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Investigating the Impact of In-car Communication on Law Enforcement Officer Patrol Performance in an Advanced Driving Simulator

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Project Abstract

Law enforcement officers must process and respond to a variety of information sources to effectively and safely patrol the environment. These demands on attention, such as dispatch radio calls, are necessary for the officer to perform the patrol and thus cannot be eliminated without compromising the officer's effectiveness. This project evaluated law enforcement officers' driving, visual attention, and situation awareness during patrol driving. We varied conditions to determine the impact of information presentation format on officers' ability to execute patrols. In addition, we were interested in how the growing number of in-vehicle technologies may be able to provide additional support to the officer and reduce the impact of information overload.

Fourteen municipal law enforcement officers, recruited from local law enforcement agencies, performed patrols using a driving simulator under general patrol conditions: baseline patrol driving, patrol driving with radio calls, and patrol driving with radio calls and an in-car data terminal. We anticipated that the need to process information over the radio would lead to changes in driving behavior (e.g., steering and lane position variability), visual attention deployment (e.g., eye movements), and situation awareness (e.g., current status of self and other officers). We also expected that the provision of redundant information via an in-car terminal would reduce the impact of this additional demand on the officer's attention. Finally, we were interested in the structure of information transmitted to the officers during patrol. We presented radio calls in both ten-codes (e.g. 10-20 = location) commonly used in police departments or in a more natural language structure (e.g., "What is your location?") Ten-codes are brief but sacrifice transparency of the message. Whereas natural language structure may be easier to understand, it can require a longer transmission time. We presented information in both formats during simulated patrols to determine if one type of transmission type has a lower impact on officers' driving, visual attention, and situation awareness.

Analysis of variance plus post-hoc planned comparisons were used to evaluate the impact of information format and language structure on driving behavior, visual attention, and situation awareness measures. Our results indicate that when ten-codes are paired with a display echoing communication with dispatch or when natural language is used without such a display, accuracy on a test of situation awareness was similar to a baseline condition without distraction. This provides evidence that police departments should be made more aware of how certain technologies and practices interact.

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A. PURPOSE, GOALS, AND OBJECTIVES

The purpose of the research presented here was to provide an objective evaluation of law enforcement officer driving behavior, visual attention, and situation awareness under standard patrol conditions. The goal of the research was to understand whether and how law enforcement officer effectiveness during patrol tasks is impacted by dispatch communication and in-vehicle devices. In order to achieve this goal, we identified two general objectives.

The primary objective was to evaluate the impact of the processing of dispatch-provided information on officer driving and patrol behaviors, officer visual scanning patterns, and officer situation awareness during simulated patrol activities. Achievement of this objective provided an understanding of how the combination of the driving task and patrol tasks affects overall officer performance. The secondary objective was to evaluate how increased information availability, such as that supported by in-car computer terminals and other technological devices, impacted officer performance.

To achieve these objectives, we conducted a simulator based experimental study that manipulated the information provided to law enforcement officers and measured the impact not only on driving behavior but also on the officers' attention to the environment. We investigated the impact of information, both auditory (dispatch calls and other radio traffic) and visual (information provided by mobile data terminals and other in-vehicle devices), on law enforcement officer driving and monitoring of the environment under normal patrol situations. Because we placed the officer in an attentionally demanding situation that at extreme levels could impair driving, for safety considerations, this study was well-suited for simulator-based investigations. The current project resulted in insights about officer performance that can be applied to future research and technological support endeavors.

B. REVIEW OF RELEVANT LITERATURE

1. Law Enforcement Driving

Driving is a complex task; several component tasks (e.g., visual scanning of the driving environment, monitoring vehicle speed and position, manipulating the vehicle controls) interact to produce 'driver performance' (Hole, 2007; Salvucci, 2006). However, the law enforcement driver has even greater attentional demands due to several factors including high speeds, the need to anticipate the behavior of suspects and other drivers, and a high potential for distraction from numerous, but necessary sources (Crundall, Chapman, Phelps, & Underwood, 2003). To prepare law enforcement recruits for such demands, law enforcement academies include specialized driving training as part of the standard curriculum. However, law enforcement driver training primarily focuses on vehicle dynamics, high-speed maneuvers, and other driving-specific factors rather than on the potential interactions between driving and other tasks (e.g., monitoring dispatch communications, patrolling a residential area). All of these other tasks could influence the effectiveness of the officer's patrol behavior and his or her safe operation of the vehicle.

Law enforcement driving is encompassed in three general categories of driving situations (Crundall et al., 2003). The first category of driving is standard patrol, in which all driving regulations are followed appropriately, including speed limits. The other two categories include instances requiring exceptions to general speed and right-of-way regulations: emergency response and vehicular pursuit. Emergency response driving occurs when a call for service is received requiring immediate assistance, such as reporting to the scene of an accident. Pursuit driving involves engagement of a fleeing suspect who may be disregarding driving regulations in an active attempt to evade law enforcement. Although high-speed pursuits do occur and receive a