'normal' circumstances,[9] the driver and the activity of driving does not play a role in producing a hazard. It is instructive to contrast this view of 'hazards' as something external to the driver with the way hazards are treated in disaster studies. As that literature reminds us, the earthquake or tsunami is not essentially a hazard; it only becomes a hazard for humans in relation to the activities of humans – e.g. where, what and how infrastructure and settlements are located (Bokwa, 2013). Similarly, the physical attributes of the road network, the position or movement of other road users, and the environmental conditions are not hazards by virtue of their existence; they only become hazards *in relation to* the activity of driving and the driver. Hence, the driver as the subject of driving necessarily participates in producing *hazards*.

By externalising the hazard in *hazard perception* studies, the activity of driving and the role of drivers can be confined to interrogating driver responses. Further, these studies participate in producing particular activities, movements, people and materials as 'hazards'. The next section explores the practices by which hazards are constituted and come to appear as self-evident phenomena.

4.2. Constituting hazards: how and what

Through the research process, researchers participate in determining what constitutes a hazard. Over the past half century, a variety of methods have been developed to determine, and often compare, drivers' abilities to correctly identify risky situations. Simulator studies require participants to recognise and respond to

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[8] Situation Awareness is an object of study constituted within the psychology literature (see van Winsen et al., 2015).

[9] The only time driving might be considered problematic is if the driver is affected by alcohol, licit or illicit drugs, lack of sleep etc. or is behaving outside of driving norms (e.g. speeding).

hazards or danger (e.g. Barrett and Thornton, 1968; Currie, 1969). Test drives involve the researcher accompanying drivers on trips and noting the events, movements and objects drivers respond to (slowing, changing lanes) or verbally identify as hazards (Soliday, 1974). Photo, video and film experiments entail participants identifying and/or ranking hazards depicted in the various scenarios (Benda and Hoyos, 1983; Armsby et al., 1989). More recently video and film experiments include eye tracking technologies to determine where attention is focused (Crundall et al., 2003). Questionnaires have also been used with participants required to rate the hazardousness of traffic situations (Soliday, 1975). Participant responses are contrasted with the research community's categorisation of hazardous or, in eye tracking studies, attention time allocated to 'correct' elements. These methods participate in bringing specific materials and manoeuvres into effect as hazards (or not-hazards).

The particular materials and manoeuvres specified as hazards are informed by: crash data analyses (Currie, 1969; Page et al., 2012), advice from experts such as police and driving instructors (McKenna and Crick, 1994), iterative interactions between researcher and researched in accompanied drives (Soliday, 1974), or general definitions supported (or not) by examples. These general definitions constitute hazards (hazardous situation or traffic conflict) in terms of a driver's need to respond or the potential for a negative outcome.

> A hazard is any object, condition or situation that tends to produce an accident when drivers fail to respond usefully; hazardous situations are combinations of conditions and objects, usually with a temporal feature (Dewar et al. cited in Di Stasi et al., 2009, p. 363).

> Any object, situation, occurrence or combination of these that introduce the possibility of the individual road user experiencing harm. Hazards may be obstructions in the roadway, a slippery road surface, merging traffic, weather conditions, distractions, a defective vehicle, or any number of other circumstances. Harm may include damage to one's vehicle, injury to oneself, damage to another's property, or injury to another person (Haworth et al. cited in Borowsky et al., 2009: 279).

Other researchers list, describe or provide photos and video stills of samples of hazardous situations, perhaps noting particular elements or actions as hazards. For example, Benda and Hoyos (1983: 3) identified a car door opening adjacent to a motorcyclist and snow on the road as hazards while parked cars or cars travelling ahead on a road were not-hazards. Similarly, Borowsky et al. (2009) identified parked cars as not-hazards and pedestrians crossing the road as hazards. In each of these instances, the driver happens upon a hazard which they may or may not avoid but they are not conceptualised as participating in producing the hazard.

As noted in the theory discussion, the research process necessarily involves the operation of power in the activity of dividing populations and things producing them as hazards/not-hazards (Foucault, 1982). These categories have effects in the world as they make identities available and provide ways for 'road users' to think about the road, themselves and other road users. Researchers also exercise power as they divide and rank research participants according to their ability to identify *appropriate* elements and sort scenarios in line with the research community's own classifications. The 'objectivity' associated with experimental processes adapted from the physical sciences confers authority on the research and the researcher's taxonomy. Over the past 40 years a catalogue of *hazards* has been created and elaborated so that the elements on that list appear as self-evident.

