

How Usain Bolt can run faster -- effortlessly

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Usain Bolt can achieve faster running times with no extra effort on his part or improvement to his fitness, according to a study published today in *Significance*, the magazine of the Royal Statistical Society and the American Statistical Association. Cambridge Professor of Mathematical Sciences John D. Barrow illustrates how, based on concrete mathematical evidence, Bolt can cut his world record from 9.58 seconds to 9.45.

Usain Bolt holds the current 100m world record, at 9.58s, and has been described as the best [sprinter](#) there has ever been, dramatically reducing his running times since he first won the world record in 2008. Previous scientific studies have been carried out aiming to predict his [maximum speed](#), yet have failed to take all the relevant factors into account, and Bolt has already surpassed the speeds they predicted.

Today's *Significance* study highlights the three key factors instrumental in improving Bolt's performance, which combined produce an improvement of 0.13s.

Firstly, Bolt's [reaction time](#) is surprisingly poor, in fact one of the longest of leading sprinters. By responding to the gun as quickly as possible without triggering a false start, with 0.10s, he would shave 0.05s off his world record to 9.53s.

Secondly, advantageous [wind conditions](#) can help athletes improve their times, although this is supposedly taken into account. Bolt's Berlin record of 9.58s benefitted from a modest 0.9m/s tailwind. If he were to

benefit from a maximum permissible tailwind of 2m/s, he would expend less effort on beating wind drag and reduce this record further by 0.05s to 9.48s.

Thirdly, running at altitude reduces the air density in the wind drag calculation, as was witnessed at the 1968 Olympic Games in [Mexico City](#) (2240m above sea level), where significant improvements over short distances were displayed (although for longer distances the altitude makes running more difficult). As a result, athletics world records are only permitted at altitudes of up to 1000m, but this still allows Bolt to reduce his time by a further 0.03s to 9.45s if he runs at this altitude.

"With the relatively big chunks we've seen Bolt take out of world records, we are still a long way from understanding the limits of his, and others', sprinting speeds," said Professor Barrow. "What this study serves to illustrate is the insight maths can give into sports performance, which has not been done previously to such a degree of accuracy."

More information: Barrow JD; How Usain Bolt can run faster – effortlessly; *Significance* (2012); [DOI: 10.1111/j.1740-9713.2012.00552.x](#)

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