Visual behavior of drivers at complex intersections: a protocol for on-road assessment

Naomi Kenner, David Krauss, Genevieve Heckman, Robert Rauschenberger, Jay Todd, Robyn Kim

In trying to understand how a motor-vehicle accident may have occurred, questions often arise regarding typical visual behavior of drivers. While much is known about the human visual system and visual attention from basic scientific research, the most useful information for this purpose is provided by studies of on-road driving that address specific driving scenarios, and how visual attention contributes to the success or failure of the driving task in these scenarios.

We present a protocol that allows assessment of driver eye movements during a set of on-road driving tasks. A variety of typical driving scenarios are encountered with a focus on signalized intersections and complex environments during daytime lighting conditions. This provides on-road driving data to fill a gap in the literature regarding typical visual behavior of drivers when negotiating intersections during the day.

Participants between the ages of 25 and 59 drive a rental vehicle on one of two pre-specified routes on the freeway and streets of Marina Del Rey in Los Angeles, CA. Participants will review the 20-30 minute route prior to driving, and an experimenter passenger will provide direction reminders during driving. Participants wear a SensoMotoric Instruments eye tracking system mounted on an unobtrusive baseball cap, and eye movements are recorded using iViewX2 and analyzed using BeGaze2. This system is compatible with most eyewear, including sunglasses, eyeglasses, and contact lenses, and is calibrated at a distance we have determined to allow improved data collection for objects and areas of interest external to the vehicle.

Two driving routes have been established to provide exposure to a variety of common signals and signage including stop sign intersections; signalized intersections with left turn only, through only, and right turn only lanes; signs indicating allowed and prohibited turning maneuvers; signs with street names; signals for protected turn movements; signals before and after the intersection; and signals on the left and right sides of the intersection. These routes take drivers on busy surface streets, quiet back streets, and a section of freeway; they also require drivers to execute different goals at the intersections (turning left, turning right, or proceeding straight).

The data gathered address a variety of questions and our initial focus is on the question of visual behavior at intersections: how fixation patterns on signs, signals, and leading vehicles are modulated by the visual complexity of the intersection and the goal of the driver. Ultimately, the data will constitute a robust, comprehensive database that can be easily analyzed or referenced.

This project provides data on overt visual attention and the typical visual behavior of drivers that is relevant at both theoretical and applied levels: it informs the work of those interested in visual attention, those interested in the driving task, and those interested in assessing the contribution of human factors to motor vehicle accidents.

Naomi Kenner
Exponent
3401 Market Street
Suite 300
Philadelphia, PA 19104
Phone: 215-594-8911
E-mail: nkenner@exponent.com