

LETTER TO THE EDITOR

Call for Letters–Viewpoint: Technological Advances in Elite Sport: Where Does One Draw the Line?

Fair advantage: the effect of drag and effective drafting in elite sport

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TO THE EDITOR: We would like to thank Muniz-Pardos et al. (1) for their viewpoint on the technological advancements in elite sport. Although “traditional” methods of elite pacing, i.e., running behind pacers, have demonstrated partial effectiveness, they often rely on pacers who, generally, withdraw halfway through the race. Therefore, pacing is strongly dependent on the pacers’ experience and has a higher kilometer-to-kilometer coefficient of variation compared with pacing by means of technologies such as WaveLight lighting (1). However, a drawback of relying on the latter’s technological innovations is that they diminish the benefits of drafting that traditional pacing provides, a technique integral to traditional pacing and commonplace in sports like cycling or skating.

Although pacers are a common part of elite racing, their drafting benefit to an athlete has possibly been less explored because the effect of drag accounts for less than 10% of the total mechanical work while running at high speeds (2). This research was reinvigorated with Eliud Kipchoge’s Breaking2 project and has led to various computational fluid dynamics simulations studies. For example, Fernandes et al. (3) explored different pacing formations via simulations and determined what the optimum drafting strategy is based on the number of pacers present. Recently, we conducted experiments in a wind tunnel to analyze the drag exerted on the body when subjected to headwinds or tailwinds of various speeds (between 0 and 15 m·s⁻¹) while running on a treadmill at 4 m·s⁻¹ (4). Drag increases with the square of wind speed and at 15 m·s⁻¹, a headwind generates a drag of ~50% of the external mechanical work. Extrapolating our findings for overground running, the apparent drag experienced by an elite marathon runner at 5.83 m·s⁻¹ without any additional wind added to the system is about equal to 8.1 N. In the case of Kenenisa Bekele (56 kg), the apparent drag would be ~1.4% of his body weight.

Valsecchi et al. (5) observed a ~10% decrease in perceived effort and ~4% decrease in oxygen consumption when running 1.5 m behind another runner in a wind tunnel. When projecting these results to a whole marathon, the authors obtain a 535 s or 6% improvement to marathon time. Although such improvements may seem hypothetical, reducing the drag by improving drafting techniques does lead to small but considerable improvements in elite running. Indeed, even a 1%

improvement on Kelvin Kiptum’s current marathon record time would lead to a 72 s improvement in the overall time, enough to pass under the 2-h mark.

We would therefore argue that an effective manner of improving performance would be by improving racing strategy to account for effective drafting. Such improvements should not be seen as technological, contrary to advanced footwear technologies or WaveLight pacing, and should be considered as a “fair” approach to pushing performance.

GRANTS

This study was funded by the Fonds de la Recherche Scientifique of Belgium (FNRS-CDR J.0200.22)

DISCLOSURES

No conflicts of interest, financial or otherwise, are declared by the authors.

AUTHOR CONTRIBUTIONS

R.M.M. and A.H.D. conceived and designed research; performed experiments; analyzed data; interpreted results of experiments; drafted manuscript; edited and revised manuscript; and approved final version of manuscript.

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