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Lane filtering and situation awareness in motorcyclists: An on-road proof of concept study

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What is lane filtering?

Lane filtering and safety

- Little research
- Proponents cite benefits as:
  - Reduced commuting times
  - Increased fuel efficiency
  - Improved safety: reduction in rear-end collision risk and improved visibility
- Opponents cite risks as:
  - Reduced safety: violation of driver expectation potentially increasing risk of conflict between rider and other road users
- No research evidence to support either the risks or benefits

Lane filtering and situation awareness

- Being at the front of the queue might improve visibility for motorcyclists but what happens on the way there?
- How does lane filtering impact on motorcyclists' awareness of what is going on around them?
- Assessment of motorcyclists' situation awareness (SA) might provide some insight
- Situation awareness refers to road users' understanding of 'what is going on around them' (Endsley, 1995)
- Do filtering motorcyclists focus more or less of their attention on surrounding hazards and traffic than motorcyclists who do not filter?

Aims

- On-road ‘proof’ of concept study designed to:
- Investigate whether and how lane filtering influences motorcycle rider situation awareness at intersections
- Address factors to be considered in the design of a larger study in this area

Method: Participants

- 25 experienced motorcyclists aged 27-64 (mean = 43.7, SD =12.5)
- 24 were male
- All held full Victorian motorcycle licence
- Length of licensure: 19.4 years on average (SD = 16.4)
- Riding experience: 260 kms per week on average (SD = 156.1)
- Recruitment through the weekly on-line Monash Uni newsletter
- Part of a larger study investigating road user situation awareness
- Study approved by Monash Uni Human Research Ethics Committee

Method: Materials

- Participants rode their own motorcycle
- Motorcycle fitted with portable camera attached to handle bars or headlight assembly
- Verbal Protocol Analysis (VPA) or 'think aloud' analysis to elicit cognitive and perceptual processes by motorcyclists as they rode
  - Think aloud what is seen and done but do not explain actions
  - VPA recorded using dictaphone attached to helmet
- Study route -15 km urban route in Melbourne's south eastern suburbs
  - Arterial and residential roads (50, 60, 80 km speed limits)
  - Three fully signalised intersections for analysis
    - Two with two turning lanes, one with one turning lane

Method: Procedure

- Participants informed that the aim was to examine their situation awareness in different types of urban environments
- Participants were not informed that their behaviour was being observed for instances of lane filtering
- No instructions were given about how participants should ride
- All rides took place on weekdays during non-peak - 9:30am or 1pm
- Instructions and practice on VPA before riding the route
- Participants were examined one at a time
- Participants were followed by the experimenter in a car

Data analysis

- 21 riders available for analysis
- Video data examined for 21 riders x 3 intersections to determine:
  - Number of instances in which lane filtering was possible
  - Number of instances in which lane filtering occurred
- Excluded from analysis at each intersection any rider for whom the traffic lights on their approach side were green or no vehicles in queue
- Lane filtering occurred if the rider overtook at least one stationary or slow moving vehicle in the queue
- Seven riders filtered across the three intersections (33%)
- Filtering occurred 12 times out of 43 'eligible' instances (27.9%)

