

DRIVERS' USER-INTERFACE INFORMATION PRIORITIZATION IN MANUAL AND AUTONOMOUS VEHICLES

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ABSTRACT—This study investigated what information items should be presented to drivers in future autonomous vehicles by comparing how preferences regarding information differ from those in the current manual-driving environment. A survey of 29 in-vehicle information items was conducted among 156 participants, who drove a virtual indoor simulator in both manual- and autonomous-driving modes. In all, 29 items of in-vehicle information were classified into three tasks. The primary driving task had mobility as its core value, secondary driving tasks were activities that played supportive roles in vehicular movements (e.g., car accident notifications, wipers), and tertiary driving tasks included non-driving activities. The results indicated that drivers place less priority on receiving secondary task-related information and greater priority on tertiary driving task information in the autonomous mode of driving compared to the manual driving environment. Second, females have a higher preference for information in both modes of driving, whereas males demonstrated a higher incremental level for information in the autonomous environment. Third, older drivers and those in their 20s should be given the highest priority in information dissemination. This study is useful as it can provide a basic guideline for designers of user experiences and user interfaces.

KEY WORDS : Autonomous driving, Driver preference, In-vehicle information, Three tasks of driving, Simulator

1. INTRODUCTION

The information and communications technology (ICT) and automobile industries have become increasingly integrated. Augmented by ICT, sensors that initially supported convenience and safety in vehicles now provide advanced driver assistance system services. Additionally, electronics are now widely used in the automobile industry owing to the increase in the number of drivers who are comfortable using displays, which is a result of the increase in smartphone users in the 2000s. This has led to an increase in in-vehicle display areas, and a decrease in the number of physical buttons required to control in-vehicle systems.

Because of the integration of ICT and electronics in automobile industries, “autonomous vehicles” are receiving increasing attention. Both traditional original equipment manufacturers, such as Mercedes Benz, BMW, and Volvo, and non-vehicle companies, particularly Google, have introduced their own autonomous concept cars. A legislation making provision for the implementation of autonomous vehicles is also in process. For example, in the United States, states such as California

(September 2012), Florida (April 2012), Louisiana (June 2016), Michigan (December 2013), Nevada (June 2011), North Dakota (March 2015), Tennessee (April 2015), Utah (March 2016), and Washington D.C. (April 2013), have enacted and chaptered laws that make provision for autonomous vehicles under legislative or regulatory requirements (National Conference of State Legislature, 2016).

With the emergence of fifth-generation cellular technology (5G) that enables high data transfer rates and broad coverage with low latency, vehicle-to-everything (V2X) communication is becoming feasible. This will further enable the commercialization of autonomous vehicles in future societies. Indeed, as 5G increases the level of integration in automotive industries, an exponential growth of in-vehicle services can be enjoyed, including infotainment and telematics (Sonnenberg, 2010; Holstein *et al.*, 2015). Autonomous vehicles are expected to act as a type of platform wherein individual drivers can enjoy their preferred services, thus changing the concept of the vehicle as simply a mode of transportation to that of a private space. Before considering which in-vehicle services can be enjoyed by future societies, it is necessary to determine what information autonomous vehicles should provide, based on the various elements of driving tasks. This study determines drivers' information prioritization in both

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