
The UniBW M Bike-Riding Simulator for Traffic Safety Research

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Abstract:

Traffic safety researchers use simulators to examine potentially dangerous traffic interactions in controlled settings. Data gained from these experimental studies in simulators need to be relatively valid to field data. For traffic safety studies, interesting variables are foremost longitudinal measures. To examine the relevant population, simulators need to be used by a wide variety of people. Therefore, simulation sickness is to be minimized while providing high immersion to elicit the most natural behavior.

The UniBW M simulator is optimized for evaluating longitudinal riding behavior with a strong focus on bicycling safety. This includes a precise physical simulation of the riding load (and achievable speed) due to simulated environmental forces and a fully functional, parameterizable brake system concerning brake behavior and achievable decelerations. This is done to enable realistic speeds as well as accelerations/decelerations both on the plain but also when riding uphill or downhill. In addition, the riding dynamics include a pedelec and a headwind simulation, which affects the riding load and, therefore, the achievable speed. The impression of load and speed is supported by a bicycle-specific soundscape, which generates rolling, braking, and wind noises. The steering and movement system is designed passively to support realistic body tension and affords minimal balancing. To reduce simulator sickness, a 360° monitor-based hexagon viewing system is used.

At the workshop, results of validation with field cycling data and results for subjects' immersion and simulation sickness symptoms from the first study will be available. A video presentation of the simulator is planned.



Figure 1. Photograph of the Bike-Simulator at Universität der Bundeswehr in München.