Investigating visually distracted driver reactions in rear-end crashes and near crashes based on 100-car study data

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Abstract

Rear-end crashes are common accident scenarios and account for approximately 30% of all police-reported accidents in the United States. Previous studies have shown that driver inattention just before the rear-end crashes or near crashes is a major contributing factor. To improve the development of active safety systems, which take into account driver inattention, it is important to understand when and how the driver reacts; from the moment the driver shifts state from being distracted to attentive and becomes aware of the potential threat. This paper investigates the reaction (braking, steering) selection that visually distracted drivers make in a critical rear-end crash situation using the 100-car naturalistic driving study data. A simple model describing the driver's perception reaction time (PRT) based on headway distance to the forward vehicle is presented. The results presented in this paper can assist further studies where more data will be available and help elucidate how people react to critical near crashes and crashes on road.

Introduction

Rear-end crashes have been shown as the most frequent among all crash types, accounting for 29% of all police reported crashes in the United States, summing up to approximately 1.8 million annually (Najm et al., 2007). Society and industry have found crashes to be a serious problem and several solutions have emerged over time. Between the 60s and 80s safety belts emerged followed by airbags. In the 90s new active safety systems, exemplified by anti lock brakes and electronic stability control, supported the driver-vehicle system from loosing stability. From the year 2000 and onward the focus has shifted towards active safety systems assisting the driver in a non-attentive situation. For example, a forward collision warning (FCW) system behaves like an ever vigilant guardian alerting the driver if the driver response to a forward braking vehicle is delayed or missing. If the driver is estimated to be incapable of reacting in time the vehicle may apply autonomous emergency brake.

One important input in designing forward collision warning systems, roads, and assessment of the benefits of new driver assistance systems is perception reaction

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