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Introduction

HCI for Elderly and Smart Vehicle Interaction

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1. INTRODUCTION

Human factors and human–computer interaction (HCI) face two major trends in studying future vehicles: one is an aging society and the other is the autonomous car. Regarding the autonomous car, the general public are facing fast technical changes. This year Mercedes-Benz introduced the F 015 “Luxury in Motion” as their future vision of the autonomous car. The tech giant Google already tested their self-driving car over 1 million miles. As the autonomous car has been developing, researchers have said that the major cause of driving deaths is the human being, not the failure of the vehicle.

The age of autonomous vehicles looks like it is just around the corner. Within the next 5 years, a large number of companies are going to introduce vehicles that can drive themselves at least part of the time (Autonomous Car, n.d.). Many drivers are expecting a bright future for the autonomous vehicle. However, there are still many problems to be solved before commercializing the autonomous car, such as vehicle communication, environmental challenges, detection of sensor failure, and so on. Yet, among these problems, there is no doubt that safety is the autonomous car’s top priority because of its effects on drivers’ behavior in terms of trust and complacency. With these autonomous car–related issues, human factors and HCI should be able to suggest a research direction and a blueprint of an autonomous car considering the autonomous car related technology development.

Regarding our aging society, the global share of older people (60 years of age or older) increased from 9.2% in 1990 to 11.7% in 2013 and will continue to grow as a proportion of the world population, reaching 21.1% by 2050 (United Nations, 2015). So there is no doubt that the aging driving population will be one of the key issues for road safety. New technology is introduced regularly and vehicle technology changes rapidly, so the importance of aging issues for road safety will increase, as older people often have difficulty learning new technology. Because our society continues to age, we have to consider the elderly in vehicle design, particularly new displays, digital dashboards and instruments, and new interaction types.

These days, dozens of companies are stepping up their efforts to develop an autonomous car, and drivers from the baby boom generation are getting older; the era of the self-driving car in our aging society is not far from now. Considering the importance of these issues, human factors and HCI researchers should pay more attention to research about autonomous vehicles and about aging drivers with autonomous cars.

This special issue presents two major trends in vehicle design for human factors and HCI. One article covers the overall research trends of smart technologies and the elderly in the literature. Three articles discuss how to handle people’s behaviors in adopting an autonomous vehicle. The last two articles suggest some new methods of usability and vehicle design for the elderly.

2. SPECIAL ISSUE CONTENTS

Rhiu, Kwon, Bahn, and Yun (Research Issues in Smart Vehicles and Elderly Drivers: A Literature Review) collected 11,267 articles on smart vehicles and reviewed 257 HCI/HFE studies (including 45 studies on elderly drivers) on smart vehicles systematically and comprehensively. Through identifying the current status of existing studies, they provided valuable insights in establishing research directions for HCI/HFE researchers. According to the results of their review, they suggested future research directions as follows: ‘Assistance system’, ‘Physiological & mental state recognition’, ‘Position sensor technology’, ‘Behavior recognition’, and ‘Infotainment’. In particular, they claimed that HCI/HFE researchers need to focus on several specific research foci of each future research category. For example, identifying the acceptable level of automation, observation/recognition in a naturalistic driving situation, developing customized services using information from diverse sensors, investigating new driving behaviors, and identifying an acceptable level of new technologies/services were suggested for future research. This study can be helpful
for HCI/HFE researchers in understanding current status and gaining more insight of smart vehicle research from user perspectives.

Lee, Mehler, Reimer, and Coughlin (User Perceptions Toward In-Vehicle Technologies: Relationships to Age, Health, Preconceptions, and Hands-On Experience) investigated how different factors from user characteristics and system features potentially affect the adoption of in-vehicle smart technologies. They built and tested a research model that described the relationships of individual characteristics, preconceptions, and task performance and perceptions measured during a system experience to attitudes and expectations toward in-vehicle technologies: voice-control interface, active parallel parking assist, and cross traffic alert. In their study, perceptions of a hands-on system experience showed strong associations with post-experience attitudes and expectations. With their findings, they discussed implications for research in the emerging domain of smart technologies in automobiles, as well as for practice in design and delivery of in-vehicle technologies.

