The University Of Sheffield.

Influence of road lighting on cyclist numbers and safety

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Lighting Research Group, University of Sheffield

29th CIE Session

Washington, 17-19 June 2019


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Three questions for today…

1) Can lighting encourage more cycling after-dark?

2) How does lighting affect cyclist's ability to see hazards?

3) What else needs considering alongside lighting, to make cycling safe at night?

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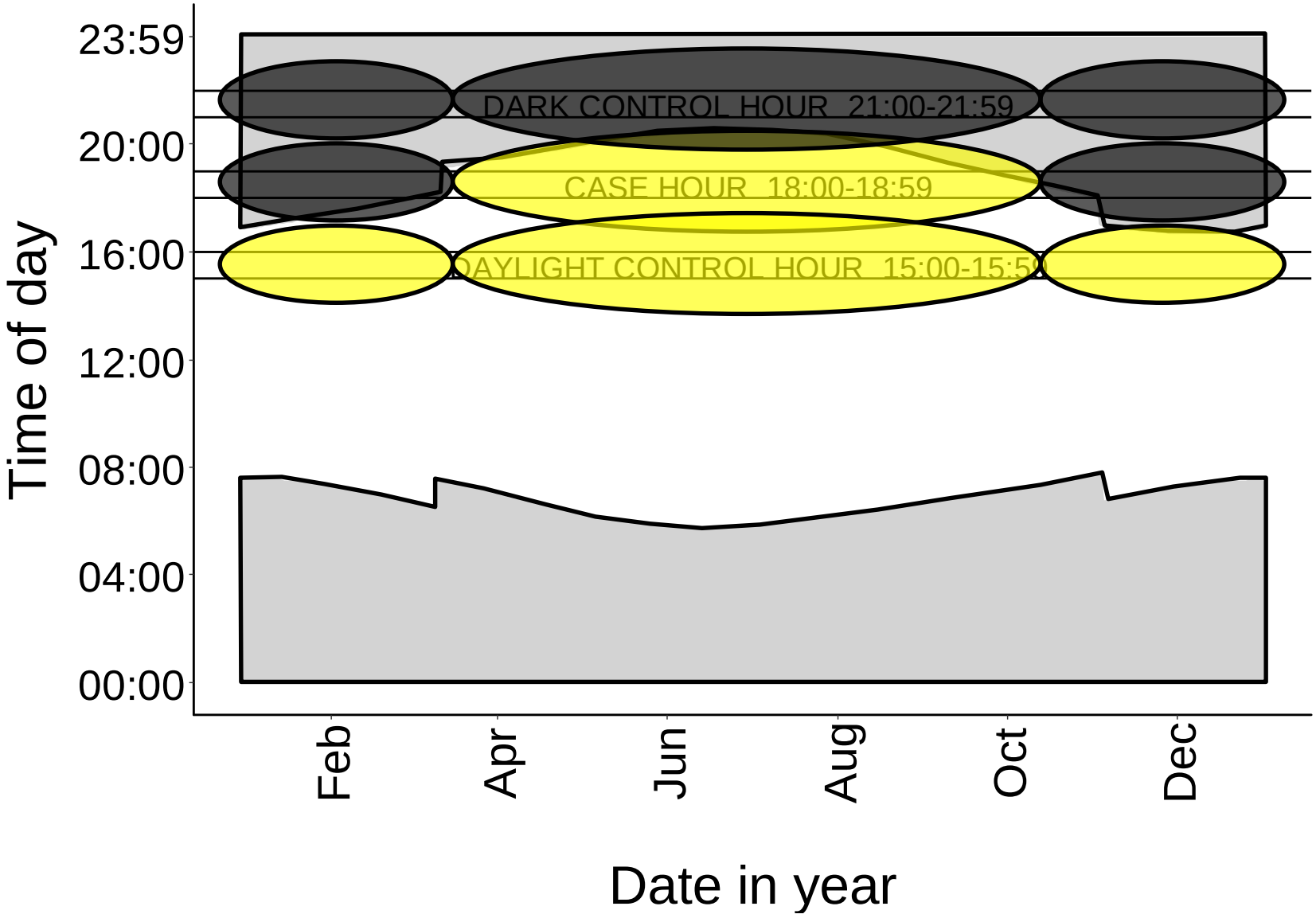
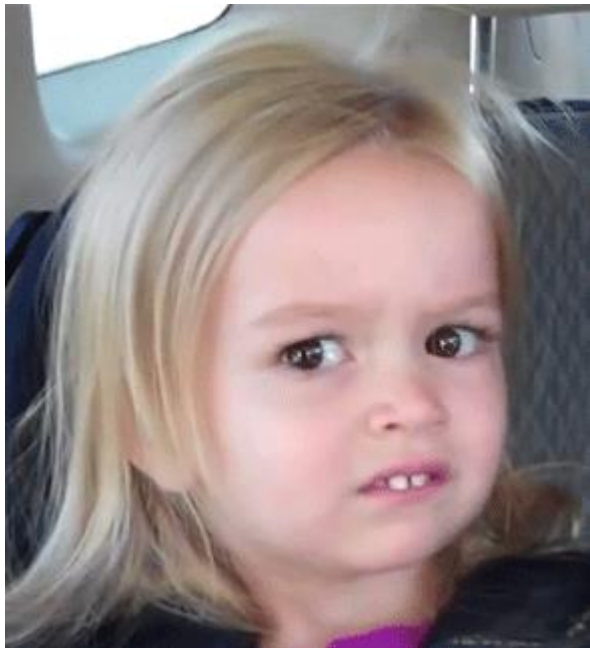
Quantifying effect of darkness



Quantifying effect of darkness – odds ratio

$$\frac{\text{Case hour in daylight} \div \text{Case hour in darkness}}{\text{Control hour when case hour in daylight} \div \text{Control hour when case hour in darkness}}$$

