SUMMARY OF Ph.D. DISSERTATION

School School of Science for Open and Environmental Systems	Student Identification Number	SURNAME, First name SATO Toshihisa

Title

Study on Human Interface of Information Devices

Based on Elderly Users' Cognitive Characteristics and Process of Use

Abstract

Information Technology is becoming available for use in daily living including houses and transport areas. In comparison with young users, elderly users have more problems in using the information devices because of the influence of reduced physical and mental functions of elderly users, and there has been various work on the elderly users' behavioral and cognitive characteristics. However, the human interface based on the age-related cognitive declines is not clarified. In the traditional study on human interface of the information devices, it is hypothesized that human factors are stationary characteristics. This paper points out the importance of considering that the process of use which includes a change in context of the use while getting familiar with the information devices, a change in users' condition and users' adaptation to the information devices, has considerable effects on the usability of the information devices.

This paper describes an investigation on human interface based on the elderly users' cognitive characteristics and a fundamental investigation on the influence of the process of use on the usability of the information devices. With regard to the process of use, the influence of interface factors on the users' adaptation to the information devices is discussed. As the examples of the information devices, this paper focuses on in-vehicle navigation system which has already come onto the market, narrow road driving assistance system which helps drivers to pass along a narrow road in safety and with lower mental workload, and control device of information network appliances which can control a wide range of electric home devices.

In Chapter 1, the popularization of the information devices in daily lives is introduced. In Chapter 2, global tendencies of the research and development on ITS (Intelligent Transport Systems) and the information network appliances are summarized. In Chapter 3, literature studies on the age-related declines in physical and mental abilities are summarized. In Chapter 4, it is proposed that the analysis of interface factors based on users' cognitive process is applied to interface design flow of the information devices in order to develop human interface which can overcome age-related cognitive declines. Conceptual models on the process of use which are represented as the change of the users' cognitive process are proposed. In Chapter 5, two studies examine human interface of the ITS based on elderly users' cognitive characteristics and users' adaptation. First, the proposed interface design method is applied to the narrow road driving assistance system, and the results of the usability tests show that the proposed method contributes to the development of human interface of the narrow road driving assistance system accessible to elderly users. Second, a simulator-based and a field experiments are conducted in order to clarify the valid indices for the evaluation of drivers' learning and adaptive process when using the in-vehicle navigation system while driving, and the results show total glance time and total operating time are appropriate for the evaluation of the drivers' behavioral adaptation. Based on these indices, the influence of the menu structures to complete one operational task on the young/elderly drivers' behavioral adaptation is investigated. In Chapter 6, two studies examine human interface of the information network appliances based on elderly users' cognitive characteristics and users' adaptation. First, the same method as the narrow road driving assistance system is applied to interface design flow of the control device of the information network appliances. The results of the usability tests show the effectiveness of the proposed method in the development of the control device interface suited to the elderly users' cognitive behavior. Second, from the results of the experiment which aims to investigate the influence of interface factors on the young/elderly users' adaptation to the control device, the usage of the interface based on users' cognitive process leads to early and proper adaptation to the control device.

The above results suggest that the interface design method based on users' cognitive process can be applied to the ITS and the information network appliances, and this method is effective in the development of human interface based on age-related cognitive declines and users' early and proper adaptation to the information devices.