Lee, Kim, Lee, and Shin (Can Autonomous Vehicles Be Safe and Trustworthy? Effects of Appearance and Autonomy of Unmanned Driving Systems) investigated how anthropomorphic cues of an artificial driving agent contribute to shaping more positive user perceptions of unmanned driving systems. They developed and tested driving scenarios in which participants interacted with an artificial driving agent with different levels of anthropomorphic cue induced by the variations in appearance (human-like vs. gadget-like) and autonomy (high vs. low) of the agent. The results of the experiment indicated that the greater level of anthropomorphism induced by human-like appearance and high autonomy in the agent evoked the feelings of social presence, which in turn positively affected the perceived intelligence and safety of—and trust in—the agent. Based on these findings, they demonstrated that the external (i.e., appearance) and internal (i.e., autonomy) anthropomorphic cues can be both strategically manipulated to provide more positive and socially meaningful interaction with technology, and discussed both theoretical and practical implications for designing more safe and trustworthy autonomous vehicles.

Choi and Ji (Investigating the Importance of Trust on Adopting an Autonomous Vehicle) investigated the user’s adoption aspects of autonomous vehicle regarding trust. To explain the impact of different factors on autonomous vehicles intention, a research model was developed based on the Technology Acceptance Model (TAM) and trust theory. Their survey study results demonstrated that perceived usefulness and trust are major important determinants of intention to use the autonomous vehicles. Their results also show that three constructs - system transparency, technical competence, and situation management - have a positive effect on trust. They identified that trust has a negative effect on perceived risk.

Choi, Kim, Lee, and Kwon (A Weighted QFD-Based Usability Evaluation Method for Elderly in Smart Cars) developed a quantitative usability evaluation method (UEM) for elderly drivers, which has different weight values on each factor concerning physical and cognitive context of elderly drivers. They conducted an analysis of the relationship between universal design guidelines for elderly drivers and usability principles by using the quality function deployment method. They also compared the proposed UEM with existing UEM in terms of thoroughness, validity, and effectiveness. The proposed quantitative UEM can be applied to enable developers to conveniently analyze and improve the details of the usability problem through relationship analysis of guidelines and proposal of an optimal tangible technology for elderly drivers and a vehicle system applying this technology.

Kim, Lim, Jo, and Kim (Utilization of Visual Information Perception Characteristics to Improve Classification Accuracy of Driver’s Visual Search Intention for Intelligent Vehicle) introduced a novel approach to utilize drivers’ cognitive characteristics for classifying an intention underlying visual search behavior in driving context. In their study, two issues are considered as influential factors on a driver’s eye movements: a driver’s visual information processing characteristics (VIPC) and purpose of visual search. Based on their study results, the effectiveness of utilizing VIPC for grouping drivers was tested with task goal classification model by comparing the models’ performance when drivers were grouped by typical demographic data. Results show that grouping based on VIPC improves accuracy and stability of prediction of the model on a driver’s intention underlying visual search behaviors. Their study is expected to be applied on personalization and adaptive interfaces based on the quantifiable drivers’ behavioral data.

The studies introduced in this special issue are not enough to cover the wide range of elderly and smart vehicle interaction in Human Factors and HCI. But, it is this special issue’s objective that these studies can highlight various researches’ effort in Human Factors and HCI. There are a growing number of research issues related with Human Factors and HCI: User Interface and UX for Elderly, Evaluation Methods and Guidelines for Elderly, Multimodal Interaction in Smart Car, Elderly Behaviors in Smart Car, Augmented Reality for Elderly in Smart Car, Interfaces for (semi-) Autonomous Car, Assistive Technology for Elderly in Smart Car, and Trust and Privacy Issues in Smart Car. All of them will improve the safety and UX of future vehicle and contribute to solve the elderly driver issue in near future. Thus, Human Factors and HCI researchers should make more efforts in coping with these two major trends.

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REFERENCES