= Odds ratio – effect of darkness on cyclist numbers



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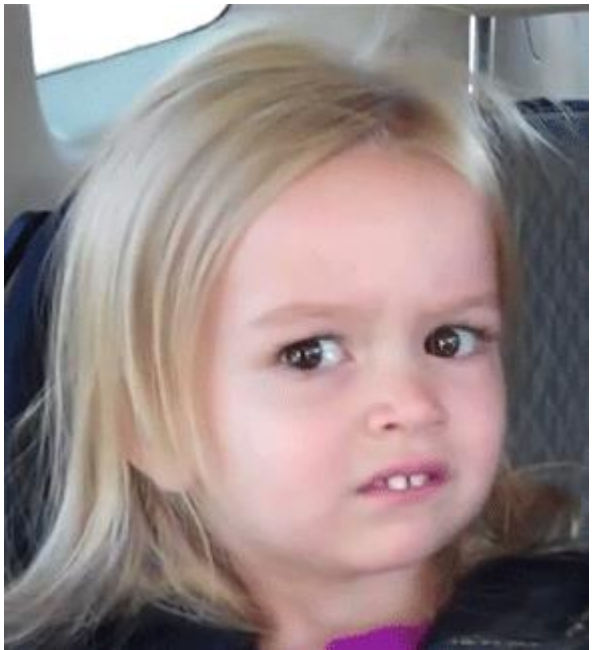
Odds ratio > 1 indicates darkness causes decrease in cyclists



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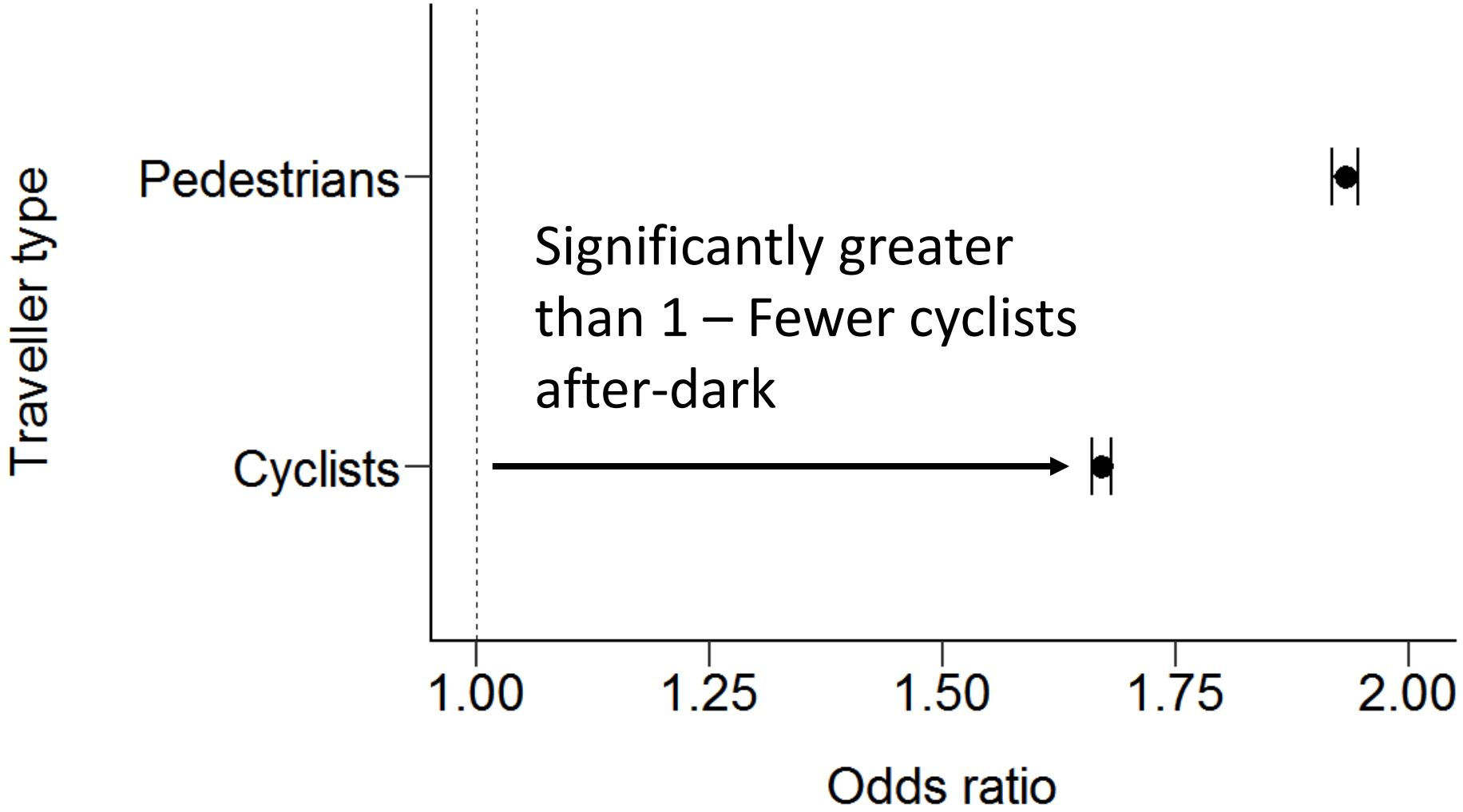
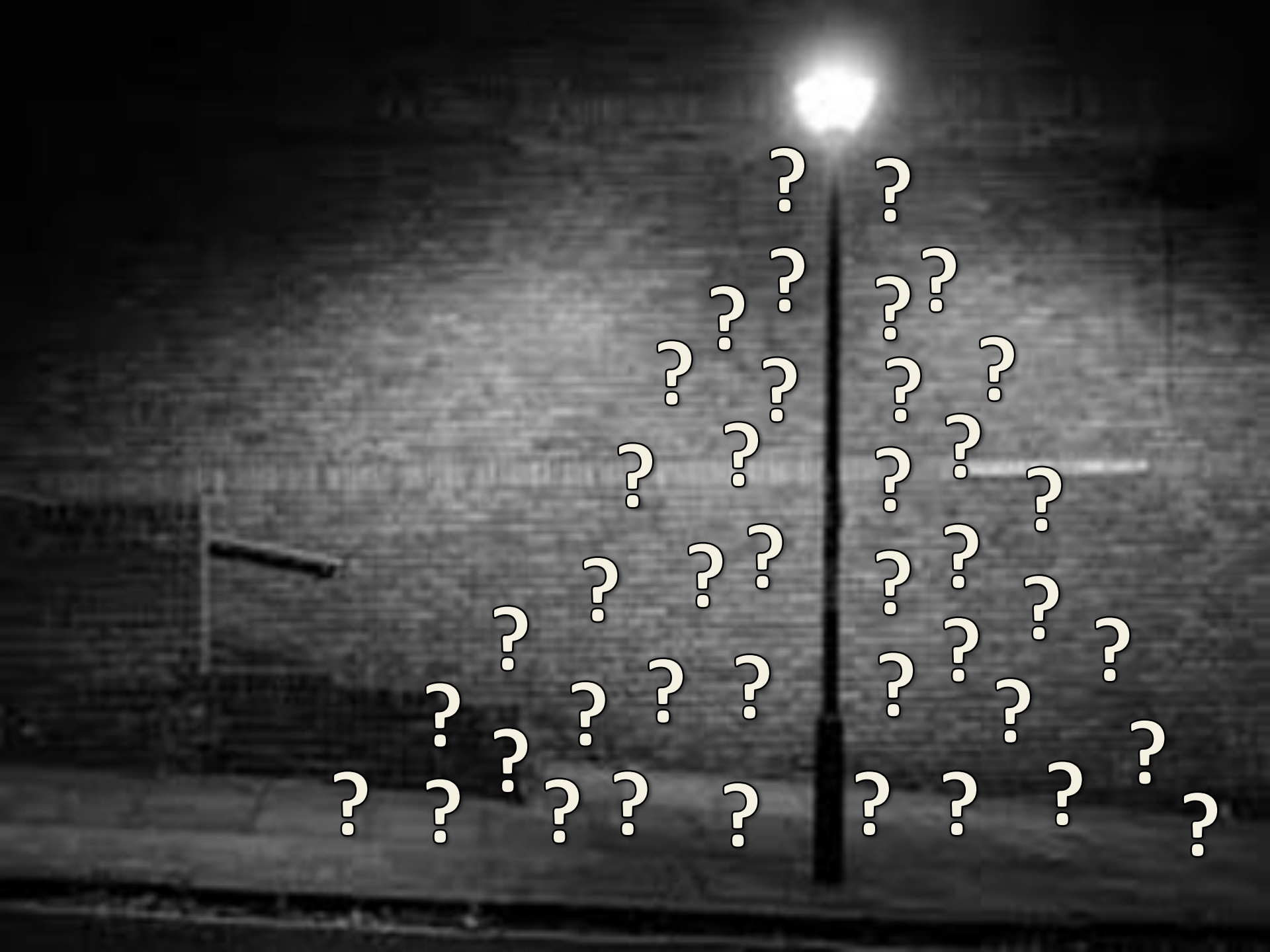


