

Researchers develop formula that can calculate person's speed by just looking at their footprints

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The calculation works perfectly well both whether the individuals are running or walking. Credit: Christian Haugen

Two Spanish scientists have designed an equation that provides a highly accurate estimate of an individual's speed based on stride length. They used data from professional athletes and walking and running experiments on a beach in order to come up with the equation. The result

has applications in the study of fossil trackways of human footprints.

In the spring of 2008, 14 palaeontology students from the Complutense University of Madrid ran along a beach in Asturias (Spain) at the request of a planetary geologist who was a friend of their fieldwork director. Javier Ruiz, from the Complutense University of Madrid (Spain), and his colleague Angélica Torices, from the University of Alberta (Canada), just out of curiosity, wanted to check how accurately an individual's [speed](#) could be calculated based on their tracks.

The results, published in 2013 in the journal *Ichnos*, show that, without needing any other data such as leg length, they were able to achieve quite a high degree of accuracy, with a margin of error of 10 to 15%.

"For humans, we are able to calculate speed based on stride length alone with a very good degree of accuracy," Javier Ruiz told SINC.

The authors applied their formula to estimate the speed at which the humans were travelling who left the [Pleistocene era](#) fossil trackways found in the Willandra Lakes Region of Australia.

"A previous study had made a very elaborate calculation of their speed but the results were as high as if they had been [professional athletes](#)" Ruiz explained. His results show a reasonable sprint pace.

In order to come up with their [equation](#), Ruiz and Torices compared the data obtained in the experiments with the students with data from professional athletes who compete in 100 and 400-metre races.

Up to now, the individual's leg length or at least an estimate of the length was required to calculate speed based on tracks. An equation formulated by the British zoologist Robert McNeil Alexander in 1976 was used which he based solely on data obtained from his children running.

Ruiz and Torices measured the speed and stride length of the students as they ran along the beach and applied Alexander's equation. "The data fit with the equation very well", Ruiz explained, "Alexander did a good job with very little statistical data but with a large mathematical basis and we have seen empirically that his equation is correct."

The speed of elite athletes

In the case of the athletes, the researchers had data on speed and stride length but not limb length, which led Ruiz to modify the equation so that this piece of data was not needed. "There was a very good degree of accuracy with the new equation with a 15% margin of error, even better than the equation that was generally used whose margin of error was 50%."

In addition, the calculation works perfectly well both whether the individuals are running or walking and this was very surprising according to Ruiz. "There is a little more variability in running but even so it works very well."

Despite that fact that the speed calculation is very accurate, Ruiz admits that it cannot be applied in an absolute and unequivocal manner but rather statistically. "Strangely, sometimes 400 and 100-metre athletes have the same stride length but run at different speeds. What the body does is try to optimise how energy is used at a given speed."

More information: *Ichnos*, [DOI: 10.1080/10420940.2012.759115](https://doi.org/10.1080/10420940.2012.759115)

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