Spatial Ability And Advanced Traveler Information System Route Guidance

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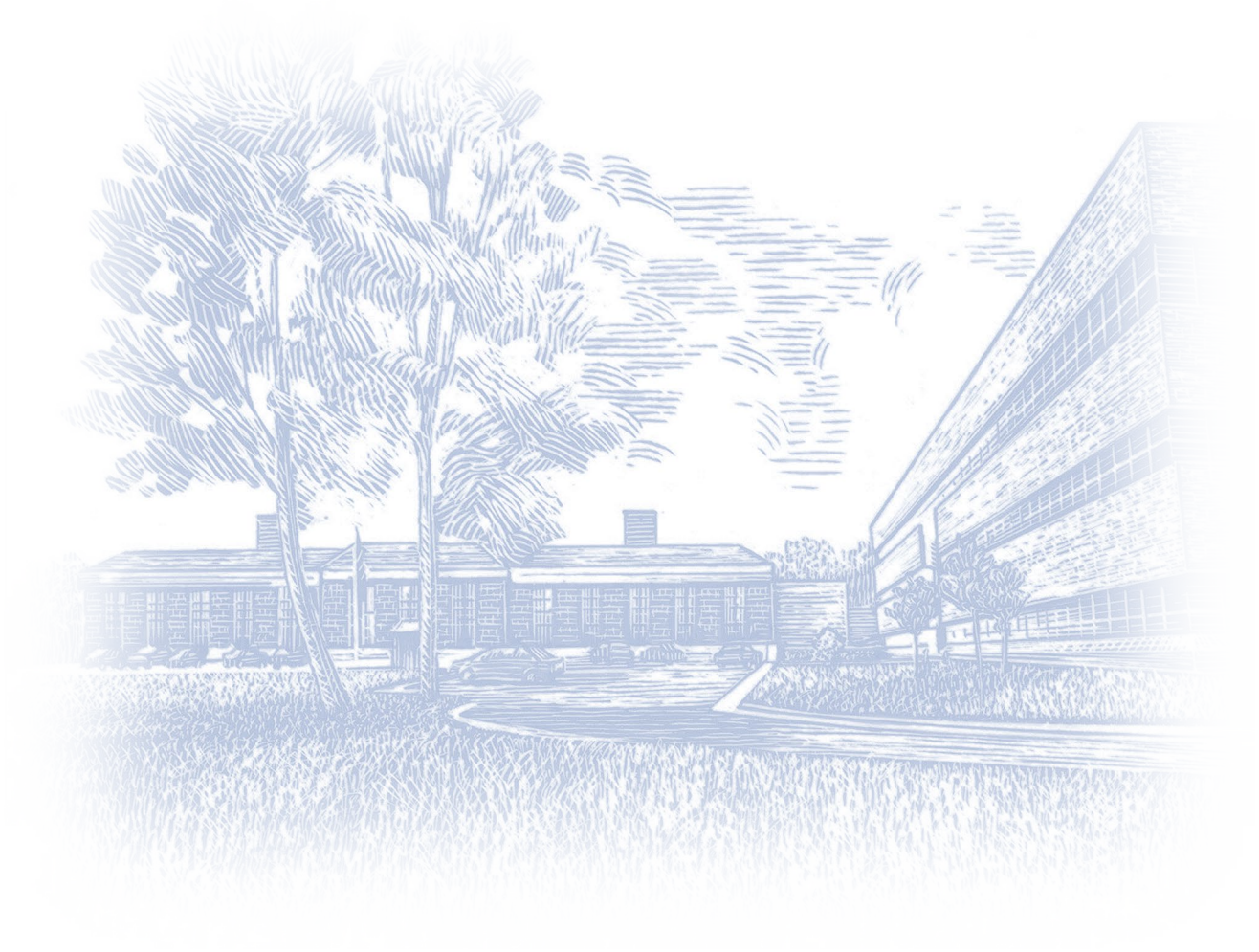

U.S. Department of Transportation
Federal Highway Administration

Federal Highway Administration
Turner-Fairbank Highway Research Center
6300 Georgetown Pike, McLean, VA 22101

Foreword

One goal of Advanced Traveler Information Systems (ATIS) is to provide in–vehicle route guidance information in order to facilitate driver navigation and mobility and to reduce travel time. An effective route guidance system would enhance the route–following ability of all drivers, including those with poor navigational skills. Drivers with poor navigational skills may be more likely to commit navigational errors; as much as 6 percent to 9 percent of all travel time has been attributed to driver navigational errors, resulting in wasted fuel, increased congestion, traffic delays, and higher risk of accidents.

Navigational skill requires spatial ability, which is the ability to process information about the relationships among objects in space and time. Navigating requires the ability to read maps, recognize terrain, be aware of one's direction, and compare the spatial features of the real world to the ATIS in–vehicle display. As a result, individuals with high spatial ability are likely to have good navigational skills, while individuals with low spatial ability are more likely to become confused and lost. Age–related declines in spatial ability suggest that older drivers may have diminished navigational skills. Older drivers may have an increased likelihood of getting lost and may have a particular need for navigational assistance. Route guidance systems would especially benefit older drivers and drivers with low spatial ability.

