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# Drafting in cycling

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## Abstract

This presentation provides an overview of scientific studies on drafting in cycling. Drafting is traditionally defined both in the scientific literature as in the practice of professional and recreational cycling as "benefiting from the area of low pressure behind another cyclist, which reduces the air resistance and the required power to maintain a given riding speed" (Crouch et al. 2014; Malizia and Blocken 2020). Already in the late 1800s, the large benefits by drafting in cycling were exploited in drafting races where cyclists could reach speeds above 100 km/h. In 1899, Murphy rode a mile in less than one minute by drafting behind a train (Heijmans and Mallon 2011), thus at an average speed of 100.2 km/h. In 1909, Guignard rode 101.623 km in one hour by drafting behind a motorcycle (Gronen and Lemke, 1987; Ritchie, 2011). A recent study assessed the large benefits obtained by drafting behind a motorcycle (Blocken et al. 2020). It was shown that drafting at separation distances d = 2.64, 10, 30 and 50 m can reduce the drag of the cyclist down to 52, 77, 88 and 93% of that of an isolated cyclist, respectively. A cyclist power model was used to convert these drag reductions into potential time gains. For a non-drafting cyclist at a speed of 54 km/h on level road in calm weather, the time gains by drafting at d = 2.64, 10, 30 and 50 m were 12.7, 5.4, 2.7 and 1.6 s per km, respectively. These time differences are very large and evidently can influence the outcome of cycling races. More recent research indicated that drafting is not only beneficial when the cyclist is in a trailing position, but also when he or she is in the leading position. This had been suggested before (Olds 1998), was first demonstrated by CFD simulations and wind tunnel tests in 2013 (Blocken et al. 2013) and later confirmed by Barry et al. (2014), Defraeye et al. (2014) and others. Later, it was shown that also a trailing team car or a motorcycle can provide a substantial drag reduction for a cyclist (Blocken and Toparlar 2015; Blocken et al. 2016). These effects by trailing vehicles are not prevented by the regulations of the International Cycling Union, not even by the updated version on vehicle circulation in the peloton (UCI 2017). The most extreme case of drafting is achieved when riding in the belly of a tightly packed cycling peloton. The drag reduction in this case is not only caused by riding behind other cyclists, but by being embedded in a cluster of cyclists where several aerodynamic benefits are combined. Therefore, we suggest to modify the definition of drafting to "benefiting from the presence of another cyclist or cyclists or a nearby vehicle to reduce the air resistance and the required power to maintain a given riding speed".

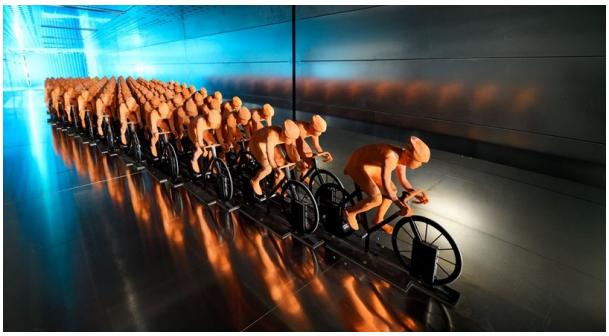

**Fig. 1** Peloton of 121 quarter-scale cycling models in the wind tunnel of Eindhoven University of Technology.

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