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# Comparing a Virtual Reality Bicycle Simulator to Real-World Cycling Behavior

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## Abstract:

Driving simulators can provide realistic models of complex traffic and road situations in a controlled laboratory environment. Although car, train, and airplane simulators are established, bicycle simulators are at an earlier stage of development. These simulators are particularly relevant as bicycle accidents have increased considerably. To decrease these accidents, it would be useful to quantify cycling behavior in complex road interactions. The current VR bicycle simulators are associated with discomfort, leading to reduced immersion and an experience that is incongruous with biking in the natural world. Taking this into consideration, it is necessary to validate current bicycle simulators with real-world cycling behavior. Our group built a stationary VR bicycle simulator. We compare cycling behavior in VR to measurements we took during cycling in the natural world, such as the orientation of the handlebars and the speed of the bicycle. Both bicycle setups include the same sensors for these measurements. We use this data to quantify how representative cycling behavior is in VR compared to the natural world. This can help to improve the validity of bicycle simulators to investigate complex traffic situations in a realistic and safe environment.



**Figure 1:** Justus-Liebig-Universität Giessen VR bicycle simulator