Eye-Gaze Demonstrates Planning in Activities of Daily Living
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Abstract
Mobile eye-tracking technology provided assessment of eye-gaze during tasks of everyday living without interfering with task performance. Planning was evidenced by substantial look-ahead gazes that were correlated with diminished comparable gazes during task-relevant steps. The approach to executive function assessment appears to have promise for those with brain-injury.

Methods
Participants
Five males (one with frontal lobe brain injury) and 3 females, ages 20 to 43, participated in the experiment.
Task
Participants were asked to complete 5 task of everyday living. 1) Wash hands. 2) Pour a drink of juice. 3) Set the table for two. 4) Butter a slice of bread. 5) Wash a cup.

Eye movements were monitored using a modified video-based infrared Applied Science Laboratories (ASL) mobile eye-tracking system. To determine the impact of the technology, participants performed each task three times: 1) Without eye-tracker; 2) With eye-tracker; 3) Without eye-tracker. Gaze activity was recorded during the second trial. Analyses examined the number and duration of look-ahead fixations on objects relevant for future steps, step-relevant fixations (fixations on objects relevant for the current step) and other fixations on objects not relevant to the current or future steps.

Results
Minimal Effects of Wearing Mobile Eye-Tracking Equipment
Both controls and experimental participants show a decrease in task time from no equipment (Trial 1) to the eye-tracking trial (Trial 2).

Times for eye-tracking (Trial 2) and subsequent performance without equipment (Trial 3) are very similar. There may be a learning effect, but the eye-tracking does not seem to produce task interference.

Common Planning Patterns
All participants showed substantial LOOK-AHEAD eye movements (looking at relevant objects prior to the step)

Controls: 14%-38% of gaze duration 25%-78% of step-relevant looking
Experimental 9%-32% of gaze duration 14% to 83% of the step relevant looking

In 4 of the 5 tasks look-ahead durations were negatively correlated with step relevant durations.

Findings and Discussion
Total and relative task response time indicated little effect on task performance of monitoring eye-gaze with mobile eye tracking technology. This approach therefore presents a useful way to assess planning activities. Look-ahead gaze behavior indicated that participants do exhibit substantial planning while performing tasks of everyday living. Negative correlations of look-aheads and step-relevant gazes indicate that advance (planning) gaze may decrease the need for looking at the relevant objects during actual task performance. Based on a single brain-injured participant, the same approach may be useful in assessment of change in executive function following injury.

References


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