

Analysis of differences in driving behavior between two countries in a naturalistic simulator experiment

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This study focuses on the multifaceted causes of motorcycle accidents in Thailand, focusing first on human factors and examining the causal relationship between the personality of motorcycle riders and their risk-taking behavior while driving. We conducted a comparative analysis of Japanese and Thai riders. The specific issues we addressed were as follows:

- 1) We constructed a multi-agent simulator that faithfully reproduces real-world urban traffic flows and proposed a method for analyzing "natural driving" in a VR environment.
- 2) We analyzed the driving behavior of motorcycle riders in two countries and analyzed the causal relationship between personality and risk-taking behavior using Structural Equation Modeling.
- 3) We analyzed whether the driving behavior analyzed using the multi-agent simulator is equivalent to driving behavior in a real road traffic environment.

An overview of the simulator system is shown in Figure 1. Traffic flow data, driving behavior, and the behavior of surrounding vehicles observed in Bangkok were analyzed and used as input information for the traffic simulation. Each agent is equipped with response models, such as the actions of cognition, judgment, and operation, and reproduces the diverse interactions between motorcycles, cars, and pedestrians. Figure 2 shows an example of the results of an analysis conducted using Structural Equation Modeling on motorcycle riders in this study. The results suggest that the influence of personality traits on traffic risk behaviors has a unique causal structure depending on the driving direction. First, for time headway, a longitudinal risk indicator, impulsivity was the largest determinant, and individuals with higher impulsivity tended to shorten the temporal distance to the vehicle in front and increase the risk of rear-end collisions. On the other hand, for relative speed when overtaking a leading vehicle, a lateral risk indicator, the degree of safety sensitivity had a strong negative causal relationship, and the lack of normative awareness and cautious attitude toward safety led to excessive overtaking speeds. These findings indicate that multifaceted safety measures are necessary to prevent motorcycle traffic accidents. For example, technological interventions using ADAS or self-control training are effective in addressing accident risks. To validate the analysis in these simulator environments, we compared time headway, a longitudinal risk indicator for vehicles in Bangkok, between the simulator and the real environment, and found that the two were in general agreement.

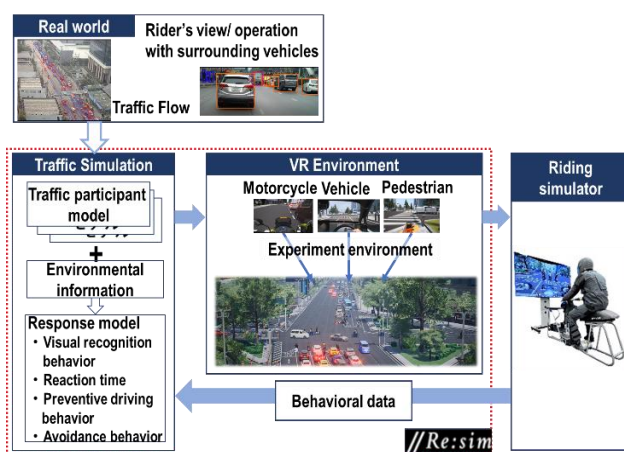


Fig.1 Multi-agent simulator that reproduces naturalistic traffic flow in Bangkok city

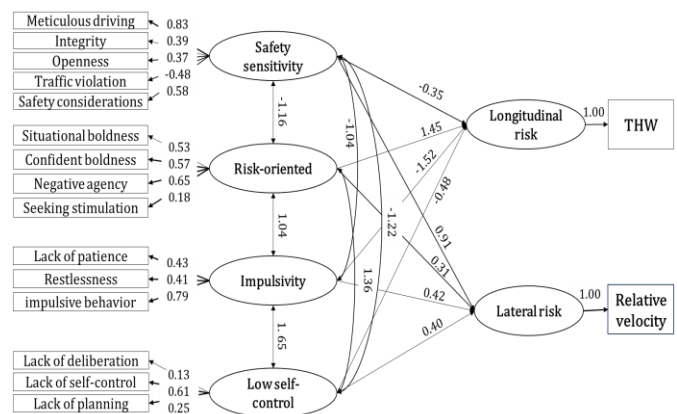


Fig.2 Relationship between personality and risk-taking behavior using Structural Equation Modeling