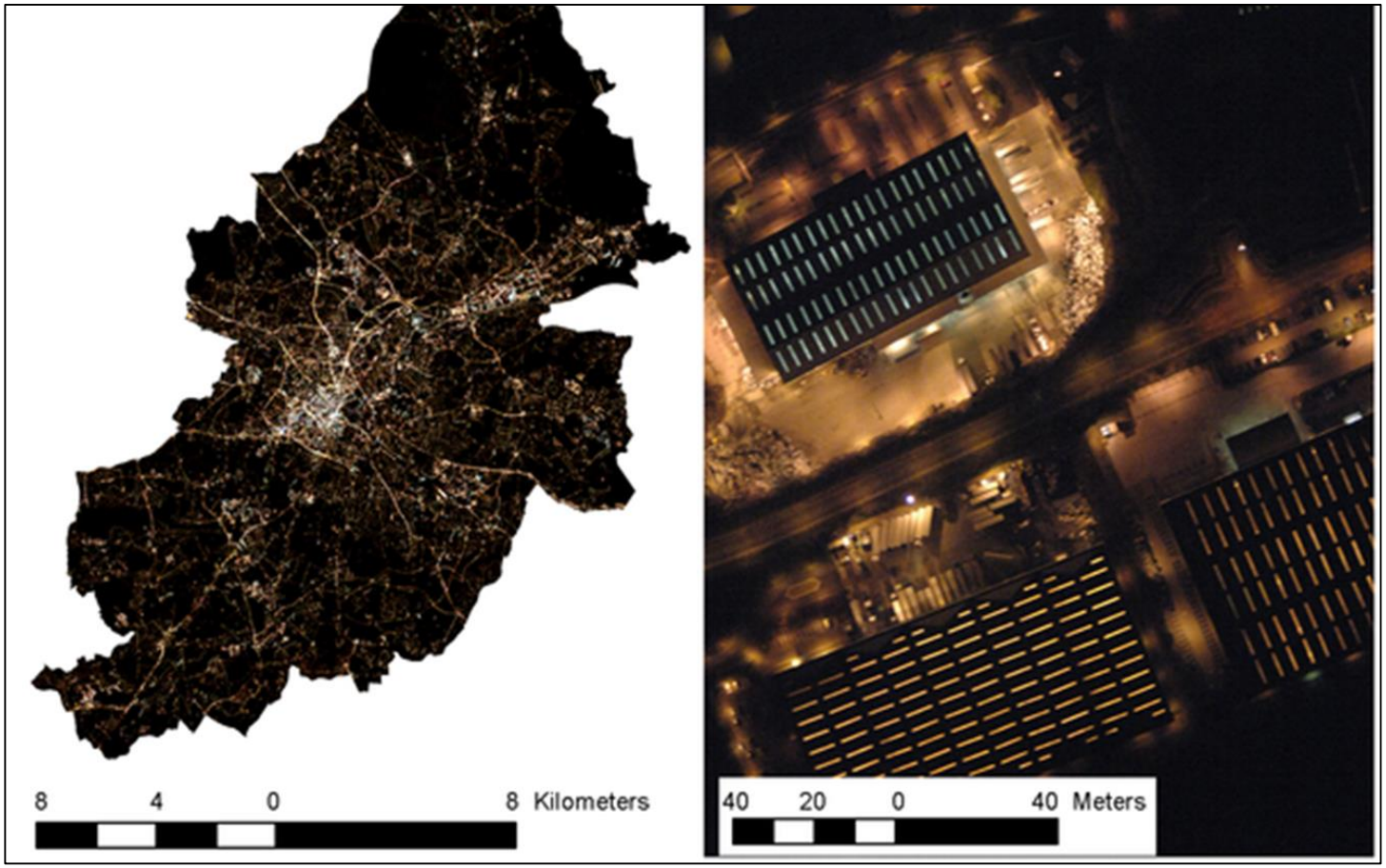
Source: Fotios, Uttley & Fox (2017), “A whole-year approach showing that ambient light level influences walking and cycling”



