When dinosaurs walked the Earth they moved like modern birds

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We know that dinosaurs ruled the Earth many millions ago, but how they walked has been a mystery.

Our new research shows that the movement of some dinosaurs has a lot in common with some of today’s ground-dwelling birds. We looked at theropod dinosaurs, which were typically bipedal (two-legged), walking on their hind legs like *Tyrannosaurus rex*.

In our study, published in the Journal of the Royal Society Interface, we took measurements of 211-million-year-old theropod footprints from a quarry at Culpeper in Virginia, in the United States, and compared them to similar measurements for locomotion in humans and 11 species of ground-dwelling bird such as the quail, emu and Australian bush turkey.

This is the first time that locomotion in the three groups of bipeds has been compared on a level playing field. In particular, we focused on a parameter called step width, which measures how widely spaced the left and right feet are during locomotion.
We compared measurements of step width against the speed of the animal, measured directly for the modern species, or by using stride length as a proxy for the extinct theropods.

**From walking to running**

In all three groups, step width decreased with increasing speed. In other words, as the animal moved faster, the left and right feet were placed closer towards the body midline, and at the fastest speeds of locomotion, the feet could even cross over the midline.

So this told us that the extinct theropods that made the footprints were at least following the same general principle seen in modern bipeds.

Interestingly, however, the way in which step width decreased with increasing speed was different between the three groups.
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In humans, step width shows an abrupt, precipitous decrease at the transition from walking to running. In other words, as soon as we start running we suddenly bring our feet much closer towards the body midline.
But in both the modern birds and the extinct theropods, no such abrupt change was observed. Instead, the step width decreased gradually with increasing speed.

This pattern of similarity and contrast suggests that the extinct theropods were moving more like modern birds than humans.

Furthermore, a gradual or continuous change with speed has been previously observed for many other measurements of locomotion in birds, such as stride length and step frequency.

Birds therefore have what is called a “continuous locomotor repertoire” – that is, walking and running are not distinct gaits (as they are in humans), but instead they transition seamlessly from one to the other.

The extinct theropods that made the footprints were probably also using a similarly continuous locomotor behaviour.

A better understanding

This research changes our thinking about theropod movement, in three main ways.

First, using a continuous locomotor behaviour could have been beneficial to theropods by allowing them to run just that bit faster while maintaining stability, thus reducing bone and muscle stresses.

Second, the unique locomotor behaviour that characterises modern birds today may actually have been inherited in part from their theropod ancestors, showing more similarities between birds and dinosaurs than previously recognised.
And third, this study helps to paint a better picture of what extinct theropods were like as living animals. We now know that side-to-side limb movements were important for theropod dinosaur locomotion to increase stability while walking, and that theropods did not simply use human-like walking and running gaits.

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This locomotory gait found in dinosaurs and birds may also be important for improving visual acuity by increasing head stability, particularly in the vertical direction.

This is important if we wish to create biomechanical models of theropod locomotion, such as one of *T. rex*, to address questions such as maximum speed capabilities or endurance.

It’s also important if we want to make sure that these types of dinosaurs are portrayed accurately in film, animation, computer simulations and other forms of popular culture.

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