Auditory perception and cycling safety (PPT)

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Auditory perception and cycling safety

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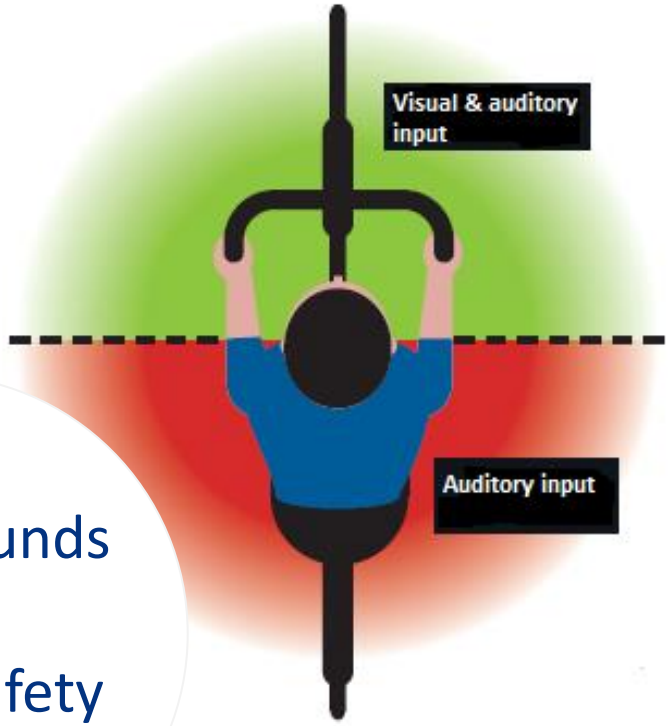

Traffic sounds and cycling safety

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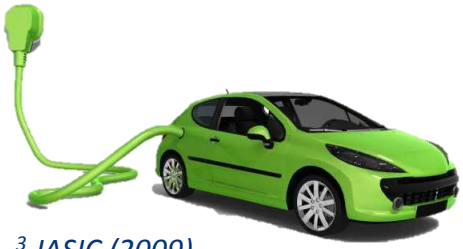
Problem

Use of auditory information by cyclists more challenging

- Portable electronic devices:
  - ♫ and 📱
  - deteriorated auditory perception[1]

- Electric cars
  - target: 1 million in 2025 in the Netherlands[2]
  - problem with auditory detection[3]



[1] *De waard et al, 2011* [2] *IEA (2012)* [3] *JASIC (2009)*

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What is the impact?

GEARBOX | REVIEWS OF CARS, TRUCKS, AND OTHER AUTOS. | MAY 15 2012 7:07 AM

The Silent Killer

Hybrids are so quiet that pedestrians never hear them coming. Now automakers are racing to make the car of the future sound like the gas guzzlers of old.

792

By Paul Collins

The quiet engine of hybrid and electric cars at low speeds poses a risk to pedestrians

Australian campaign

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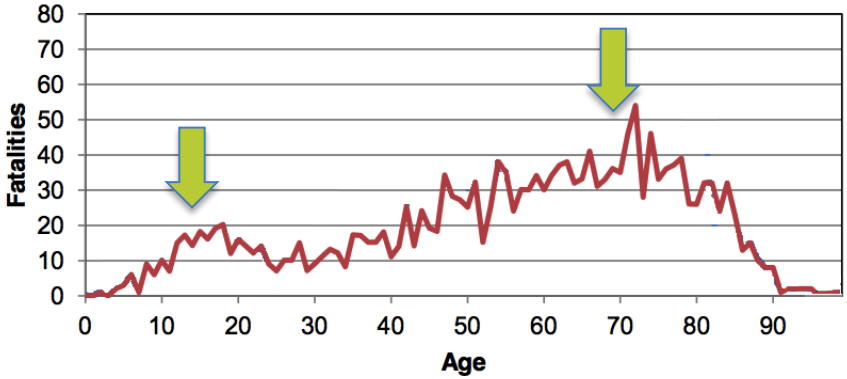
Main aim