Lighting data

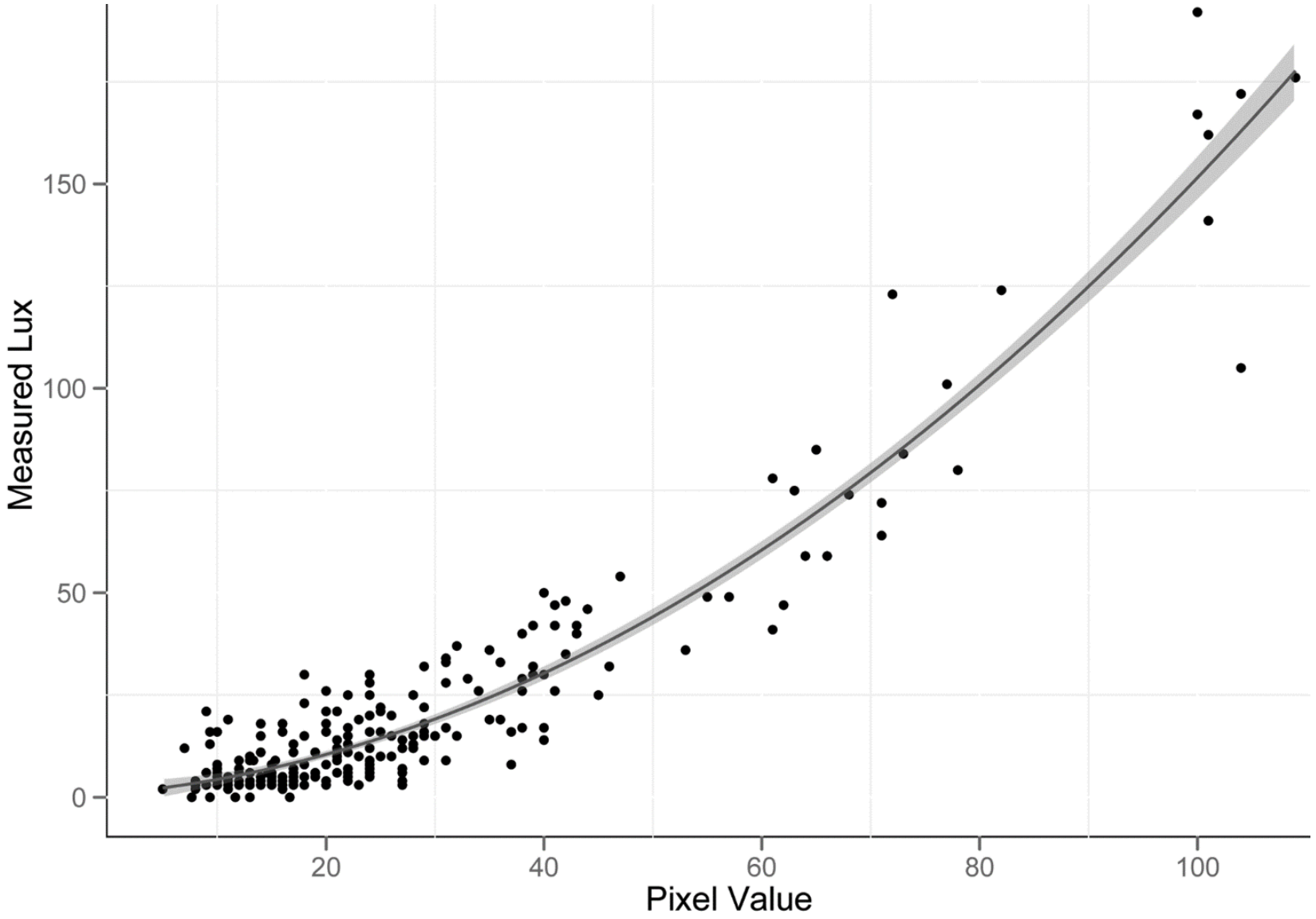
Night-time aerial photography for Birmingham – UK Environment Agency

Pixel intensities provide information about brightness and colour of lighting



Source: Hale et al (2013), “Mapping Lightscapes: Spatial patterning of artificial lighting in an urban landscape”

