

Abstract

In this thesis an attempt is made to understand driver behavior while (i) overtaking and (ii) closing-in in weak lane-disciplined traffic using naturalistic driving data obtained from an instrumented vehicle capable of collecting data at high resolution and frequency. This study proposes, possibly for the first time, definitions of the start and end of overtaking maneuver that are based on behavioral cues rather than on arbitrarily chosen positions of the overtaking vehicle. Driver behavior along both lateral and longitudinal directions are studied. The analysis of the data indicates, among other things, that (i) driver's tend to re-evaluate their decision to overtake even after initiating the maneuver, (ii) driver's tend to take approximately the same time to overtake irrespective of the speeds, and (iii) there exists a somewhat counter- intuitive but explainable relation between relative speeds and speeds during overtaking.

Although existence of closing-in, under the broad umbrella of car-following, has long been surmised, empirical evidence of its presence have been few, if any. The reason for this is that obtaining data from situations (in real world) where relative speed can be ruled out as the initial trigger for the following driver's responses leaving "excessive" distance headway as the only plausible cause is difficult. Here, such data has been successfully collected from carefully designed experiments involving multiple vehicles on an expressway. Analysis of the data shows that closing-in happens in three regimes where initially the relative speed (in absolute value) increases sharply, then remains constant for a while and finally decreases gradually compared to the initial change.

Further, the results from the studies on overtaking and closing-in maneuvers indicate that, as expected, an interplay between urgency and safety determines a driver's behavior in these situations. Interestingly, however, primacy of one's concern for safety in determining behavior becomes amply apparent from these studies. For example, even though the initial motivation for the driver to overtake or close-in is an outcome of the driver's sense of urgency, once the maneuver starts, the driver's concern for safety seems to become the primary determinant in the behavior.