COSMOS magazine

News

Why we swing our arms when we walk

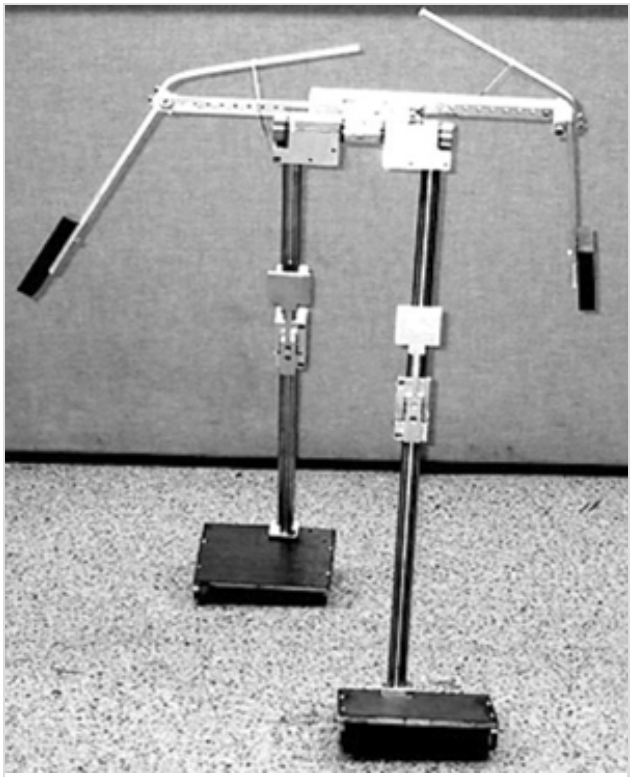
by Lisa Merolla
Cosmos Online

Wednesday, 29 July 2009

BOSTON: A new study explains why people swing their arms as they walk, a seemingly unnecessary movement for which researchers have tried to find an explanation.

The research, detailed today in the *Proceedings of the Royal Society B*, used simple robots and human experiments to show that arm swinging is both easy and beneficial. The movement requires little muscular effort, yet it makes walking much easier.

"This puts to rest the theory that arm swinging is a vestigial relic from our quadrupedal ancestors," said Steven Collins, a biomechanical engineer with the University of Michigan in the USA. "Instead, arm swinging is a sensible part of an economic gait on two legs."



The 'passive dynamic walking machine' used in the experiments.

Credit: University of Michigan

Walking machines

Collins first became interested in the role of arm swinging through his work with walking robots, which he uses to test ideas about human locomotion. He works with 'passive dynamic machines', which walk down a small incline without any power source, as well as robots that use motor-driven springs to push off the ground.

However, the first machines had trouble walking without arms, tending to spin and fall. When Collins and his colleagues added free-swinging arms to the machines, they moved in a way similar to human arms.

The researchers designed an experiment to determine the purpose of this arm swinging. They had 10 people use their arms in different ways as they walked: either swinging normally, held at their sides, bound to their sides or moving out of sync to the walking.

They measured the effort required from the shoulder muscles, as well as the effort of walking overall, which was quantified as metabolic cost.

Tendency to spin

The results showed that arm swinging, either normally or in the opposite direction, required little effort from the muscles. "Instead of being muscle-driven," Collins said, "arm swinging appears to arise from the natural dynamics, or passive dynamics, of the body as it walks."

Related articles

Maths proves the silliness of 'silly walks'

Walking tall gave humans energy advantage

Did apes start upright walking in trees?

Exercise no walk in the park

Ants on stilts gauge distances with internal pedometer

The experiments also showed that keeping the arms steady increased the effort of walking by 12%, the equivalent of walking 20% faster or carrying a 10 kg backpack. When the arms were bound at the sides, not as much effort was needed, which suggests that holding the arms down requires more exertion that letting them swing.

But forcing the arms to swing out of sync increased the effort of walking even more. The researchers' explanation, which they developed by observing the walking robots, is that this alternate movement makes legs work twice as hard to prevent your body from spinning.

Collins explained: "during a step your legs try to make your body spin about a vertical axis... in a motion resembling pirouetting ballerina."

Swinging arms in the normal direction cancels this out, meaning leg muscles don't have to counter the spinning tendency. However, swinging arms in the opposite direction doubles-up on the spin; as a result, your leg muscles must work twice as hard to keep from turning.

Collins hopes to use these findings about arm swinging to design more efficient walking robots. In addition, he said they could have future applications for physical therapy.

David Lloyd, director of the University of Western Australia's Gait Laboratory, in Perth, said the paper "clearly shows what role the arms' swing has in normal gait."

He added that some neurological disorders, such as Parkinson's disease and cerebral palsy, cause constrained or opposite arm motion. This abnormal movement negatively affects sufferers' walking balance and energy expenditure.

###

Follow Cosmos on Twitter!
twitter.com/cosmosmagazine

Readers' comments

Add new comment