DISPLAY ROTATION AND LOCATION IN ADVANCED TRAVELER INFORMATION SYSTEM (ATIS)

A major challenge for designers of ATIS is to design displays that do not overload the driver. This is a particular concern for older drivers who may have decrements in the abilities required for safe driving. To compare information provided by an ATIS display to the real world, drivers may need to mentally rotate a display to match it with the forward view through the windshield. If the display is adjusted to reduce the amount of rotation required, the time to process the information should also be decreased. Several aviation displays implement this approach by rotating a 2-dimensional display around its center horizontal axis creating the impression of 3-dimensional depth.

The purpose of this study was to examine the utility of reducing information load from two directions. First, by examining rotated and non-rotated displays (as shown in Figure l), and second, by comparing the conventional instrument-panel mounted (IPM) location to a heads-up display (HUD) location. In addition, the effect of these interventions on older drivers was examined.

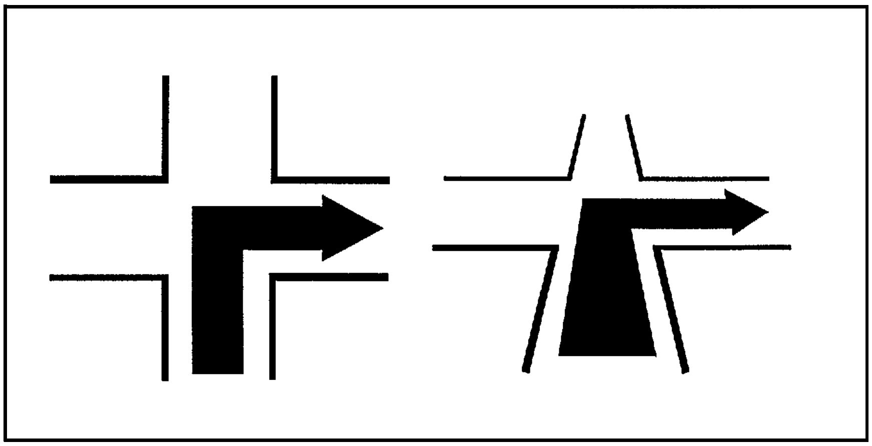

Figure 1. Picture of non-rotated (left) and rotated (right) displays.

Research Method

This study was conducted in the VIDSIM laboratory at the Federal Highway Administration's Turner-Fairbank Highway Research Center. The VIDSIM is a part-task driving simulator comprised of a modified driving buck and a 45-inch large screen television placed in front of the buck. The simulator includes a tracking task via a computer controlled servo-laser that projects a continuous red laser dot on the screen. The laser dot moves randomly back and forth across the screen and is countered by turning the steering wheel in the opposite direction. Males and females in three age groups - Young (24-40), Young-old (65-70), and Older (71+) were tested.

During the study, the drivers viewed an intersection as if they were approaching it. Several types of intersections were used including bifurcations, crossroads, and various approaches to a T-intersection. In addition, the drivers concurrently viewed an ATIS display located in either an IPM location, or in a HUD location. The displays were projected in either a non-rotated or rotated orientation. The drivers were required to indicate whether the type of intersection projected on the forward television screen matched the type of intersection presented in the ATIS display.

Results

<u>Reaction Time</u>:

- The rotated display elicited faster response times than the non-rotated display in the HUD location.
- The non-rotated display elicited faster reaction times than the rotated display in the IPM location.

<u>Resnonse Accuracy</u>:

- The rotated display elicited lower accuracy than the non-rotated display in the HUD location.
- The non-rotated display elicited lower accuracy than the rotated display in the IPM location.
- Both the Young and the Young-old groups were more accurate than the Older group in the IPM location, while there were no age group differences in the HUD location (see Figure 2).
- Young subjects were more accurate using the JPM location, while Older subjects were more accurate using the HUD location.

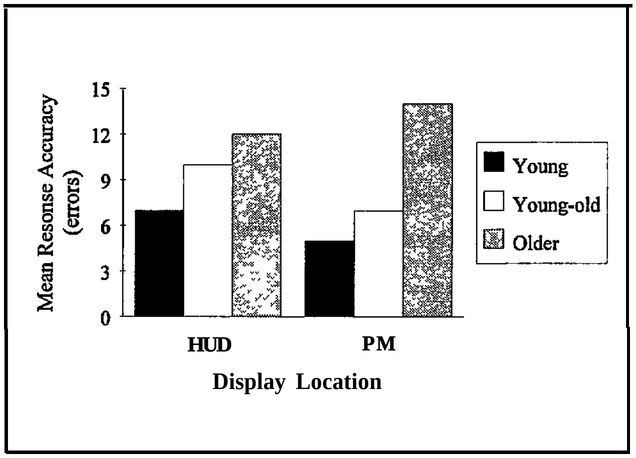

Figure 2. Mean Response Accuracy by Display Location and Age-Group.

Study Implications

The results indicate that the benefits of rotated displays are location-dependent, with the rotated display eliciting faster performance in the HUD condition, and the non-rotated display eliciting faster performance in the IPM condition. However, this finding is reversed for response accuracy, suggesting the presence of a speed-accuracy trade-off. Given this trade-off, the results of this experiment are not clear with regard to the optimal display rotation.

It is important to note that the older drivers had greater accuracy using the HUD condition than the IPM condition. This result, combined with the fact that drivers preferred the HUD location, suggests that this placement may be beneficial to all drivers, and in particular older drivers.