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“World-class athletes of both sexes cover 100 metres in about 10 seconds. What percentage of this is spent touching the ground? And what’s the figure for a 2-hour marathon?”

Every step we take can be broken up into two parts: ground contact time and flight time. As people run faster, the time they spend in contact in the ground decreases but so too does step time, meaning the relationship between them does not necessarily change.

Usain Bolt’s current world record for 100 m is 9.58 s (an average speed of 10.4 meters per second) and previous research estimates his ground contact time and step times to be approximately 91 ms and 236 ms respectively. He typically covers the 100 m in 41 steps, spending approximately 39% of the race in contact with the ground. In the same race, both the ground contact and step times of Asafa Powell and Tyson Gay were shorter (average of 75 and 206 ms respectively), meaning they spent 36% of their race in contact with the ground.

There isn’t any published data from Kipchoge’s run in Berlin where the new marathon record was set at two hours, one minute and 39 seconds, but we can draw upon other scientific literature to try estimate the time spent on the ground in this run. Average speed throughout the race was 5.8 meters per second, and ground contact times at this speed are between 110 and 130 ms. Assuming an average ground contact time of 120 ms and Kipchoge taking approximately 25,000 steps throughout the marathon, approximately 41% of the race was spent in contact with the ground.

These results show the capacity of elite athletes in generating high ground reaction forces in very short times, which is known to be related to faster running speeds. The higher percentage observed in the marathon will be due in part to how long-distance runners strike the ground – sprinters land on the balls of their feet, rarely allowing their heel to touch the ground which shortens ground contact time. In contrast, in the marathon the heel tends to drop during contact even in highly trained runners due to development of fatigue in the lower limb muscles, which naturally increases ground contact time. It is worth noting however the relatively small difference observed between these two race distances (36 to 41%), highlighting the very high level of training of these athletes.