博士論文要旨

論文題名：Research on the Prevention of Prospective Memory Errors in Train Drivers

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The memory of future actions, such as “I will give my friend a message when I see him,” is called prospective memory. A prospective memory error is a phenomenon in which a person is unable to recall a prospective memory at the time of the execution of their plan. Such errors sometimes cause serious accidents; thus, their prevention is essential. Considering the prospective memory error of train drivers, this study focused on over-speeding caused by forgetting a temporary speed restraint section. Furthermore, this study proposed a method to prevent this error and examined its effectiveness.

Chapter 1 focused on safety in the aviation and railroad fields. The importance of countermeasures for prospective memory errors in preventing over-speeding and the necessity of proposing and verifying the effectiveness of methods for preventing prospective memory errors that can be easily implemented by train operators were discussed from the perspective of software countermeasures.

Chapter 2 discussed accidents that actually occurred due to prospective memory errors. Then, focusing on prospective memory errors by train drivers, the accidents caused by such errors were outlined. Among the many types of accidents, the dangers of over-speeding caused by the train driver's failure to remember the existence of a speed restraint section were explained. The current measures to prevent over-speeding and their problems were also discussed.

Chapter 3 examined the effect of having the intention to carry out plans. Previous studies have suggested that prospective memory is retained in long-term memory with high accessibility by having an executive intention (intention superiority effect). However, it was unclear whether the accessibility improvement was caused by the processing in the encoding stage or by the possession of executive intention itself. Therefore, experiments 1, 2, and 3 examined the effect of processing in the encoding stage and the effect of execution intention, confirming that the intention superiority

effect was caused by the effect of execution intention.

In Chapter 4, a method for preventing prospective memory errors (prospective calling) was proposed. Even if prospective memory is retained with high accessibility (intension superiority effect), it is not guaranteed that the prospective memory can be recalled at the time of execution. Therefore, an imaging-type prospective calling method was proposed in which prospective memory is learned while imagining the situation at the time of execution. In addition, the repetition-type prospective calling method was proposed in which the prospective memory is intermittently recalled to retain the recalled plan in the working memory until the time when the plan is to be executed.

Chapter 5 demonstrated that these two types of prospective calling prevent the prospective memory error (experiments 4 and 5). In both experiments, participants were university students. The Einstein paradigm, commonly employed in prospective memory research, was used in the experimental procedure. The prospective memory error preventive effects of imaging-type prospective calling in experiment 4 and of repetition-type prospective calling in experiment 5 were confirmed.

Chapter 6 examined the effect of prospective calling on the prevention of commission errors. A commission error is an error in which a person sees or hears information that must be ignored and takes an incorrect action. For example, a driver may see a green light while traveling at a speed limit of 30 km/h, accelerate unintentionally, and exceed the speed limit. In experiments 6, the induced commission error effect of prospective calling was confirmed and the prevention of commission errors was confirmed in experiment 7.

Chapter 7 elaborated on an experiment using a train operation simulator with train drivers conducted to verify the effect of the prospective calling on the prevention of over-speeding. The results confirmed that the rate of over-speeding was lower when the driver used prospective calling compared to not using it.

Chapter 8 summarized the previous sections and discussed the direction of future research on prospective calling. The possibility of applying prospective calling to other situations in addition to over-speeding and the need for research on the negative effects of prospective calling (error-inducing effects) were also presented. Finally, the applicability of psychological findings to the railroad field from the perspective of one-man operation and automatic operation was reviewed.