Relationship between limited auditory information:  and cycling safety

Focus

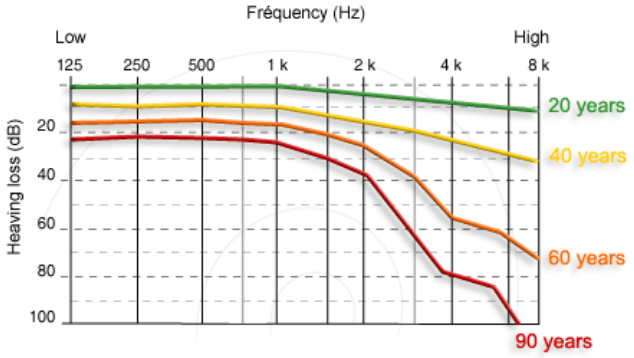
Teenagers and the elderly

- Cyclist fatalities by age in EU-19 countries *



*in 2010; data from 2009 was used for the Netherlands, Northern Ireland and Sweden

- Decline in hearing abilities in old age



- Frequent use of devices by youngsters

- Three age groups
  - 16-18 years old
  - 30-40 years old
  - 65-70 years old

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Three studies

Auditory localisation

Study 1

♫ and

Impact

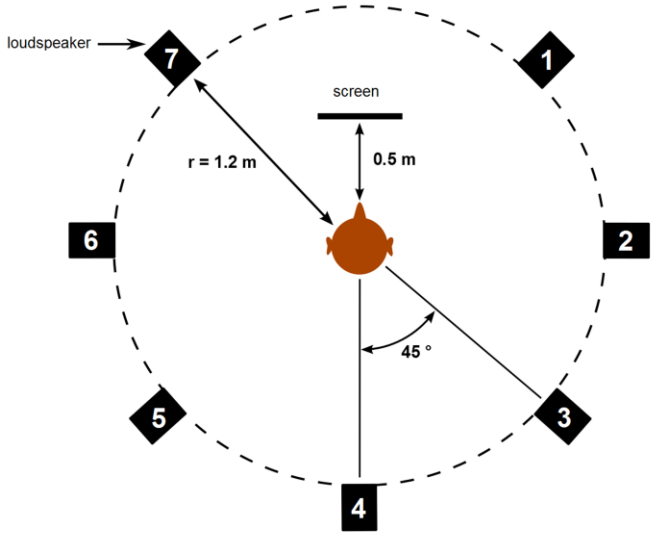
Study 2

Compensatory behaviour

Study 2 & 3

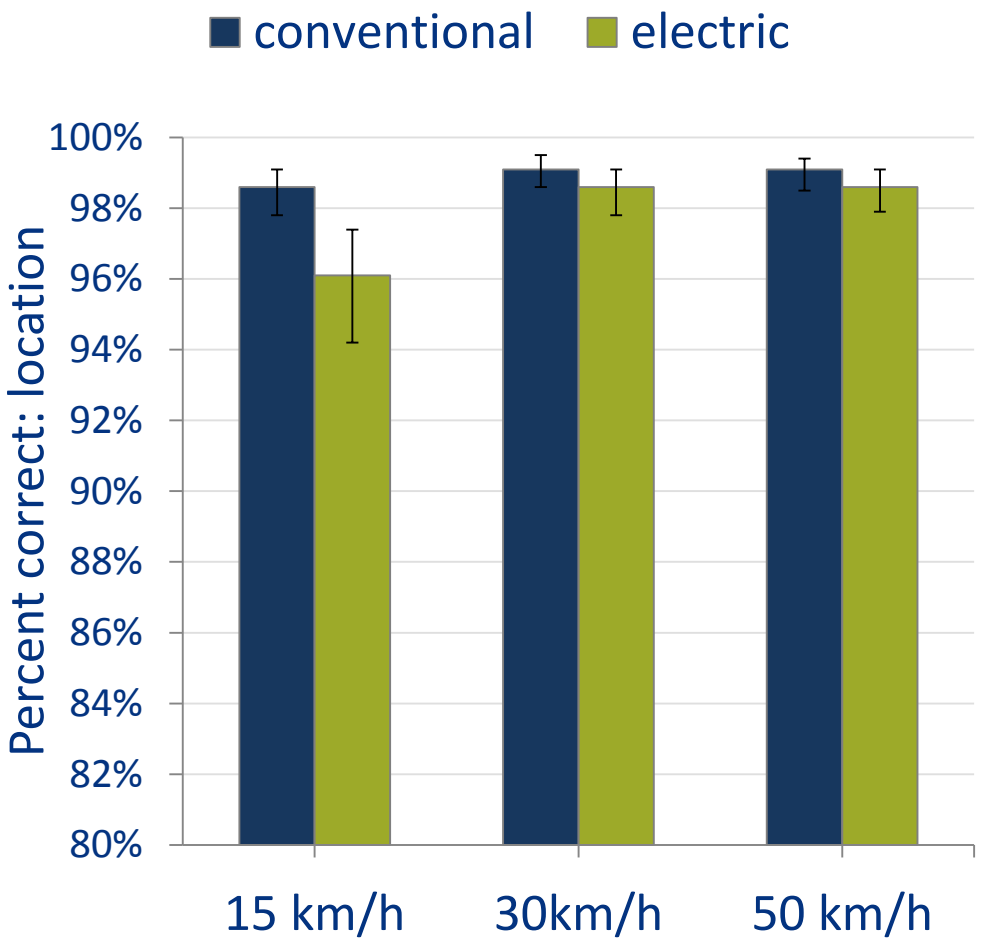