People, such as pedestrians, are routinely identified as hazards in the academic literature. We investigated whether cyclists are constituted in similar terms. While quantitative analysis is not our core concern, it is notable that of the 200 papers included in our review, 81 (40.5%) mentioned bicycles/bikes (19) or cyclists/bicyclists (62) and of these 74 (91%) associated bicycles or cyclists with hazards or

problematic situations (See Appendix A). As noted in the method section, comments made about bicycles and cyclists were sorted into categories according to whether cyclists were identified as a hazard or problematized in some other way (e.g. risk, critical events). A full list of articles, cyclist-related comments and the categorisation of those comments is provided as Appendix A (supplementary data).

Cyclists were referred to as hazards (hazard cues, potential or precursors to hazards) by virtue of their presence on or near the road or their 'everyday' behaviour such as riding along, entering or crossing a road. For example, in describing clips used for their eye tracking study, Underwood et al. (2005) explained:

> In the present film clips, the hazards developed more slowly, with fewer abrupt-onsets (e.g. a pedestrian appearing from behind a parked vehicle) and more gradual-onsets (e.g. a cyclist on the road ahead). Gradual-onset hazards take time to develop and for the viewer to identify the object and then classify it as a hazard. (p. 352)

Lists of hazards might extend to a broader range of road users 'Such potential hazards include pedestrians, parked cars, cyclists and other vehicles, whether oncoming or in one's own lane' (Jackson et al., 2009: 155). However, when driver behaviour is identified as a hazard, it is the vehicle not the person that is constructed as the problem.

Cyclists were constituted as hazards for a perceived lack of discipline, 'abrupt', 'sudden' and 'unexpected' appearance or for 'emerging' after being hidden from the driver's view by vehicles, vegetation, and fences.

> Cyclist suddenly leaves pavement and wanders across the path of vehicle (non-staged). (McKenna and Crick, 1994: 5).
> Looking at the dendrogram (Fig. 1) we can find in the cluster of the hazardous situations events such as the unexpected appearance of pedestrians, cyclists or motorcycle drivers or cars on the brink of collision. (Benda and Hoyos, 1983: 3).
> Some situations contained a hidden *threat* which might emerge from behind an obscuring object. For example, ... a bicyclist might emerge from behind a line of bushes hiding the sidewalk[10] (Taylor et al., 2011: 4) (emphasis added).

These representations of cyclists are made as simple statements of fact: cyclists can *appear* unexpectedly and cyclists can be hidden *threats*. While the research objective might be to develop anticipatory skills in drivers, these statements produce the cyclist's movements as problematic and the driver must be ready for them. The authority of research is brought to bear in identifying the cyclist's movements, not the driver's view, as problematic. This representation both re-produces and confers authority on what 'drivers', as categories of road users, can say about 'cyclists'.

Evans and Macdonald (2009) identify particular characteristics of drivers as problematic.

> 'Hazard Perception': conceptual framework and definitions...Errors of 'awareness and anticipation'...*inadequate anticipation* of the actions of cyclists, pedestrians on a crossing, or other drivers. (Evans and Madonald, 2002: 93)

In this scenario, the emphasis is on drivers' understanding and ability to anticipate cyclists' movements. None-the-less, as with the preceding examples, cyclists are represented as hazards, raising questions about the effects of this representation. What happens when we categorise a particular group of road users as hazards? How is road space itself being produced? Are roads inclusive places of movement or

places of particular kinds of movement?

The 200 papers we reviewed did not include any discussion of the assumptions or potential effects of representing cyclists (or other road users) as hazards. This research has developed alongside and extended the distribution of *hazard perception*, and the many *hazards* it produces, into transport websites, transport and road safety policies, driver instructor curricula, driver training modules, simulation models, and driver licence testing. There is a continual or *ongoing formation* (see Bonham and Bacchi, 2017) of the hazard/not-hazard in each of these sites. Novice drivers enact this division as they watch Hazard Perception YouTube clips, click responses in (not-)hazard simulator scenarios or take their driver licence test. While some people, specifically cyclists and pedestrians, are catalogued as hazards rather than as everyday participants in and producers of the road environment we need to question the possible effects of this categorisation. We need to question, for example, whether this way of thinking about cyclists as hazards participates in creating tensions between drivers and cyclists.

The constitution of hazards – what disrupts driving and threatens the driver – simultaneously constitutes normal driving and normal driving conditions in particular ways. For example, anything that requires a driver to change speed or direction has been identified as a hazard (Lim et al., 2013: 197). Pedestrians and children are also frequently identified as hazards but they have been largely excluded from road space. Cyclists have maintained a place on the roads but in designating them as hazards it is possible to question the wisdom of allowing them to use the roads and it works directly against attempts to encourage 'road sharing'.