The objectives of this study were to determine whether an ATIS route guidance system was likely to enhance route–following performance for older drivers and drivers having lower spatial ability; and whether an ATIS route guidance system was a better navigational aid than traditional aids such as paper maps and text directions

Study Methods

In order to explore the effects of age and spatial ability on navigational ability, drivers were grouped by age and gender, and were then tested on paper–and–pencil spatial ability tests. They performed a navigational task using: (1) text directions, (2) a highlighted street map, and (3) a simulated ATIS turn–by–turn system in a driving simulator. Each driver indicated which direction the car should proceed at intersections along a route. The route was represented by the navigational aid that the driver was using at the time. Measures of the driver's ability to follow the route were defined as the number of correct navigational decisions, and the time it took to make a navigational choice (reaction time) after the car reached the selected intersection.

Study Results

The measures of spatial ability predicted the accuracy of navigational decisions, such that drivers with higher spatial ability made more correct decisions than did drivers with lower spatial ability. Also, compared to the younger drivers, older drivers performed worse on the spatial ability measures, made more incorrect navigational decisions (see figure 1), and took longer to decide which way the car should turn. The differences in spatial ability between the older and younger drivers partly explained their differences in navigational accuracy.

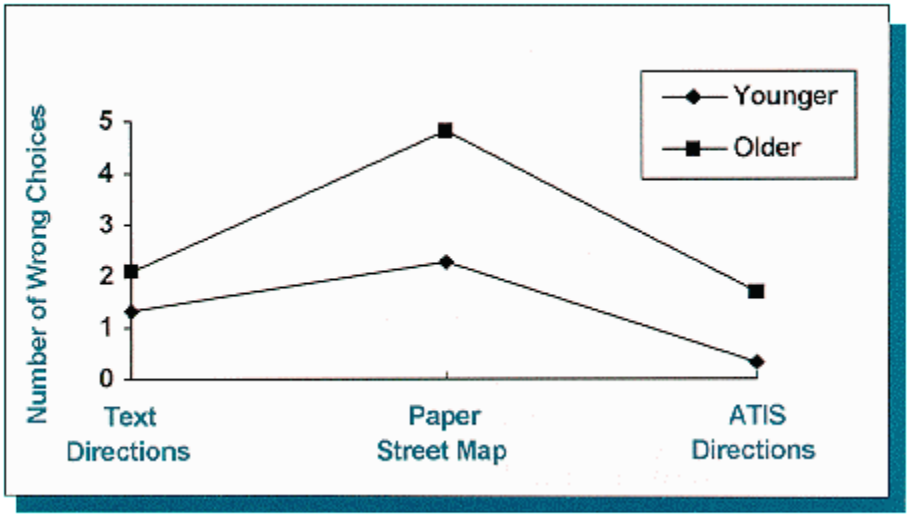

Figure 1. The number of wrong navigational choices per navigational aid

The ATIS route guidance system led to the best navigational performance for drivers of all ages, of both genders, and of high or low spatial ability. Not only did the drivers perform better when using the ATIS route guidance system, but they preferred to use it, as shown in figure 2.

Implications

The results of this study demonstrate that:

1. spatial ability predicts navigational performance,
2. navigational skill declines with age, due to age–related decrements in spatial ability, and
3. the ATIS route guidance system provided route information in a way that enhanced navigational performance of drivers of all ages and spatial ability. The implications of these results are that ATIS route guidance systems are viable navigational aids, facilitating navigational performance for both older and younger drivers, and for drivers with lower spatial ability.

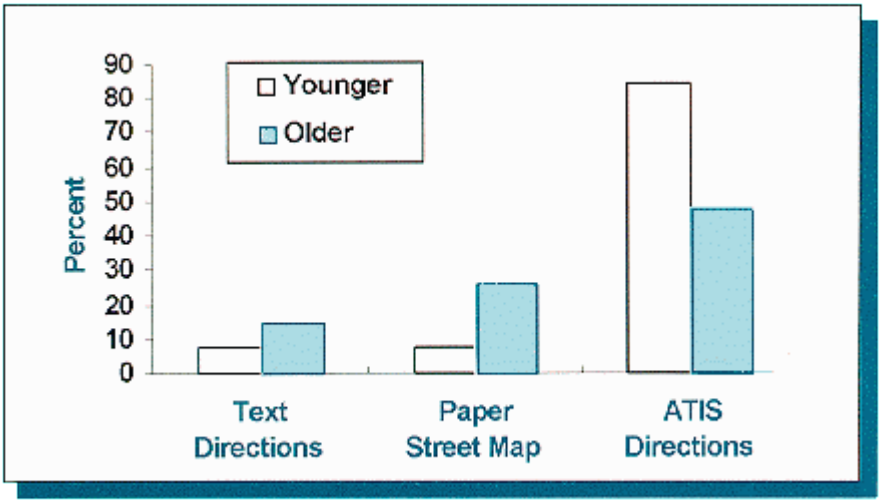

Figure 2. Driver preferences of navigational aid.

For More Information

A full report on this study is available from the FHWA R&D Report Center, phone no. 703 285–2144.
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This research was conducted by the Federal Highway Administration. For more information, contact:
Elizabeth Alicandri, Manager
Human Factors Laboratory, HSR–30
703 285–2415.