Study 1: Auditory localisation of conventional and electric cars

- 65 participants (cyclists)



Stelling-Konczak, A., Hagenzieker, M., Agterberg, M.J.H. & Van Wee, G.P. (2016). Auditory localisation of coventional and electric cars: laboratory results and implications for cycling safety. Transport Research Part F, 41, Part B, 227-242.

Study 1: Results – car type and speed



- Accuracy of auditory localisation is quite high
- Participants were worse at indicating the location of electric car sounds
- Low car speeds: lower localisation accuracy

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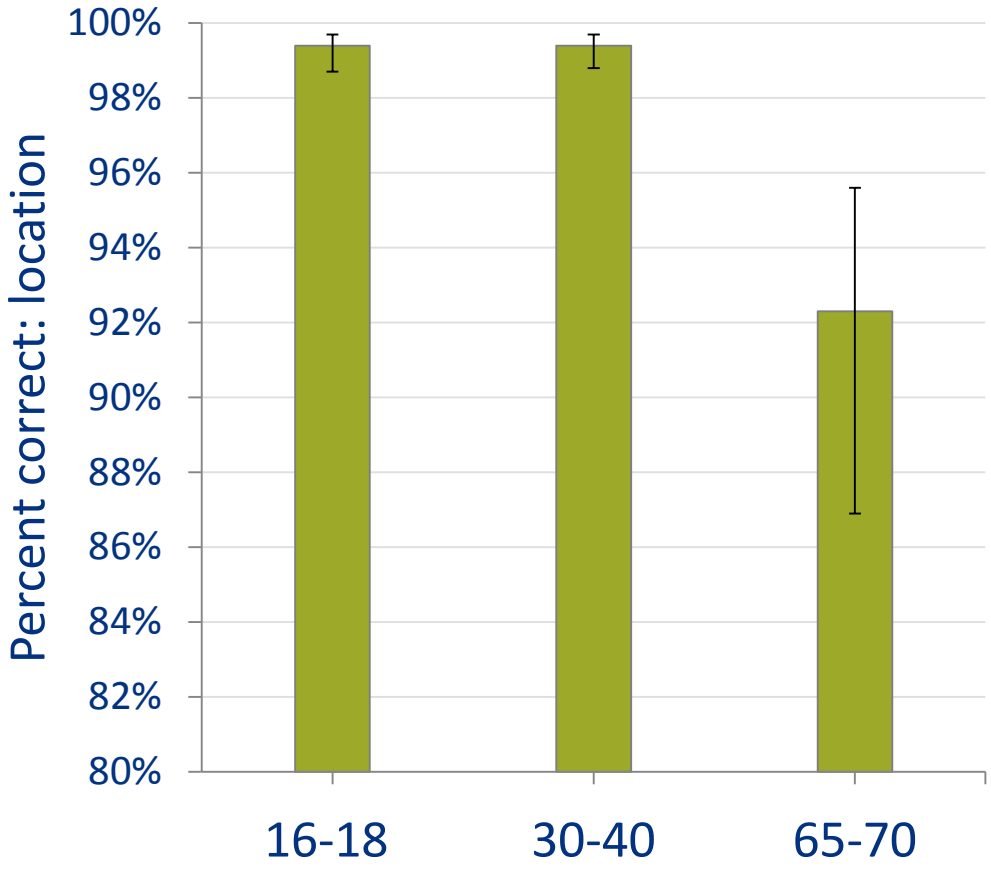
Study 1: Results - age groups