Lighting data

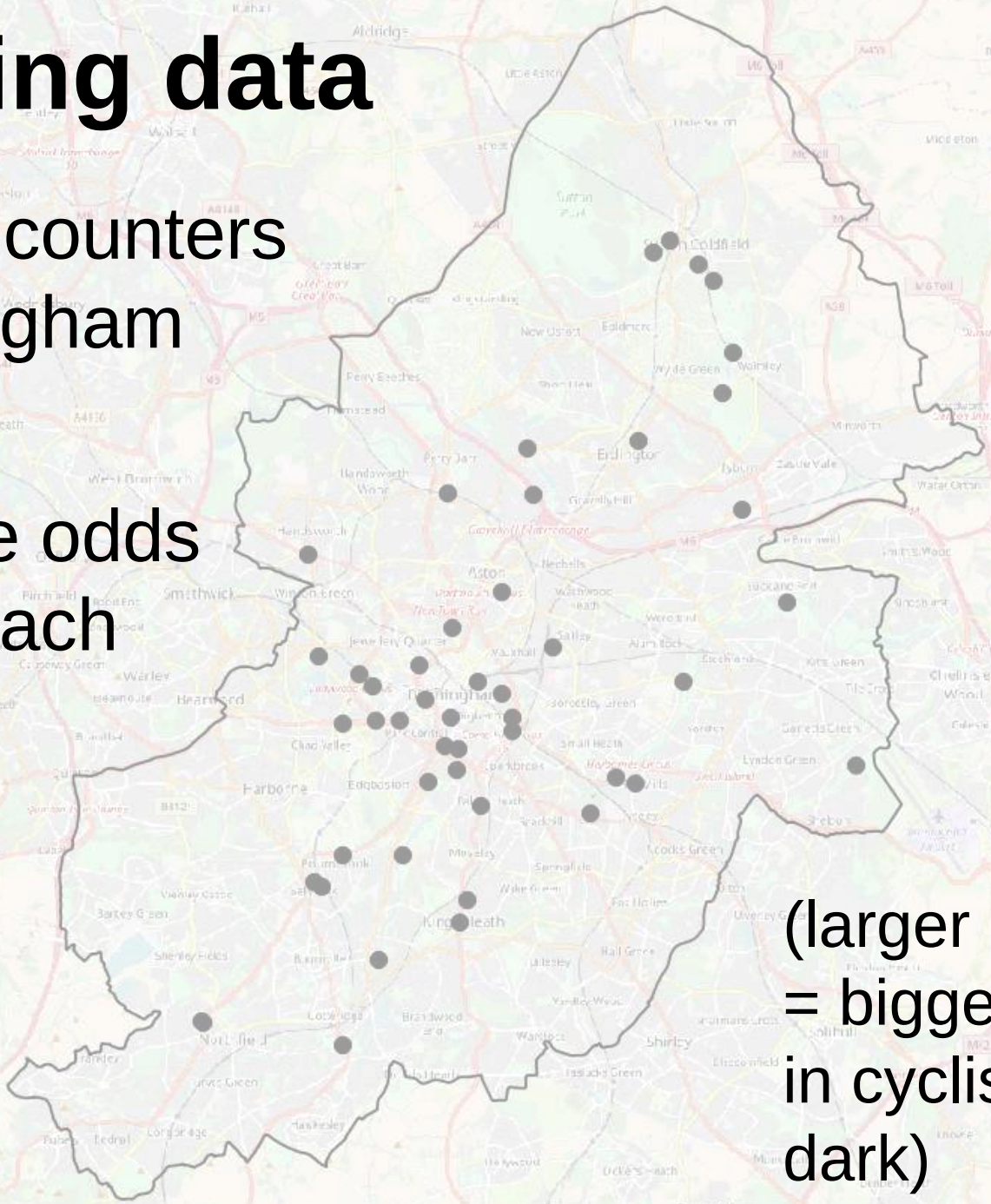


Source: Hale et al (2013), “Mapping Lightscapes: Spatial patterning of artificial lighting in an urban landscape”

Cycling data

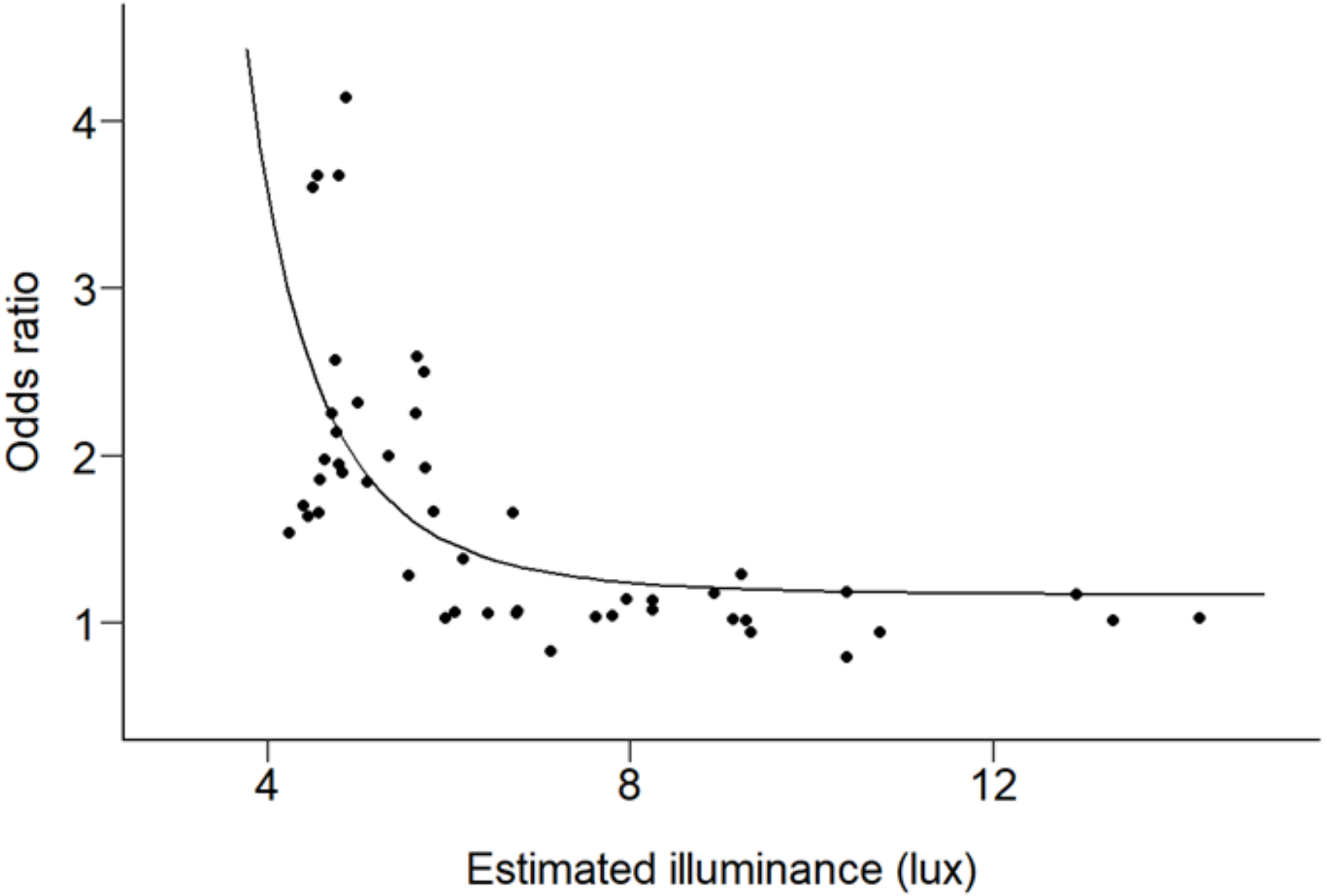
48 cycle counters in Birmingham

Calculate odds ratio at each counter



(larger odds ratio = bigger reduction in cyclists after-dark)

