

SUMMARY OF Ph.D. DISSERTATION

School Keio University	Student Identification Number	SURNAME, First name NAKANISHI, Miwa
Title A PSF-based Evaluation of Speech Control as a Man-Machine Interface		
Abstract <p>This study attempts to evaluate the possibility of applying speech control to actual situations on the basis on PSF.</p> <p>Naturally, a Man-Machine Interface is important in order that man and machine work together in perfect harmony. Whether the Man-Machine Interface can enhance users' performance or not depends on not only the characteristics of itself but also the ones of the situation, including the task, the system, and the users. These factors which effect on users' performance can be thought of as PSFs (Performance Shaping Factors), and should be taken into account when evaluating the Man-Machine Interface. In this study, speech control, which is expected to be a new way against manual control, is evaluated based on PSF. The practical processes are as follows.</p> <p>1)Choice of PSFs</p> <p>Comparative experiments were carried out between speech control and manual control, in which subjects performed three tasks typical of system operation. The data was analyzed from several perspectives such as patterns of human behavior, human error, and so on. The results showed what kinds of factors effect on perception, thought, action. And the 37 primary factors out of them were chosen as PSFs.</p> <p>2)Organization of PSFs</p> <p>The factors of human basic performance, that is perception, thought, and action were added to the 37 PSFs, and the causality of each factor was summarized in a matrix. Moreover, based on the causality matrix, the PSFs plus 3 human performance factors were organized into a hierarchical structure model with the following three ranks: the basic PSFs, the intermediate PSFs, and the human performance factors.</p> <p>3)Quantification of PSFs</p> <p>In order to make it possible to identify how the basic PSFs effect on the intermediate PSFs and the human performance factors, the hierarchical structure model was quantified. Then the basic PSFs concerning the Man-Machine Interface were scored from specialists' viewpoints based on some researches, on the other hand, the PSFs concerning the situations were scored from users' viewpoints with a checklist. And in consideration that PSFs often include qualitative factors, Fuzzy theory was applied to calculate the impact of a factor on another factor.</p> <p>Finally the above processes were executed to evaluate the possibility of applying speech control to some actual situations. The results, for example, suggested that it should be possible to apply speech control to the normal monitoring task in industrial plants, however that it should be avoid to apply it to emergency in industrial plants. This suggestion agrees with the general understanding that speech control is proper for quiet and non-critical situations but is not for tight and critical situations.</p> <p>As described above, this study found some characteristics of speech control through the experiments, organized them on the basis of PSFs, and revealed possibility of applying it to some actual situations. Further the above processes could be a prototype for a man-machine interface evaluation method in which the situation factors are embedded.</p>		