5. Traffic participation

Rather than objectivising road users, vehicles and the road context as 'hazards' the concept of traffic participation may open up alternative ways of creating knowledge and intervening in the driver licensing process. The concept of traffic participation foregrounds the immediate activity of moving among others (people and things) and the relational nature of that movement. People are constituted as participants – rather than drivers, pedestrians, cyclists or passengers – which offers new possibilities and expectations about conduct. A participant is someone involved with others in a particular endeavour, producing an outcome of/for all. Together, participants continually and actively create traffic so that how one participant engages with another will facilitate, re-orient, hinder or modify the traffic endeavour. It is possible to fill up the category of participant with new content in the context of traffic. The traffic participant may be someone: who is continually adjusting her/his movement to accommodate and be accommodated by others; who appreciates the road environment (curves, surface defects, signage) and its affordance of her/his journey and the journeys of others (Wilhoit, 2018); who appreciates the characteristics of any device that affords her/his journey and seeks to modify (hopefully minimise) its impact on others. A traffic participation test could replace a hazard perception test where the focus would be on the novice drivers' ability to demonstrate her/his understanding of the diversity of participants and explain how her/his own movement can enhance safety in that situation. Such an approach should aim to produce road space as a safe and forgiving environment for all travellers.

6. Conclusion

The term hazard, along with danger and recklessness, was used in the early part of the twentieth-century in relation to motorists and then to a broader range of road users. In the second half of the century, the concept of *hazard perception* was enabled in road safety research by the intertwining of the Cartesian subject, the new field of cognitive knowledge, liberal commitments to maximal mobility, and newly forming transport bureaucracies informed by related transport knowledges. These conditions made possible a re-problematization of road

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[10] The authors continue on to say 'In other situations, a vehicle on the road ahead hidden by another vehicle could become a potential threat. For example, a vehicle in a left turn lane might suddenly pull into the adjacent lane in front of the driver.' However, as noted previously it is the vehicle that is identified as the hazard not the driver.

crashes from motorists as *hazard* to the external environment as full of *hazards* that motorists must learn to perceive and avoid.

The research process brings *hazard perception, hazards* and *non-hazards* (and their constituent elements) into effect as self-evident objects. The hazard is always external and threatens harm to the driver. The driver is not seen as an active producer of the traffic situation but a responder to that situation. It assumes that the normal driver is not a hazard. By contrast, the cyclist, is a *hazard*. The *reality* of cyclists as *hazards* is taken up and distributed via driver licensing, transport and motoring authorities across society. As authorities constitute cyclists as a problem it is hardly surprising when communities share this thinking. Further, it raises doubts about cyclists as legitimate road users and provides support for hostile views.

Problematizing road crashes in terms of *hazard perception* and *hazards/non-hazards* facilitates the production of specific types of knowledge and the implementation of related programs. Likewise, the conceptualization and study of traffic interactions as 'conflicts' provides fertile ground for the production of a different but related body of road safety knowledge. Both ways of thinking create negative relations between road users. It seems useful to ask what knowledge is possible if we produce 'traffic participation' as an object of study. If traffic participation is constituted as participating in the overall endeavour of mobility, what knowledge would it enable and what programs would be implemented to govern our travel?

Author statement

Conceptualization	Ideas; formulation or evolution of over-arching research goals and aims	Jennifer Bonham
Methodology	Development or design of methodology; creation of models	Jennifer Bonham
Software	Programming, software development; designing computer programs; implementation of the computer code and supporting algorithms; testing of existing code components	N/A
Validation	Verification, whether as a part of the activity or separate, of the overall replication/ reproducibility of results/experiments and other research outputs	Veronica Coram
Formal analysis	Application of statistical, mathematical, computational, or other formal techniques to analyze or synthesize study data	N/A
Investigation	Conducting a research and investigation process, specifically performing the experiments, or data/evidence collection	Jennifer Bonham Cathy Jervis
Resources	Provision of study materials, reagents, materials, patients, laboratory samples, animals, instrumentation, computing resources, or other analysis tools	Jennifer Bonham
Data Curation	Management activities to annotate (produce metadata), scrub data and maintain research data (including software code, where it is necessary for interpreting the data itself) for initial use and later reuse	Jennifer Bonham
Writing - Original Draft	Preparation, creation and/or presentation of the published work, specifically writing the initial draft (including substantive translation)	Jennifer Bonham
Writing - Review & Editing	Preparation, creation and/or presentation of the published work by those from the original research group, specifically critical review, commentary or revision – including pre-or postpublication stages	Jennifer Bonham Marilyn Johnson Narelle Haworth
Visualization	Preparation, creation and/or presentation of the published work, specifically visualization/ data presentation	Jennifer Bonham
Supervision	Oversight and leadership responsibility for the research activity planning and execution, including mentorship external to the core team	Jennifer Bonham
Project administration		Jennifer Bonham
Management and coordination responsibility for the research activity planning and execution		Marilyn Johnson Narelle Haworth
Funding acquisition	Acquisition of the financial support for the project leading to this publication	Jennifer Bonham Marilyn Johnson Narelle Haworth

Declaration of Competing Interest

None.

Appendix A. Supplementary data

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