

Promotion of Proactive Behavioral Change to Prevent Human Error

- Part 3 Effects of Presenting Consequences of Behavioral Change in Driving Behavior Intervention for Older Drivers -

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Traffic accidents involving older drivers remain an important social issue, and crossing collisions at unsignalized intersections are one of the representative accident types. Unsafe behaviors such as incomplete stopping, high approach speeds, and insufficient visual confirmation have been reported to contribute to such accidents. Therefore, effective interventions are needed not only to help older drivers understand safe driving behavior but also to promote actual behavioral change. In our previous study, we proposed an intervention combining first-person perspective presentation of the driver's own driving and an instructor's safe driving with repeated practice using a driving simulator (DS) providing real-time visual feedback. Although the method tended to reduce speed at unsignalized intersections with poor visibility, individual differences in behavioral change remained. One possible reason is that some drivers may understand what behavior should be changed without sufficiently understanding why the change is necessary or what benefit can be obtained. Therefore, this study examined how presenting the utility of behavioral change as either a merit or a demerit affects older drivers' behavior.

The target behavior was maintaining a low speed when passing through an unsignalized intersection with poor visibility. The baseline intervention consisted of first-person perspective presentation of the participant's own driving and an instructor's safe driving, followed by repeated DS practice with visual feedback based on the difference between their speeds. Three conditions were compared. The Control condition received only the baseline intervention. The Merit condition additionally received information showing that maintaining a low speed enabled collision avoidance. The Demerit condition received information showing that failing to sufficiently reduce speed resulted in an unavoidable collision. CG scenarios were presented using the DS. In the Merit condition, participants observed that low-speed driving allowed the vehicle to stop and avoid a bicycle emerging from a blind area. In the Demerit condition, they observed that insufficient speed reduction resulted in a collision despite emergency braking.

Twenty-four older adults who drove at least once per week participated in the experiment. Participants were allocated to the three groups while considering age, sex ratio, and pre-intervention instructor evaluations. They completed public-road drives before and after the intervention. Behavioral changes were evaluated using instructor ratings and objective driving data. The instructor evaluated changes in "stop-sign intersection" and "overall." Mean vehicle speed was also calculated in two sections of an unsignalized intersection with poor visibility: from the stop line to the intersection entrance, and from the intersection entrance to the point where the blind area disappeared.

The instructor ratings showed a higher proportion of improvement in the Demerit condition than in the other conditions for both evaluation items, whereas the Merit condition showed no clear difference from the Control condition. No statistically significant pre-post differences in mean speed were found in any group. Nevertheless, mean speed tended to decrease in both the Control and Demerit conditions. The effect sizes for the Control and Demerit conditions were -0.33 and -0.50 in the first section, and -0.91 and -0.50 in the second section, respectively. No large pre-post change was observed in the Merit condition.

The small change in the Merit condition may have been influenced by its pre-intervention speed distribution, which showed relatively little variability and included few participants with particularly high speeds. However, even among participants with pre-intervention speeds similar to those in the Control condition, the Merit condition did not clearly show lower post-intervention speeds. Thus, the present data did not indicate an additional speed-reduction effect of merit presentation beyond the baseline intervention. In contrast, the Demerit condition showed an overall tendency toward reduced speed, and some participants showed lower post-intervention speeds than Control participants with similar pre-intervention speeds. Particularly large reductions were observed in some participants with relatively high pre-intervention speeds. This suggests that demerit presentation may further promote behavioral change depending on the driver's pre-intervention behavior rather than uniformly affecting all drivers.

Both additional interventions concretely demonstrated the relationship between speed and collision avoidance, but the presented consequences differed: successful avoidance in the Merit condition and collision in the Demerit condition. The results suggest that presenting the negative consequence of maintaining inappropriate behavior may make the need for behavioral modification more salient and thereby promote greater behavioral change in some drivers.

In conclusion, the baseline intervention and the intervention supplemented with demerit information tended to reduce driving speed, whereas merit information produced no clear additional effect. Demerit presentation may further promote behavioral change, particularly among drivers with relatively high pre-intervention speeds. However, the sample size was small, and larger studies are needed to examine the reproducibility of these findings.