Factors Affecting Glance Behavior when Interacting with In-vehicle Devices: Implications from a Simulator Study

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BACKGROUND
- In-vehicle devices should not induce long off-road glances
- Secondary tasks may divert drivers’ attention from the roadway
- Individual glances that exceed 2s double the crash risk³

STUDY OBJECTIVE
- Examine the impact of in-vehicle task types, text lengths, and the presence of task-irrelevant texts on driver’s glance behavior

METHODS

PARTICIPANTS
- 28 participants (15 males, 13 females)
- 4 age groups: 18-24, 25-39, 40-54, 55-75 years old; 7 drivers in each group

EXPERIMENTAL DESIGN
- Within-subject independent variables: Task type, Length, and Irrelevant text
- Repeated measures ANOVAs were used to examine:
  - Maximum glance duration (Max-GD): The longest duration of all individual glances during a task
  - Total eyes-off-road time (TEORT): The sum of all individual glances during a task

DRIVING SCENARIO
- Four-lane undivided rural road with speed limit of 55 mph
- Drivers were asked to maintain 50 mph and 2-second headway

RESULTS

DRIVER RISK LEVELS
- Hierarchical cluster analysis using:
  - Maximum glance duration
  - Average no. of glances
  - Average percentage of eyes-off-road (EOR)
- Two clusters
  - High risk (n=8)
  - Low risk (n=20)

MAXIMUM GLANCE DURATION
- Exceeded 2s even for short text entry tasks and low-risk drivers
- Significantly increased with text length
- However, the increase was not linear
- No difference between medium (6 char) and long (12 char) length text entry

TOTAL EYES-OFF-ROAD TIME
- Increased linearly as text length increased
- Task-irrelevant text significantly increased TEORT
- 0.4s to 1.1s longer when irrelevant text was present
- No significant differences between high- and low-risk drivers

DISCUSSION
- Evaluations should consider extreme glance behaviors and individual differences
- Crash risk might be best represented by extreme glances rather than mean²
- Large individual difference on the MAX-GD may relate to:
  - Risk taking propensity³
  - Chunking techniques: Typing several letters at once
- Task-irrelevant text may impact driver’s ability to separate text box from clutter of surrounding text
- Shortening the text length does not guarantee safer EOR durations for high-risk drivers
- Recommendations include designing type-ahead feature and providing real-time alerts

REFERENCES

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