Illuminance and cycling after-dark



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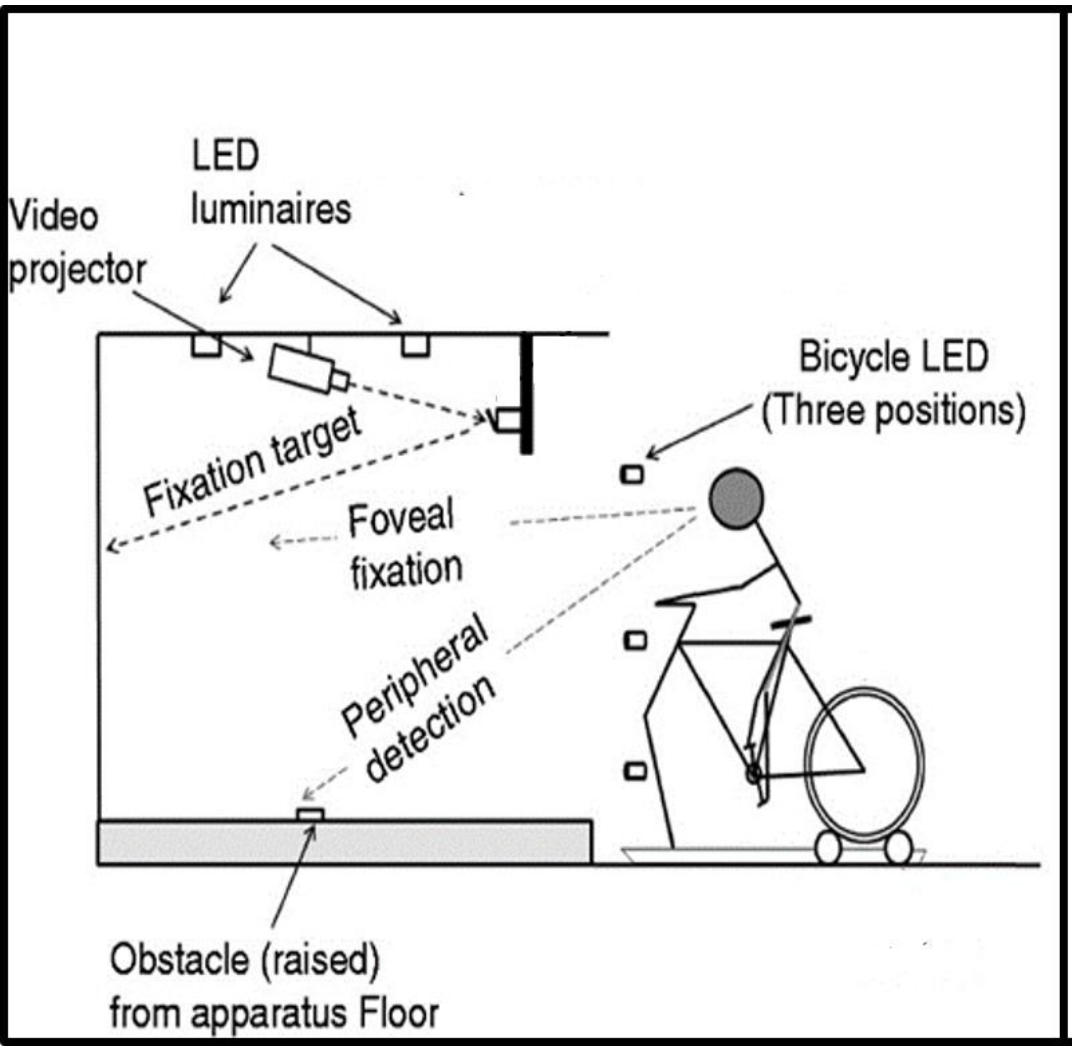
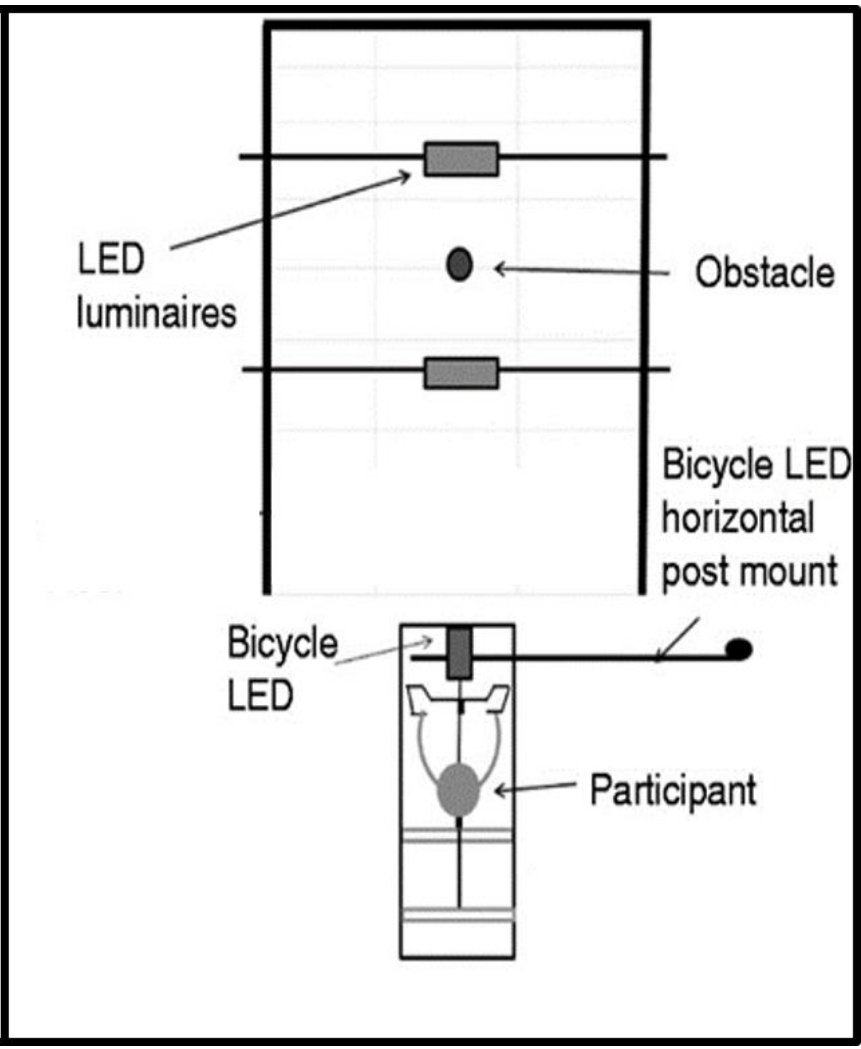
Cyclist obstacle detection experiment

