Visual perception and response behavior by driving simulator and eye tracking system

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Abstract

The aim of this work was to evaluate a tool measuring the driver’s skill of visual perceptions and motor behavior in various traffic situations. For this aim, the relationship between the eye movement and the response properties for trained, untrained, and aged drivers was examined. In an experiment, eye movements during simulated driving were measured using a driving simulator and eye tracking system. Histories of eye movements of driver were superimposed on driving road scenes. The results of eye movement of the driver showed that visual stimuli in the peripheral vision affected eye movements during driving. In situations where there are few objects to be attended to (e.g., a straight road), the amount of eye movement were smaller, and fixation durations were longer, than in situations where there are many objects (e.g., a crosswalk). The results also showed that eye movements depend on the driver’s experience. The response properties during driving work, including perceptual, cognitive and motor abilities, were also evaluated. Some experimental paradigms were performed for measuring response times needed for detecting a visual stimulus and braking distances. The results of response times and braking distances were discussed in the context of the eye movements and the visual attention.

Keywords – response time, visual perception, eye tracking system, driving simulator, trained, untrained and aged driver

1. Introduction

It is important for a driver who drives an automobile safely to perceive hazard [1,2] which is associated with accidents in a traffic situation. The hazard perception is a needed function to take on hazard information at early stage [3,4], and the most of necessary information is obtained from visual information processing and visual attention [5]. Therefore it is useful to analyze the relationship between the feature of eye movement and response time. For this aim a driving simulator and an eye tracking system were used. An experimental paradigm is performed for the measurement of time histories of eye movements during the driving by simulator. The experimental system proposed in this paper is able to realize the situation of driving and analyses of human factor for awareness of hazard or risk. Another aims of this work is also to offer the knowledge for hazard information by relevance between several traffic situations and human factors in order to forecast a human behavior such as visual attention during driving work.