- Older age: lower localisation accuracy (no interaction effects)
- Small differences – severe (fatal) consequences

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Study 2: Impact of ♫ and 📱

- Internet survey among 2249 cyclists

- Compensatory behaviour while ♫ or 📱
- Impact of ♫ or 📱 on cycling safety
  - crashes and noise-related incidents (surprised/startled)

Stelling, A., Hagenzieker, M. P. & Van Wee, G.P. Cyclists and traffic sounds: the results of an internet survey. Paper presented at 3rd International Cycling Safety Conference 2014, Gothenburg, Sweden.

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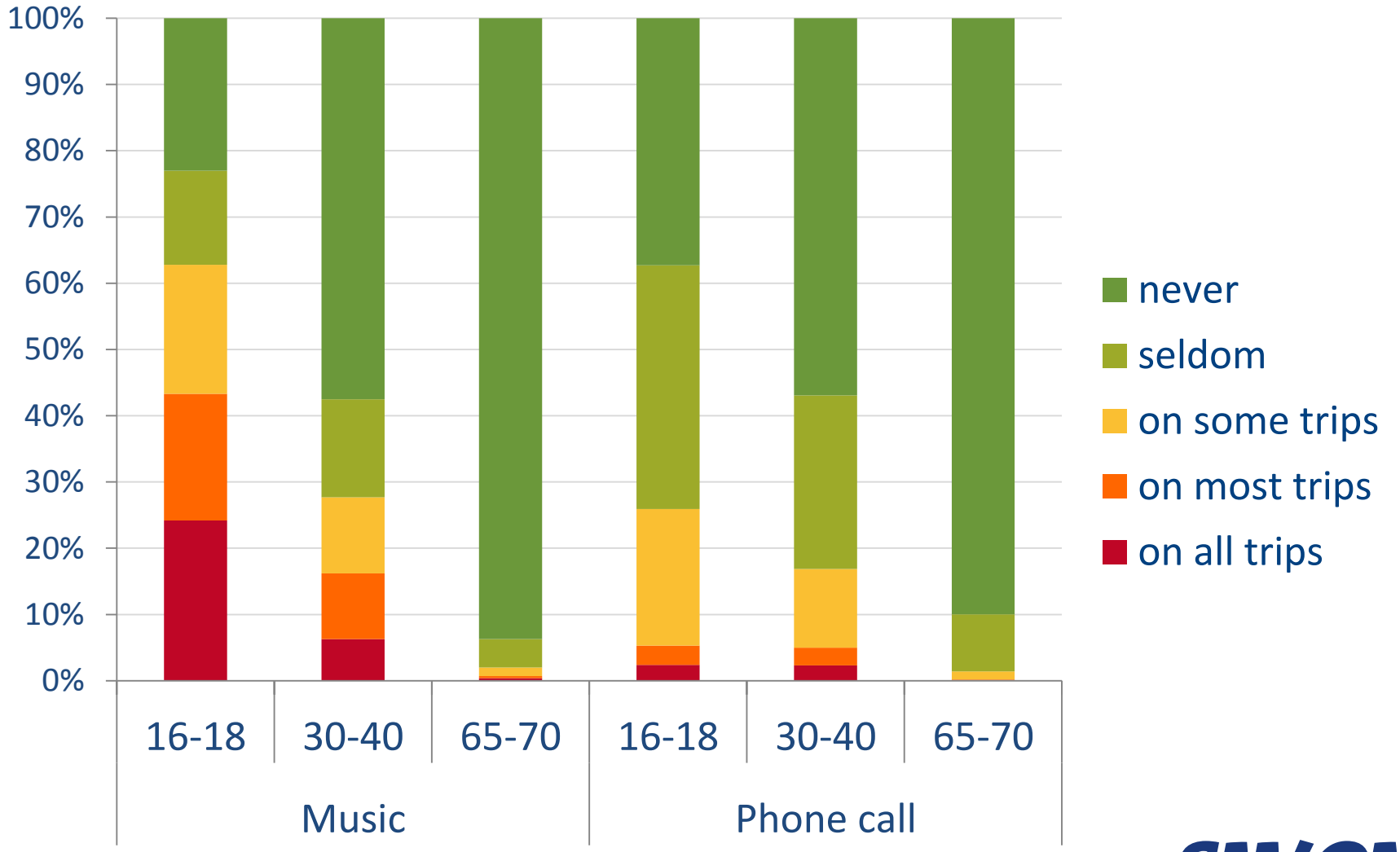
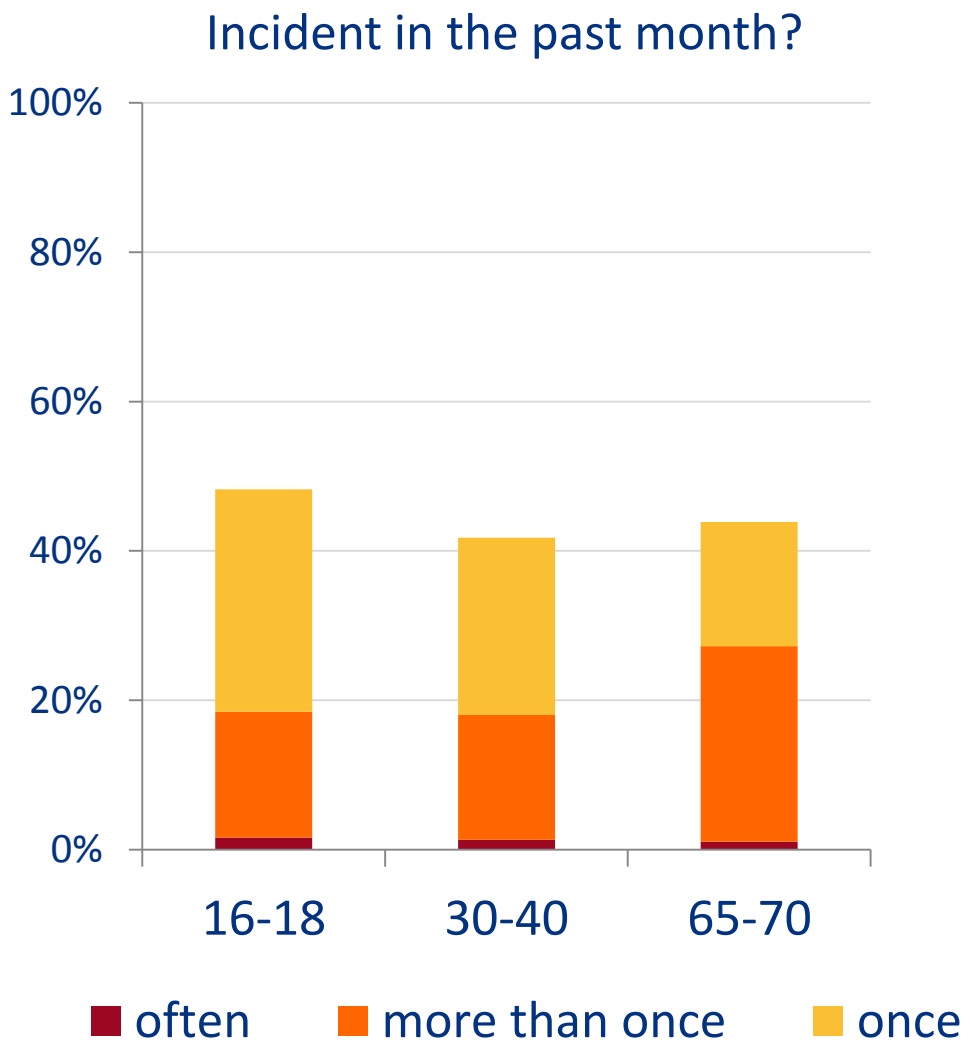
Study 2: Results – frequency of ♫ and



