

Effects of Task-Irrelevant Cars on Judgments of Deceleration and Time-to-Contact During Car-Following

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Rear-end collisions represent over 25% of crashes with other moving vehicles (NHTSA, 2005). Factors that potentially contribute to such accidents include a driver's ability to respond to a lead car's deceleration and to estimate how much time remains until a collision would occur (DeLucia & Tharanathan, 2009). Prior research (Oberfeld & Hecht, 2008) showed that time-to-contact (TTC) judgments of approaching objects were influenced by task-irrelevant distractor objects. This finding has implications for rear-end collisions when drivers must detect a lead car's deceleration amidst surrounding cars. However, Oberfeld and Hecht simulated a stationary observer rather than a moving observer which is more representative of driving. We measured effects of task-irrelevant distractor cars on judgments of a lead car's deceleration during simulations of self motion. Observers viewed car-following scenarios in which only a lead car was present or a lead car and two distractor cars were present in adjacent lanes. The lead car decelerated 10 s or 15 s after the scene's onset, at either 4 ft/s² (slow) or 10 ft/s² (fast). The distractor cars decelerated earlier, later, or at the same time as the lead car, or never decelerated. Brake lights were disabled. Observers were instructed to maintain 40 mph and to press a button as soon as the lead car decelerated. Mean response time was significantly longer in the presence of distractor cars when the lead car decelerated 15 s after the scene's onset, at 4 ft/s². In a separate study of a TTC (prediction-motion) task used by Oberfeld and Hecht, car-following speed was pre-set to 40 mph, and the lead car decelerated for 3 s and then disappeared. Observers pressed a button when they thought a collision would occur. Distractor cars affected TTC judgments only when deceleration was concurrent with the lead car. In contrast to deceleration detection, TTC judgments were significantly shorter when distractor cars were present compared with absent, suggesting that effects of distractor cars are task-dependent. In summary, task-irrelevant distractor cars can affect deceleration detection and TTC judgments. The implication is that drivers cannot always ignore task-irrelevant cars on the road. Cars on lanes that do not have immediate consequences for a rear-end collision nevertheless may affect a driver's response to a lead car's deceleration. Warning systems designed to prevent rear-end collisions may be needed more in relatively dense traffic when drivers are potentially distracted by task-irrelevant cars.

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