Section



Plan



Cyclist obstacle detection experiment

Three related experiments

30 participants

Obstacle detection task, using peripheral vision

Increased realism: cycling activity, dynamic fixation target

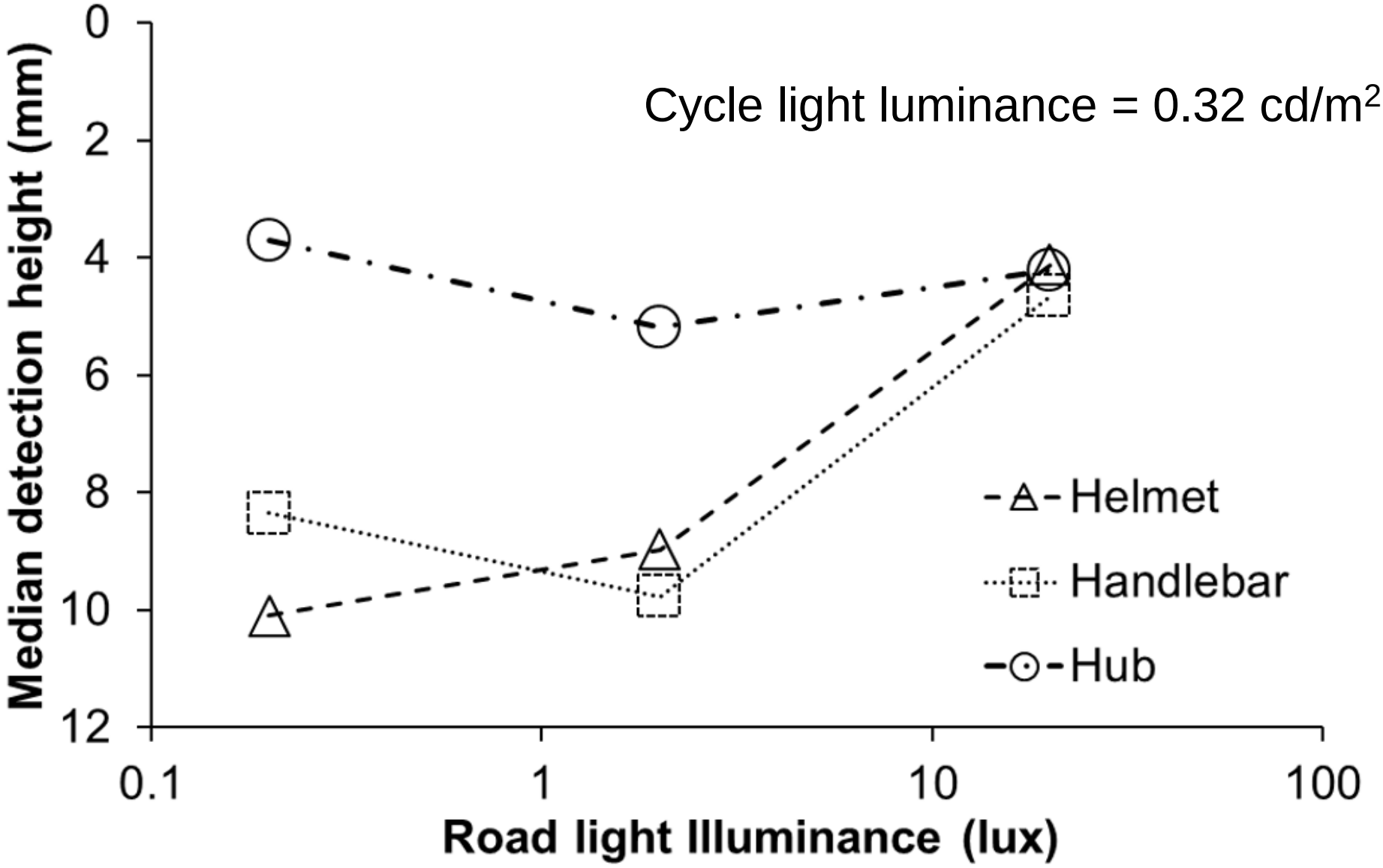
Independent variables:

- Overhead lighting illuminance (0.2 – 20.0 lux)
- Cycle light luminance (0 – 1.0 cd/m^2)
- Cycle light position (hub, handlebar or head)