Study 2: Results – self-reported incidents



Study 2: Results - Compensatory behaviour?

- Compensatory behaviour reported by the majority:
  - most often: increase of visual attention

- Neither ♫ nor 📱 related to incidents reported by teenage cyclists

- Net outcome may still be risky if:
  - no sufficient compensation
  - or suboptimal / less safe (cycling) infrastructure

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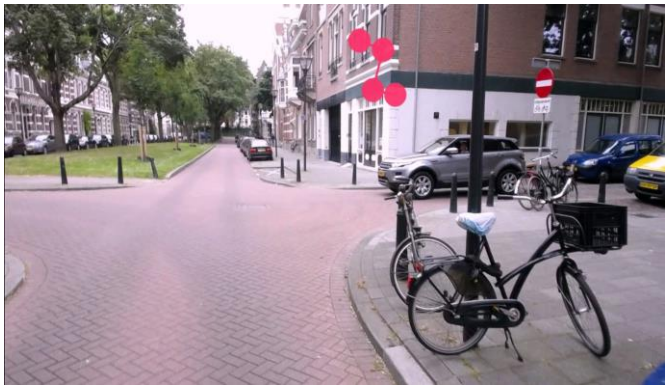
Study 3: Study in real traffic with cyclists ♫

- To what extent does ♫ affect glance behaviour of teenage cyclists?
- Eye-tracker
- 2 trips per cyclist: baseline & music condition
- Ethical considerations



- Uncontrolled intersections
- Intersecting road to the right

Stelling-Konczak, A. et al. (submitted). A study in real traffic examining glance behaviour of teenage cyclists when listening to music: results and ethical considerations.

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Study 3: Results cyclists' visual behaviour whilst ♫

- 14 cyclists
- No significant differences between baseline & music condition

Performance measure	Condition	
	Baseline	Music
Looking to the right *	0.490 (0.328)	0.406 (0.296)
Mean number of glances	4.07 (3.7)	3.71 (4.4)
Mean glance duration (in ms)	500.1 (298.5)	648.9 (397.5)

- Effects may exist

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Discussion: Should we be concerned about cyclists  ?

- Accuracy of auditory localisation is quite high, but problematic for electric cars at low speeds
- ♫ popular among teenage cyclists
- Cyclists report compensatory strategies for ♫ (and )
- Compensatory strategies not found in real traffic

- Sufficient compensation?
- Combined effects?
- Mix of vehicles: transition period

