The Benefits of Direct Vision

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Accident Statistics

In the EU 4,254 people died in collisions involving heavy goods vehicles (HGVs) in 2011.

28% of road deaths following HGV collisions were Vulnerable Road Users:
- 15% pedestrians
- 7% cyclists
- 6% powered two-wheeled vehicles
Project Purpose & Aims

• There are currently NO research studies examining whether Direct Vision of vulnerable road users could improve road safety.

• OUR MAIN QUESTION:

Does Direct Vision (windows) enhance road safety compared to Indirect Vision (mirrors)?
Vision is critically important when driving!

Traditional Cab

Low-entry Cab

Indirect

Direct
Mirror Image

Mirrors provide useful visual information not directly visible to drivers. However, there are potential safety issues:

- Mirrors can distort reflected objects
- Reflected objects may be overlooked compared to direct objects
- Recognition rates compromised near mirror edges
- Mirrors may be set up incorrectly, impairing coverage
- View can be influenced by elements such as rain and dirt

Our Focus
Our Research

Three ongoing experiments:

1. Reacting to Visual Objects
   - Direct vision – via windscreen
   - Indirect vision – via mirrors

2. Driving and Braking
   - Traditional vs. Low-entry cab

3. Added Cognitive Load
   - Reacting to Visual Objects
   - Traditional vs. Low-entry cab
Laboratory Set-up: Virtual City Driving
Laboratory Set-up: Mirror positioning
Task Design: High Visibility

High Visibility
Task Design: Low Visibility
Task Design: Pedestrian
Experiment 1: Reaction Times

The results showed that **direct vision responses were on average 0.7s faster** than indirect vision.

![Bar chart showing reaction times for different object types: Pedestrian, High Vis (blue), Low Vis (grey). RT doubled for Low Vis (grey) compared to Pedestrian.]
What would this delay mean?

At slow (15mph) driving speeds this would cause 4.7m of extra travel before braking. At 5mph (pulling off speed) this still equates to 1.5m extra travel.

These distances are more than enough to collide with a pedestrian in front of the vehicle.

<table>
<thead>
<tr>
<th>Speed</th>
<th>Extra Travel</th>
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<tbody>
<tr>
<td>15mph (24km/h)</td>
<td>4.7 m</td>
</tr>
<tr>
<td>10mph (16km/h)</td>
<td>3.1 m</td>
</tr>
<tr>
<td>5mph (8km/h)</td>
<td>1.5 m</td>
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Experiment 2: Pedestrian Collisions

To assess if slower Reaction Times in Experiment 1 would lead to more collisions, we examined driving when pedestrians crossed the road in front of the vehicle.

Traditional cab

Low-entry cab
Experiment 2: Pedestrian Collisions

We analysed driving when pedestrians crossed the road in front of either a Low-entry cab or Traditional cab.

Do slower Reaction Times mean more collisions in city driving?

Yes. The Traditional cab increased incidence of pedestrian collision by 23%.
Experiment 3: Added Cognitive Load

Drivers usually perform other tasks when driving that can be distracting.

Experiment 3 examined the impact of a concurrent task on Reaction Times and Collisions.

As previously Direct and Indirect vision (or Traditional/Low-entry cab) conditions were examined independently.
Experiment 3: Added Cognitive Load
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Does cognitive load slow Reaction Times?

Yes. Cognitive load slowed Reaction Times by an additional 0.5 seconds (for both Direct and Indirect vision)
Experiment 3: Added Cognitive Load

Does cognitive load impact on collisions?

Yes. Proportion of drivers colliding with pedestrians increased by 40% in the Traditional cab when cognitively loaded.
Summary of Findings

Indirect Vision (via mirrors as opposed to windows)

- 0.7 sec slower reaction time
- 1.5 m increased distance prior to braking (at 5 mph)

Potential but undetermined causes

Objects /VRUs overlooked in mirrors

- Gaze and/or attention toward road

Potential but undetermined causes

- 0.5 sec slower reaction time
- 1.1 m increased distance prior to braking (at 5 mph)

Cognitive Load

Potential increased likelihood of collision

23%

Potential increased likelihood of collision

40%
Further Details

• These are preliminary research findings

• End of project report submitted to TfL 14/10/2016

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