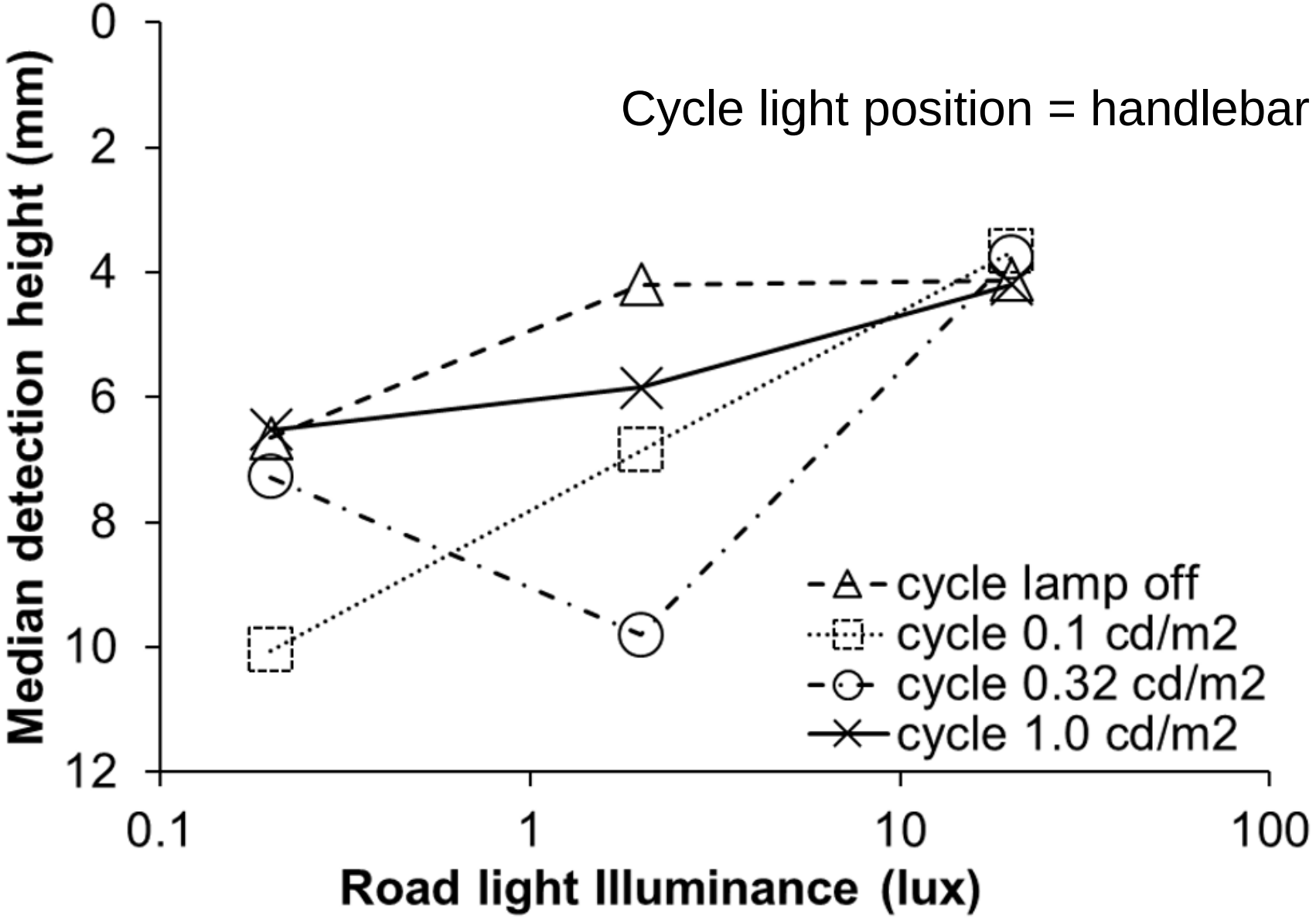
Dependent variable:

- Height of obstacle when detected

Finding 1: Hub better than handlebar-mounted



Finding 2: Cycle lights ineffective



Cycle lights for being seen…

Video source: Allen Krughoff via YouTube, https://www.youtube.com/watch?v=QpYn4LrtH-o
[clipped using https://www.kapwing.com/]

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Detecting a cyclist – contributing factors

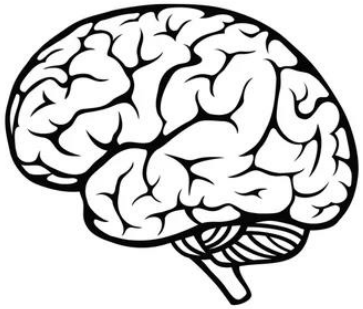
Can lighting make a difference?

Visibility

Conspicuity

- Sensory

- Cognitive



https://v637g.app.goo.gl/s2BFqZ6crQidjhMo6

Improving cognitive conspicuity

‘Fault-based’ vs ‘Presumed liability’ prosecution system

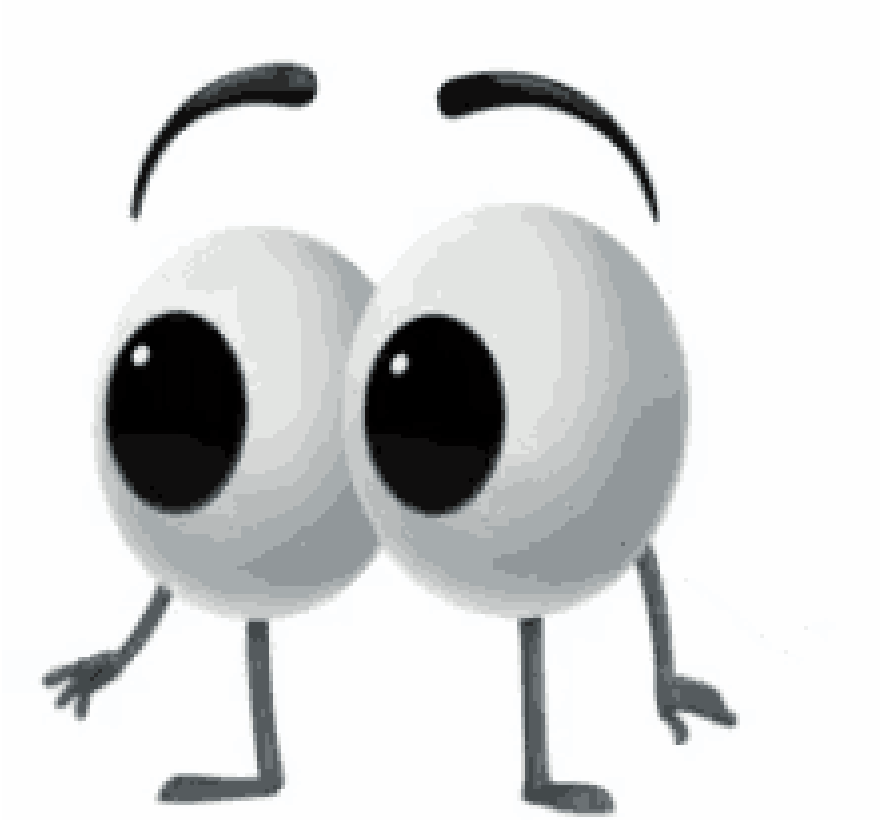
Country	Type of law	Cyclist modal share	Cyclist fatalities per billion km
Denmark	Presumed liability	18%	5-15
Germany	Presumed liability	10%	15-20
Netherlands	Strict liability	26%	8-12
Switzerland	Presumed liability	6%	Not available
UK	Fault-based	2%	25-40
United States	Fault-based	1%	55-60

Source for table: RoadShare (2014). *The case for presumed liability on Scotland’s roads.* Available online: http://www.roadshare.co.uk/research [accessed 10/06/2019]

Improving cognitive conspicuity

‘Fault-based’ vs ‘Presumed liability’ prosecution system

Presumed liability shifts responsibility for collisions to driver



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Thanks for listening

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http://www.lightingresearch.group.shef.ac.uk/

New CIE Research Forum – Lighting for Cyclists

Thursday 20th June, 2:00 – 3:30pm, Thurgood Marshall East