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Possible countermeasures

Ban on headphones

Enforcement

Add-on sound

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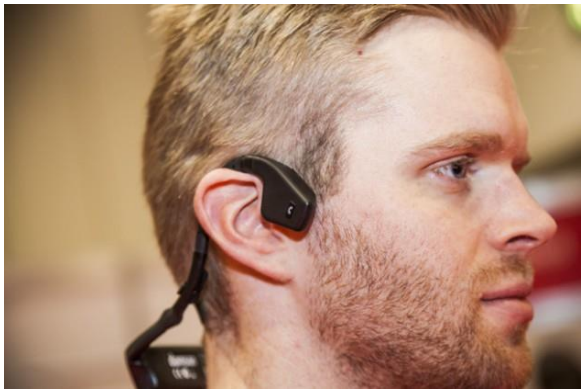
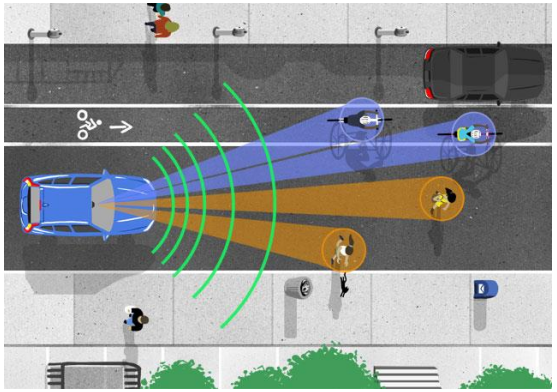
Possible countermeasures: technology



Damson 'Headbones'

Safe + Sound

BikeMic

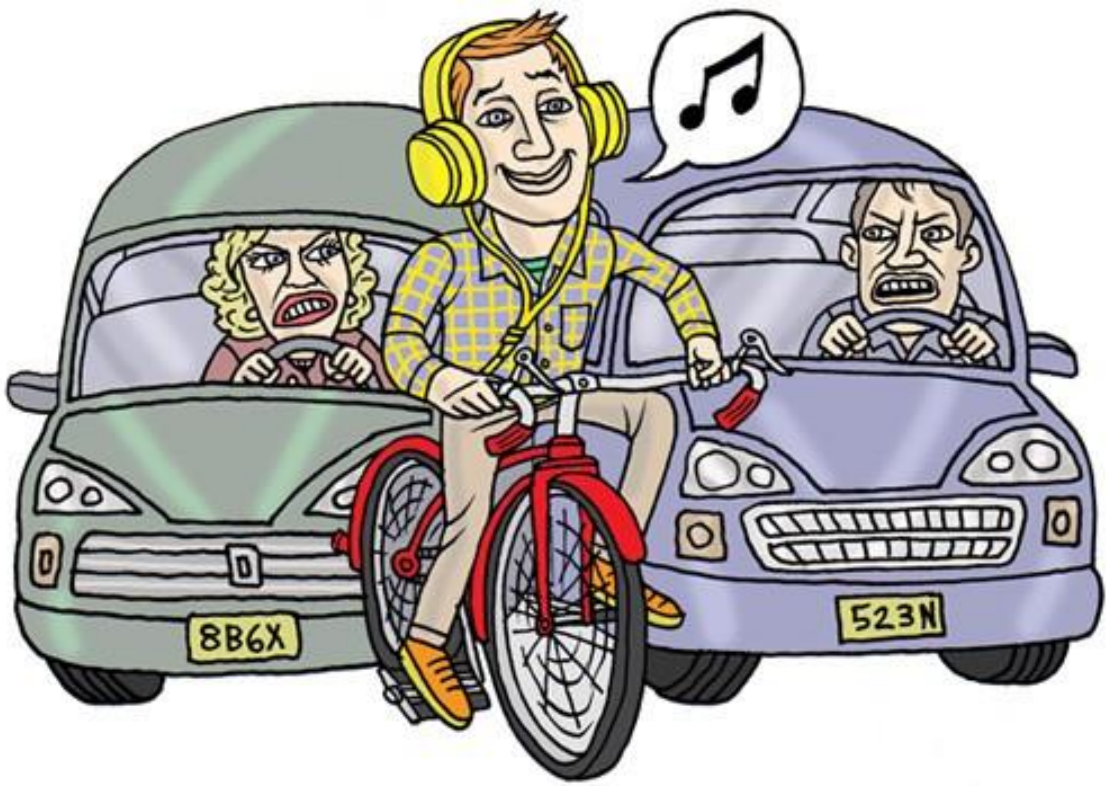


Pedestrian/cyclist detection systems

V2P/B communication

- Suitability?

Thank you



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