The overtaking behaviour of motorized vehicles in cyclists with and without a child on the same bicycle in the Brussels Capital Region

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Safe Overtaking Manoeuvre

Road Safety Advisory Council (Australia)

Distance is exaggerated for effect. Leave at least 1.5 metres when passing a cyclist on higher speed roads.
Unsafe Overtaking Manoeuvre
Introduction

Methods

Main finding 1

Main finding 2

Main finding 3

Conclusion

Safe overtaking manoeuvre

perceived traffic risk

cycling prevalence

(1-3) see last slides
<table>
<thead>
<tr>
<th></th>
<th>Larger lateral clearance distance</th>
<th>Smaller lateral clearance distance</th>
</tr>
</thead>
</table>
| The motorized vehicle (3-7) | / | Professional drivers
Larger vehicles
Opposing traffic |
| The road environment (6-10) | Tangent section
Wider roads
On-road cycling lanes | Curved sections
Centreline |
| The cyclist (4-6, 11-13) | Higher speed
Being female
‘Police’ vest | Closer to the edge (road and cycling lane)
Helmet wearing |
Introduction

Aim of the study

- Lateral clearance distance
- 3 cycling conditions:
  → Cyclist without child
  → Cyclist with child bike seat
  → Cyclist with child bike trailer
- Safest means of transport
**Methods**

**Measurements**
- Instrumented bicycle (distance sensor)
- 17 cycling trips
- Regular commuter/utility cyclist

**Road**
- One single, flat, bidirectional road
- Two types of cycling infrastructure
- Brussels Capital Region

**Cycling conditions**
- 3 different conditions
Methods

Sensor

- Ultrasonic distance sensor
  - accuracy: ± 1 cm
  - frequency: 10 measurements per second
- Mounted on luggage rack
  - Subtraction for outermost point
    - Bicycle handlebar
    - Child bike trailer
Main finding 1

• 1417 overtaking manoeuvres
• Mean lateral clearance distance = 124.2 cm
• Significantly > 100 cm
• 25.4% < 100 cm
• Safety problem!
  ➢ Punishment?
Main finding 2

- Cyclists without child = 117.3 cm
- Cyclists with child = 127.5 cm
- Larger and safer with child
- Drivers’ perception (13)
- Overtaking manoeuvre = adjustable (13)
Main finding 3

• Lateral clearance distance
  ≈ cycling condition
  ≈ peak traffic hours

• Off peak traffic hours
  - Child bike trailer = safer than without

• Morning & evening peak traffic hours
  - Child bike seat = safest

* Significant at $p \leq 0.05$
Conclusion

- Larger lateral clearance distances when a child is present
- Safest way of child transport dependent of
  - peak traffic hours
- Child bike seat safest during peak hours
- Illegal overtaking manoeuvres occur in every category
### Conclusion

- Specific study area (11)
- Generalising of the results?
- Other regions, cities and/or countries
- Speed and type of the motorized vehicle
Thank you for your attention


References


Q&A - Data Analysis

Statistical analyses using R

- Checking for random effects (cluster sampling) \(\Rightarrow\) session = significant
- Further tests corrected for session
- Multi model influencing
- Combination of 3 models to form 95% confidence set
  - Distance \(\sim\) cycling condition * peak traffic hours
  - Distance \(\sim\) cycling condition + peak traffic hours + infrastructure
  - Distance \(\sim\) cycling condition + peak traffic hours
- Mixed effects regression
A priori analysis with G*Power 3.0.10

- Small effect size ($f=0.10$)
- Significance level $\alpha=0.05$
- Power of $1-\beta=0.80$

$\rightarrow$ Number of overtaking manoeuvres $= 1290$
**Q&A - Study Area**

**Brussels Capital Region**

- extensive public transport network
- dense, very congested network of urban motorways
- network of various different cycling infrastructures

<table>
<thead>
<tr>
<th>Commuting Trips</th>
<th>2005</th>
<th>2014</th>
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<tbody>
<tr>
<td>Car</td>
<td>45.1%</td>
<td>37.9%</td>
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<tr>
<td>Public Transport</td>
<td>47.2%</td>
<td>53.1%</td>
</tr>
<tr>
<td>Bicycle</td>
<td>1.2%</td>
<td>3.0%</td>
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<tr>
<td>Peak traffic hours</td>
<td>Cycling infrastructure</td>
<td>Cycling condition</td>
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<td>-------------------</td>
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<tr>
<td>Off-peak</td>
<td>Shared lane marking</td>
<td>Without child</td>
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<td>Child bike seat</td>
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<td>Child bike trailer</td>
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<td>Bike lane</td>
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<tr>
<td>Morning peak</td>
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<td>Evening peak</td>
<td>Shared lane marking</td>
<td>Without child</td>
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<td>Child bike trailer</td>
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</table>
Q&A Cycling condition

Mean lateral clearance distance
- Significant difference
- Without child < Bike seat
- Without child < Bike trailer
- Bike seat = Bike trailer

Illegal manoeuvres
- Without child = 34.6%
- Bike seat = 21.2%
- Bike trailer = 20.6%
Q&A Cycling Infrastructure and Traffic

Mean lateral clearance distance

- Cycling Infrastructure
  - Insignificant difference
  - Shared lane marking = 125.5 cm
  - Bike lane = 123.1 cm

- Peak Traffic Hours
  - Significant difference
  - Off > Morning
  - Evening > Morning