Can a rear view assistant keep older cyclist safe?


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Introduction

- The older population has increased in number and also their cycling has increased (Veiligheid NL, 2011; CBS, 2007)

- Older cyclist are at increased risk of injury (van Boggelen et al., 2005)

- Older adults (65+) are overrepresented in the group of seriously injured cyclists involved in single-sided accidents (Zeegers, 2010).

- Turning left on a crossing is especially perceived as a problem by elderly cyclists (SWOV, 2012).

- Prevention of single-bicycle accidents is needed and has become a focus point in Dutch policy
If you could be warned by an advisory system, in what situation or during what activity you would prefer a warning or receive information?

- Dangerous locations
- Slippery road
- Warn of traffic approaching from rear
- Inform on approaching traffic situation
- Warn of approaching traffic
- Explanation of traffic signs
- Braking for an intersection
- Intersections without traffic lights
- Intersections with traffic lights
- Wind
- High speed
- Oscillating while cycling
- Support by starting cycling
- Avoiding roundabouts
- Leaning over

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

- Very important
- Important
- Unimportant
- Very unimportant
If you could be warned by an advisory system, in what situation or during what activity you would prefer a warning or receive information?

- dangerous locations
- slippery road
- warn of traffic approaching from rear
- inform on approaching traffic situation
- warn of approaching traffic
- explanation of traffic signs
- braking for an intersection
- intersections without traffic lights
- intersections with traffic lights
- wind
- high speed
- oscillating while cycling
- support by starting cycling
- avoiding roundabouts
- leaning over

**Results:**

- **very important:** 60%
- **important:** 20%
- **unimportant:** 10%
- **very unimportant:** 10%
This study

• The aim of this study was to evaluate rear-view assistance for older cyclists, by applying various forms of feed-forward technology, to warn for approaching traffic from behind.

• Testing a first simple prototype of a rear-view assistant and evaluate influence on mental workload and acceptance
Method

- Participants inclusion (age 65 and older, cycling)
- Experiment set-up
Method procedures

• Cycling simulator indoor in a laboratory setting

• Approaching intersection

• Is it safe to….
  ...Turn left?
  ...Turn right?
  ...Go straight?

• 3 sessions/conditions
  – Feed-forward light (n=14)
  – Feed-forward vibration (n=14)
  – No feed-forward (n=14)
Method

Measures (RSME\(^1\), Acceptance Scale\(^2\), PDT-task\(^3\))

Rating Scale Mental Effort

Please indicate, by marking the vertical axis below, how much effort it took for you to complete the task you've just finished.

---

Rating Scale Mental Effort: Zijlstra, 1993
Acceptance scale: van der Laan, Heino & de Waard, 1997
Method

Measures (RSME\textsuperscript{1}, Acceptance Scale\textsuperscript{2}, PDT-task\textsuperscript{3})

Rating Scale Mental Effort

Please indicate, by marking the vertical axis below, how much effort it took for you to complete the task you've just finished.

Acceptance scale

- usefulness
- satisfaction

Useful | _________ | Useless
Pleasant | _________ | Unpleasant
Bad | _________ | Good
Nice | _________ | Annoying
Effective | _________ | Superfluous
Irritating | _________ | Likeable
Assisting | _________ | Worthless
Undesirable | _________ | Desirable
Raising Alertness | _________ | Sleep-inducing

Rating Scale mental Effort: Heino & de Waard, 1985
Acceptance scale: van der Laan, Heino & de Waard, 1997
Method

Measures (Peripheral Detection Task-PDT)

• Secondary task measuring the amount of remaining mental workload.

• While cycling, a small red light was presented in the periphery of the functional visual field.

• Cyclists had to respond to the light by pressing a micro switch.
Preliminary results

- 11 participants
- Mean age: 73.82 years (SD: 4.81, MIN: 66, MAX: 83)
- Women: n=6
  Men: n=5
Preliminary results

Rating Scale Mental Effort

<table>
<thead>
<tr>
<th>Effort 0 - 150</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO-FF</td>
</tr>
<tr>
<td>FF-Vibration</td>
</tr>
<tr>
<td>FF-Light</td>
</tr>
</tbody>
</table>

Graph showing mental effort ratings for different conditions.
Preliminary results

Rating Scale Mental Effort

Effort 0 - 150

NO-FF  FF-Vibration  FF-Light
Preliminary results

Rating Scale Mental Effort

Effort 0-150

NO-FF  FF-Vibration  FF-Light
Preliminary results
Van der Laan-Satisfaction

Acceptance

Vibration

Light

1 2 3 4 5 6 7 8 9 10 11

-2 -1,5 -1 -0,5 0 0,5 1 1,5 2 2,5
<table>
<thead>
<tr>
<th>Warning type</th>
<th>PDT Missed %</th>
<th>PDT Avg RT: (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO–FF</td>
<td>37%</td>
<td>735.3</td>
</tr>
<tr>
<td>FF–Vibration</td>
<td>38%</td>
<td>779.7</td>
</tr>
<tr>
<td>FF–Light</td>
<td>43%</td>
<td>704.4</td>
</tr>
</tbody>
</table>
Discussion & Conclusion

• Workload does not increase unnecessarily
• FF-vibration was experienced as less demanding
• In general, useful and satisfying.

• Limitations
  – Controlled simulation
  – First-time users → practice is needed
  – PDT red light interfered with system
  – Few participants
• December 2014: more experiments planned!
Thank you for your attention

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