Application and Evaluation of Countdown Timers for Bicycle Traffic in a Simulator Environment

Master‘s Thesis of Stefanie Beiersdorf

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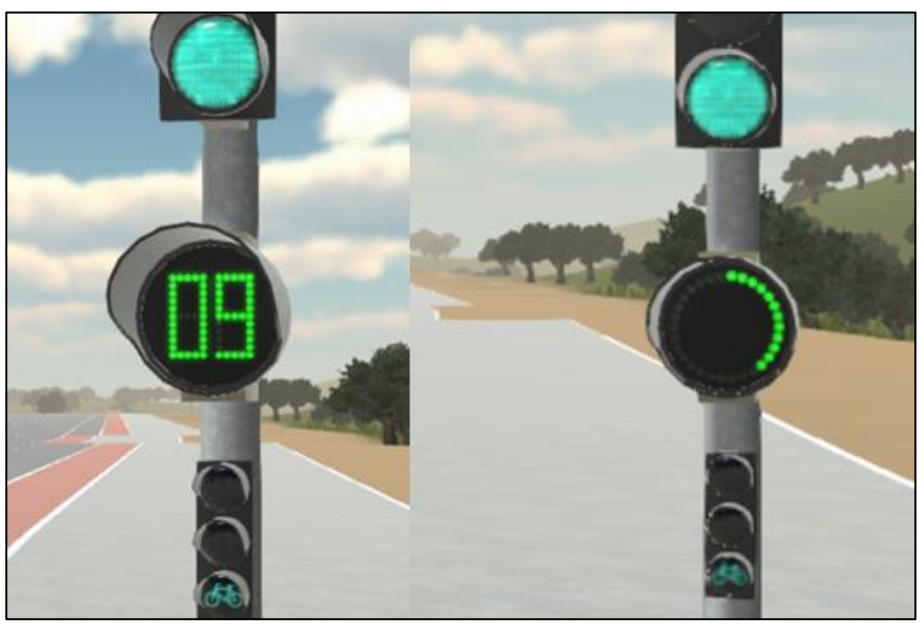

Figure 1: Two bicycle countdown timers tested in the simulator study: “seconds timer” (left) and “circle timer” (right)

Countdown timers are devices that indicate the remaining red or green phase time durations of traffic lights. Different designs have evolved over the years for indication of the time left before the next phase change. In most cases, numbers are displayed counting down the remaining seconds to zero. Another design option is an elapsing circle of LED lights. Bicycle countdown timers can help reducing red light violations [WIERSMA, 2006]. Satisfaction surveys indicate that presence of a countdown timer makes waiting at an intersection more comfortable. Furthermore, 70 % of respondents believe that they improve bicycle traffic safety [LAMBERS, M.G.F, 2009, QUOTED IN AKKERMAN, 2010]. In Germany, countdown timers for bicyclists are not implemented yet. A bicycle simulator study was conducted win the scope of this Master’s Thesis to test the effect of countdown timers on traffic safety and efficiency. Furthermore, two different designs of countdown timers (presented in Figure 1) are tested and evaluated within a survey conducted with the test participants after the simulator experiment.

The bicycle simulator consists of a bicycle which rear wheel is fixed on a bicycle trainer (see Figure 2). Sensors track steering angle and driving speed of the bicycle and these data are transferred to the simulation software DYNA4 via a Matlab-Simulink model. The simulated environment is presented with monitors or virtual reality glasses. A test track with 33 test intersections was prepared to test effects of countdown timers, with special focus on red light violations and speed adaption. Influences of remaining indicated phase time, road width of the crossing traffic road, crossing traffic volume, and additional countdown timers located 60 m in front of the intersections are to be evaluated. Comprehensibility of the two different countdown timers and their effect on required start-up time are assessed. 30 test persons participated in the simulator experiment. An additional questionnaire conducted after the simulator experiment allows the participants to assess their experience with the countdown timer designs.

Figure 2: Bicycle simulator (a) and detail of the rear wheel fixed on a bicycle trainer (b).

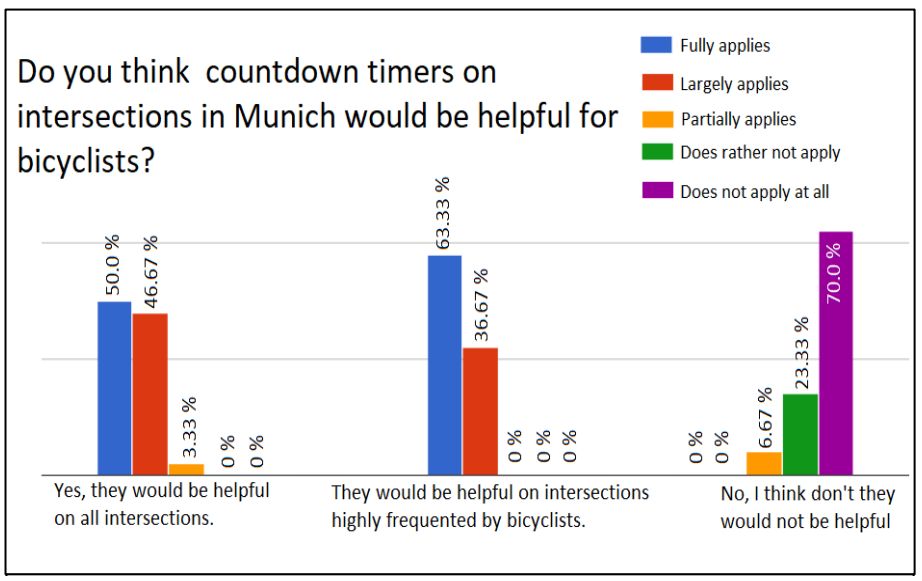

Figure 3: Results of the survey on countdown timers conducted with the participants of the simulator study.

The data from the simulator study allow indication of possible trends regarding the effects of countdown timers on red light violations. More red light violations occurred on intersections with higher indicated remaining red phase times, and on intersections with narrower crossing street widths. Comparing red light negations on intersections with “seconds timer” and “circle timer” and without timer, most red light crossings occurred on intersections with the “seconds timer” and least on the intersections with the “circle timer”. Required start-up times were lower on intersections with both timer types than on intersections without timers. Survey indicates higher compliance of the “seconds timer” than the “circle timer” and that people find the additional provided information helpful regarding speed adaption and start-up quicker. Countdown timers on intersections in Munich are welcomed by high share of test persons (compare Figure 3). However, to fully evaluate the indicated trends, further research is proposed after further improvement of the bicycle simulator.