USE OF EYE-TRACKING IN ERGONOMICS: A FIELD STUDY OF LIFT TRUCK OPERATORS’ WORK ACTIVITY

INTRODUCTION

Work inspectors’ reports [CSST 2005] from 1974 to 2004 identified 84 cases where the accident was fatal either for the lift truck operator or a co-worker.

In 28 of these cases, the lack of visibility due to the lift truck or the load carried, or the visual demands of the operator at the time of the accident, were either cited or presumed factors. Collision and overturning are the main types of fatal accidents.

Except Hella et al. [1991], few studies exist on the visual behavior and visual needs of operators of powered industrial vehicles. The aim of this paper is to present preliminary results of the use of an eye-tracker to study vision-related issues, and to discuss the feasibility of using such an instrument in field studies.

METHOD

An ergonomic analysis of the work activity of lift truck operators was done, with emphasis on their driving strategies. Fifteen of the operators participating in the study wore an Isaac ETL-500 eye-tracker while performing their usual duties. The average age of the operators was 45.4±10.6 years, and their work experience varied from 3 to 32 years.

Three groups were studied: 1) shipping of palletized paper products (n=6), 2) reception and distribution of bulk paper rolls (n=5), and 3) palletized paper products and cartons, using their own POR video data.

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The analysis focused on situations where collisions and overturning were liable to occur: moving through intersections, encounters with other lift trucks and backing-up. The objects or places in the work environment on which the POR was superposed were noted in selected portions of the activity using CAPTIV™ software. Interviews were conducted with operators, using their own POR video data.

RESULTS

PART OF TASK IS VISUALLY INTENSIVE: Frame-by-frame analysis of selected video segments identified tasks corresponding to fixations exceeding 250 ms on a single object or group of close objects, or corresponding to a series of fixations related to the same task.

LIMITED NUMBER OF POR TARGET OBJECTS: Items specific to a variety of tasks were identified (tip of fork, base of pallet, edge of door, …) but also visual activity related to the evaluation of distance between load and sidewalk, or between tip of fork and pallet.

VISUAL ASPECTS OF THE LIFT TRUCK OPERATORS’ WORK (IN PROGRESS)

Operators in Group 1 went through 131 intersections within the plant, managed 182 encounters with other lift trucks and backed up 352 times while loading a total of 70 pallets into vans and moving around 36 other pallets inside the warehouse. Partial results related to visual information acquisition by the lift truck operators are presented here.

“SAFETY” AWARENESS: The POR marker coincided with safety specific items (ramp), with co-workers on foot, and with other lift trucks. Anticipatory glances toward other operators’ locations, and checking behind the lift truck before backing up were also observed to be an ongoing behavior. Moving a load in reverse over a long distance remains an issue. Mirrors suspended from the ceiling were seldom used.

VISUAL IMPEDIMENTS: Relevant scenes showing the POR were selected to investigate visual obstructions and blind spots in order improve the visibility offered by the lift truck’s structure.

KNOWLEDGE ELICITATION: The use of POR videos during interviews elicited knowledge from the operators, for example, about the optimal placement of palletized loads in a truck and the strategies adopted for dealing with the right-of-way with other operators at intersections.

CONCLUSION

The high visual demand shown by the eye-tracking data reflects the complexity of the lift truck operator’s job and offers some plausible explanations for accidents involving collision, but less for overturning.

Eye-tracking will not completely replace an in-depth ergonomic analysis but can help in distinguishing work activities that are visually intensive or that have a significant cognitive component.