Statistics have shown elderly drivers to be the party at fault in disproportionately more crashes than any other age group of drivers (NHTSA, 2003). Limited vision due to vehicle blind spots, difficulty in determining the speed of other vehicles, and a lack of focus on the roadway ahead, are all characteristics of changing lanes that create a situation where information must be processed quickly for completion of a safe maneuver (Alcon, 2008).

A three-year study of crash data from five states (Illinois, Michigan, Minnesota, North Carolina, and Utah) found elderly drivers were 63% more likely to be merging or changing lanes just before a collision. In addition, elderly drivers were five times more likely than younger drivers to fail to yield when merging or changing lanes (Knoebel, 1997). One reason why driver-side and interior rearview mirrors may fail to provide enough information for safe lane changes is they often do not provide drivers with a complete view of the area to the rear and sides of a vehicle (Ayres, 2005). The National Highway Traffic Safety Administration (NHTSA) states that looking at an inanimate object while merging increases the chances of being in a traffic accident (1999). A study of preferred shapes for warning labels showed equilateral triangle pointing downward was the most preferred warning shape of US citizens, followed by the diamond, the octagon, and the equilateral triangle pointing upward (Riley et al., 1982). The fact that these symbols are preferred as a warning suggested to the researchers that these shapes should not be used in a potential HUD.

An investigation of visual cues to improve driver safety in changing lanes

**Overview**

A preliminary study was conducted to find an effective augmented reality cue to be used in a collision avoidance system (CAS) study to aid elderly drivers in lane changing decisions.

Results from the first study are being used to create a lane-changing experiment that will determine the relationship between biological factors and patterns of performance and safety errors in elderly drivers.

**Background & Significance**

Vallejos are an OHR system structure that can aid in a go-to network. The length of a collision avoidance with emergency age (Bottini et al., 2007; Grevani et al., 2004; Frank et al., 1986) Fig. 1. Vallejos determine dwell times and valve opening times to help drivers avoid collisions. The average dwell time in elderly drivers was found to be 0.021 seconds longer than that of young drivers (Bottini et al., 2007). The average dwell time in elderly drivers was 0.021 seconds longer than that of young drivers (Bottini et al., 2007). The average dwell time in elderly drivers was 0.021 seconds longer than that of young drivers (Bottini et al., 2007). The average dwell time in elderly drivers was 0.021 seconds longer than that of young drivers (Bottini et al., 2007). The average dwell time in elderly drivers was 0.021 seconds longer than that of young drivers (Bottini et al., 2007). The average dwell time in elderly drivers was 0.021 seconds longer than that of young drivers (Bottini et al., 2007).

Findings specific to biological factors indicate that cellular processes in return are sensitive to aging (Bottini et al., 2007). The research push forward understanding biological results to solve traffic accidents. Recent research push forward understanding biological results to solve traffic accidents. Recent research push forward understanding biological results to solve traffic accidents. Recent research push forward understanding biological results to solve traffic accidents. Recent research push forward understanding biological results to solve traffic accidents. Recent research push forward understanding biological results to solve traffic accidents. Recent research push forward understanding biological results to solve traffic accidents. Recent research push forward understanding biological results to solve traffic accidents. Recent research push forward understanding biological results to solve traffic accidents. Recent research push forward understanding biological results to solve traffic accidents.

**Experiment one: Investigating cue types**

**Introduction**

The goal of this study was to identify an experimental design for a future study that will evaluate a CAS designed to aid elderly drivers in making informed lane change decisions.

**Hypotheses**

- It was hypothesized that the CAS would improve decision-making for safe lane changes.
- It was also expected that participants would prefer one cue type to another.

**Methods**

Six young participants drove on a set of four simulated straight sections of rural highway, which were each approximately six miles in length. Participants drove on one side of a four lane roadway while the other three lanes were free of traffic. The CAS was included in a heads-up display and was used as an aid in merging maneuvers (Figs. 1 & 2). Participants were asked to choose which lane they felt was safe to change into for the next vehicle.

**Dependent Variables:**

- Headway of the lane change
- Tailway at the lane change
- Gap selection

**Results**

There were only significant differences in half of the questions on the questionnaire. Questions specific to timing, cue position, and safety all showed no significant participant preferences.

- The cue was always presented at the same time and space as the lane change decision.
- Participants reported that both cue types had similar ratings in position and timing. The presence of a cue was perceived as effective as long as it was placed to the eye.
- Cues that were too close together were not effective because it had aesthetically pleasing features (e.g. rounded lines). Cues that were far apart were seen as more obvious in the preliminary study. Therefore, no dependent variables were significant. The aspect of a dynamic (radar) cue was not found more promising results.

**Conclusion**

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**Experiment two: Biological factors and older driver safety**

**Introduction**

The broad goal of the research project is to determine the relationship between biological factors and patterns of performance and safety errors in elderly individuals with age-related impairments affecting speed of processing (SOP).

**Aims**

1. Evaluate the relationship between age, biological factors (e.g., telomere length), and performance of cognitive profiles (e.g., speed of processing) derived from a standardized cognitive test battery.
2. Evaluate the relationship between age, biological factors (e.g., telomere length), and performance of cognitive profiles (e.g., speed of processing) derived from a standardized cognitive test battery.

**Design**

Participants will be presented with a task requiring them to react to a visual stimulus. The presentation of a visual stimulus will involve the presentation of a graphic mapped onto patterns of traffic density and proximity to assist driving lane merging maneuvers (Fig. 3).

**Participants**

The goal is to a total of 120 subjects to account for all of the tasks. The sample size is based on the need to achieve significant results in the future study, expected dropouts in the formal study, and to obtain an adequate sample size (100) for analyzing telomere length.

**Methods**

The experiment is conducted with six participants. Participants in the experimental group are older drivers. Participants in the control group are young drivers.

**Dependent Variables:**

- Headway of the lane change
- Tailway at the lane change
- Gap selection

**Results**

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