Results

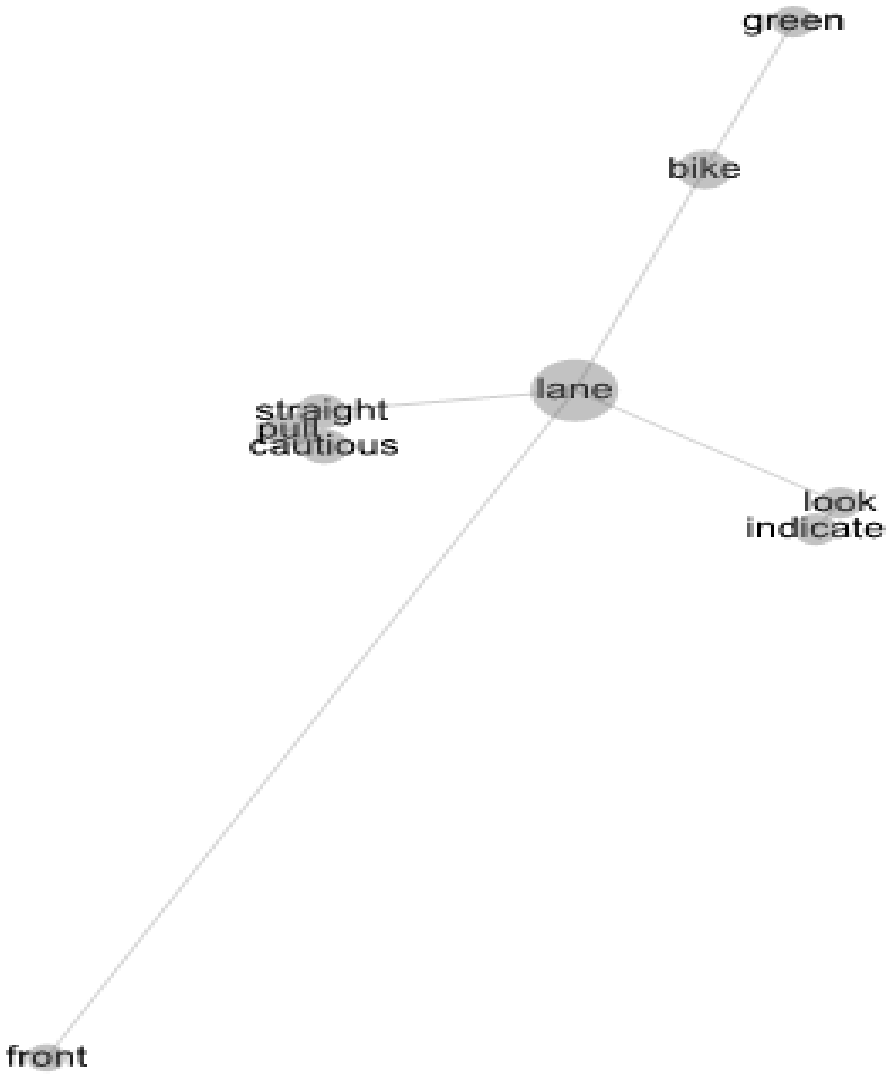
Intersection No.	No. of cases where filtering occurred and % of riders who filtered	Number and % of cases in which filtering was possible
1	1 (4.8%)	5 (20.0%)
2	6 (28.5%)	19 (31.6%)
3	5 (23.8%)	19 (26.3%)
Total	12 (57.1%)	43 (27.9%)

Leximancer analysis & network creation

- Verbal protocols transcribed into Microsoft word and analysed for each intersection using Leximancer (a text analysis software)
- Leximancer creates networks comprising concepts or information elements and the relationships between them
- The networks are taken to represent an individual's situation awareness
- Leximancer was used to produce 6 situation awareness networks: one filtering and one non-filtering network for each intersection
- Network analysis metrics then used to examine the content and structure of each of the six networks to enable comparisons between situation awareness when filtering versus when not filtering

Network analysis

- Conceptual map demonstrating concepts and links underpinning filtering motorcyclists' SA at Intersection 2



Network content: common and unique concepts

Filtering motorcyclists					
Common Intersection 1	Unique Intersection 1	Common Intersection 2	Unique Intersection 2	Common Intersection 3	Unique Intersection 3
Lights (F)	Watch	Straight (N)	Lane	Lights (F)	Whole
Cars (N)	Wait	Green (F)	Bike	Cars (F)	Cycle
	Opportunity	Look (N)	Pull	Front (F)	Filter
	Keeping	Indicate (N)	Cautious	Intersection (N)	
	Eye	Front (N)		Traffic (N)	
		Cars (N)		Lane (N)	
				Hand (N)	
Non-filtering motorcyclists					
Common Intersection 1	Unique Intersection 1	Common Intersection 2	Unique Intersection 2	Common Intersection 3	Unique Intersection 3
Lights	Lane	Straight	Road	Lights	Turning
Cars	Road	Green	Car	Cars	Red
	Arrow	Look	Coming	Front	Arrow
	Green	Indicate	Traffic	Intersection	Car
	Traffic	Front	Turning	Traffic	Crossing
	Intersection	Cars	Behind	Lane	One's
	Light		Waiting	Hand	Stick
	Car		Sure		Lanes
	Slow		Arrow		Behind
			Stay		Merging
			Confusing		Coming
			Moving		Aware
			Intersection		Road
			Highway		Moving
					Quick
					Sure

Discussion (1)

- How does lane filtering at intersections influence situation awareness in motorcyclists?
- Non-filterers focussed more of their attention on perception of surrounding hazards and traffic behaviour than filterers
- Filterers focussed more of their attention on information associated with their own actions when moving to the front of the traffic queue than non-filterers
- Limited ability to draw inferences from the results about safety due to:
  - Very small number of lane filtering opportunities and occurrences
  - Absence of unsafe outcomes in this study
  - Absence of past research demonstrating safety implications

Discussion (2)

- Demonstrates a concept and method worthy of investigation
- Future research:
  - Need a large number of riders to obtain enough filtering cases
  - Avoid experimenter following to better measure filtering
  - Measure in peak hour because filtering (and opportunities to filter) are more likely to occur then
  - Include multiple types of the same intersection
  - Large scale naturalistic study needed to assess safety

Acknowledgements

- Motorcyclists who took part in the study
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