U.S. Department of Transportation
National Highway Traffic Safety Administration

TRAFFIC TECH
Technology Transfer Series

NHTSA
www.nhtsa.gov

DOT HS 811 690

February 2013

The Effect of Sight Distance Training on the Visual Scanning of Motorcycle Riders: A Preliminary Look

The scanning skills of a vehicle operator represent a key parameter for hazard perception and effective vehicle operation. Overriding one's sight distance, or not looking far enough ahead down the roadway, may not leave a motorcycle rider enough time to detect and respond to changes in the environment.

This study used eye tracker technology to monitor where motorcycle riders were looking as they rode over an open road course and a closed course. The purpose of the project was to determine if visual behavior differs between beginner riders who have received training on sight distance, beginner riders who have not received training, and experienced riders. An additional objective was to develop the data acquisition system necessary to collect these data, and to demonstrate the feasibility of collecting eye-tracking data on the open road from riders with a variety of experience levels.

Methods

Seven beginner riders who had received training from Team Oregon's Basic Rider Training (BRT) course (beginner-trained), 12 beginner riders who had not received motorcycle rider training (beginner-untrained), and 12 experienced riders completed the study. Road tests occurred three times over the course of one year: at baseline, at a 6-month follow-up, and at a 12-month follow-up. Beginner-trained and experienced riders received feedback on their sight distances at the end of each testing session. Beginner-untrained riders did not receive feedback.

At each test session, each rider wore an eye tracker (Figure 1) while riding over a closed course and an open road course. For safety reasons, beginner-trained riders were not tested on the open road course during their first testing session because these riders had almost no riding experience prior to participation in the study.

There were two measures of visual behavior: sight distance to stopping distance ratio and the magnitude of the visual gaze area. Sight distance was the distance between the rider and his or her gaze point on the roadway, calculated instantaneously by the eye tracker.

Figure 1. Helmet With Eye Tracking System

Stopping distance was the distance necessary to bring the motorcycle to a complete stop under hard braking. When this ratio fell below 1.0, the distance to stop was greater than the rider's sight distance, meaning that the rider was not looking far enough ahead to stop safely. The magnitude of the visual gaze area was defined as the size of the area the rider scanned, as measured by the x-y coordinate data provided by the eye tracker system.

It was hypothesized that the sight distance to stopping ratio of untrained riders, who did not receive training or feedback on sight distance, would fall below 1.0 more often than the other rider groups. Additionally, it was predicted that the visual gaze area of experienced riders would be larger than that of novice riders, suggesting that experienced riders scanned more of the riding environment in front of them.

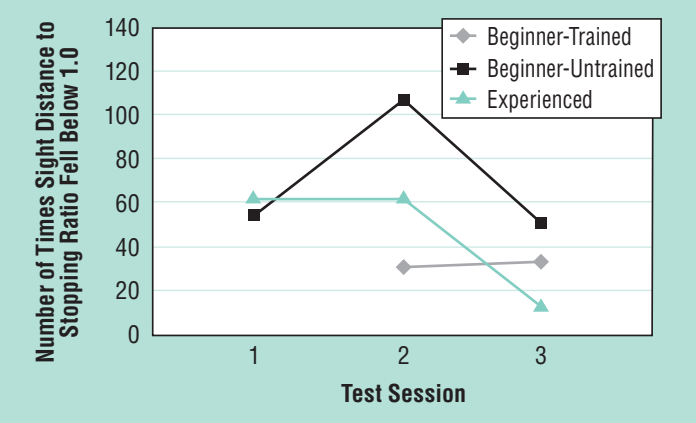
Results

Sight Distance to Stopping Distance Ratio

The number of times the sight distance to stopping distance ratio fell below 1.0 was analyzed for a curved section of the open road course, a straight section of the open road course, and a curved section of the closed course. Because beginner-trained riders did not participate in open road testing during their first test session, gaze patterns on the open road during test session 1 were not analyzed with subsequent test

sessions. During test sessions 2 and 3 on the curved section of the open road course, the sight distance to stopping distance ratio for beginner-untrained riders fell below 1.0 a mean of 72.35 times. This was significantly larger than the means for beginner-trained riders (31.09) and experienced riders (34.50). Figure 2 shows the number of times the sight distance to stopping distance ratio fell below 1.0 on this curved course section during each test session.

Figure 2. Number of Times Sight Distance to Stopping Distance Ratio Fell Below 1.0 on Curved Section of Open Road Course



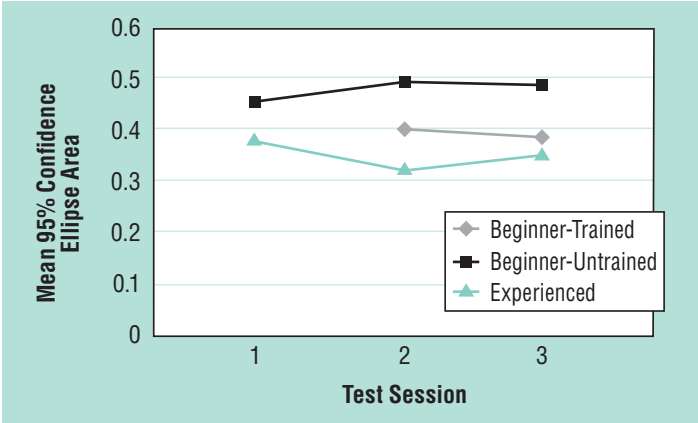
On both sections of the open road course that were analyzed, the sight distance to stopping distance ratio fell below 1.0 less often during test session 3 than during test session 2. On the closed course section and on the straight open road course section, there were no differences in sight distance to stopping distance ratio between rider groups or over time.

Visual Gaze Area

Figure 3 illustrates the size of the visual gaze area over the entire open road course. During test sessions 2 and 3, beginner-untrained riders had a significantly larger gaze area than experienced riders. The gaze area of beginner-trained riders did not differ significantly from the other two groups and fell in between them. Gaze area also did not change between the test sessions.

Over the closed course, there were no differences between rider groups in the magnitude of the visual gaze area. The magnitude of the visual gaze area on the closed course decreased over test sessions, and this change approached, but did not reach, statistical significance.

Figure 3. Gaze Area for Open Road Course



Discussion

This study demonstrated that it is feasible to collect eye-tracking data from a mix of novice and experienced motorcycle riders as they ride on the open road. The preliminary results of the study indicated that there may be a relationship between rider experience, rider training and feedback, and visual behavior while riding a motorcycle. On a curved section of the open road course, beginner-untrained riders did not look far ahead enough to stop safely twice as often as the other rider groups.

Beginner-untrained riders also exhibited a larger visual gaze area while riding on the open road course than experienced riders. This finding is in the opposite direction than what was predicted. Future analyses of the dataset could examine what riders were looking at on the open road course and may shed light on why the visual gaze areas differed in this way. For example, it could be possible that beginner-untrained riders looked at more riding-irrelevant distractions in their environments, and that experienced riders spent more time looking at riding-relevant elements of the road in front of them.

How to Order

Download a copy of *The Effect of Sight Distance Training on the Visual Scanning of Motorcycle Riders: A Preliminary Look* (53 pages), prepared by Dynamic Research, Inc., from http://www.nhtsa.gov/staticfiles/nti/pdf/811689.pdf Jessica Cicchino, Ph.D., was the task order manager for this project.

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