Assessing Text Reading and Text Entry While Driving Using the Visual Occlusion Technique

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Objective

Use visual occlusion to assess the distraction potential of text entry and text reading tasks of varying difficulty

Background

• Driver distraction impacts road safety
• Increasing presence of in-vehicle infotainment systems motivates the need to assess their distraction potential
• Visual occlusion: A surrogate driving task that may provide an efficient way to assess distraction potential

Methods

Experimental Design

- Task Type
  - Text Entry
  - Text Reading
- Task Length
  - 4 char
  - 6 char
  - 12 char
  - 24 char
  - 60 char
  - 90 char
- Ambient Text
  - Yes
  - No

Text Entry

- Computer displays a word
- Driver enters the word letter by letter
- Driver presses ENTER when done

Text Reading

- Computer displays a phrase
- Driver presses ENTER after reading
- Computer needs a statement
- Driver presses TRUE or FALSE

Visual occlusion mimics eye glances to and from roadway by alternating vision and occlusion

Occlusion goggles with 1.5 s vision: 1.5 s occlusion cycles (ISO 16673)

Participants

• 28 participants (14 men, 14 women)
• 4 age groups (18-24, 25-39, 40-54, and 55-75 years old); 7 in each group

Analysis Framework

- Repeated measures ANOVA
- Dependent variable:
  - Total Shutter Open Time (TSOT): total time during which vision is not occluded while working on a task
  - Log transformed to meet ANOVA assumptions
- Independent variables:
  - Within-subject factors: task type, task length, and ambient text
  - Between-subject factors: gender and age group

Results

- Task type-task length interaction
- TSOT ≤ 9s
  - Short: Yes
  - Med: Yes
  - Long: Yes
- TSOT ≤ 12s
  - Short: Yes
  - Med: Yes
  - Long: Yes

Summary & Discussion

- TSOT was shorter than total task time in static condition
- Ambient text had no significant impact on TSOT
- The occlusion technique is easier to implement and analyze, compared to on-road and simulator studies (no eye tracking & coding of video needed)
- Limitations of the occlusion technique:
  - Does not provide insights on real-world situations; there is no long glances due to controlled occlusion
  - No natural timesharing occurs between driving and the secondary task; no task to attend to during the occlusion cycles

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