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Brain s Importance Debated

Is Walking a No-Brainer?

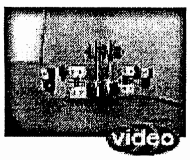
Cornell University engineering lecturer Mike Coleman, left, and graduate student Mariano Garcia display the Tinkertoy walkers. (Nicola Kountoupes, Cornell University Photography)

Maybe a pile of sticks, tied together the right way, can actually do what appears to be highly coordinated motion.
Andy Ruina, Cornell University

By Mark Baumgartner
ABCNEWS.com

April 17 What started as a playful experiment is giving researchers new insight into how we walk.

A motorless gadget made from plastic Tinkertoys and a few odds and ends surprised researchers by taking controlled, coordinated steps. The revelation shows that mechanics, rather than the brain, may have more to do with how we walk than previously thought.



See a Tinkertoy walker in action.
533 kb (avi)
512 kb (mov)
RealVideo
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Mechanical engineers Andy Ruina and Michael J. Coleman, both of Cornell University, believe this finding could lead to better artificial legs and improve rehabilitation for people with neuromuscular disorders.

A Few Serendipitous Steps

The toy, which Coleman and Ruina informally dubbed a robot, has two legs but can t even remain upright without falling over. At first, the two never imagined this unsteady thingamajig would amount to much of anything.

Playing, with no hope of success, we placed the toy on a ramp, wrote Coleman and Ruina in a recent issue of *Physical Review Letters*. Surprisingly, it took a few serendipitous, if not very steady or stable steps.

After some tinkering, the toy took repeatable, chattering, human-like stable steps without falling over, says Coleman.

Question of Walking

Those simple steps are actually a big deal in scientific circles. Walking is primarily thought to be controlled by the brain and central nervous system. Coleman and Ruina say although the brain still clearly plays a role in walking, their research shows other factors may come in to play.

The research may bolster the case for a new generation of flexible prosthetics designed to spring back to shape as the foot is lifted off of the ground.

How humans walk with their top-heavy, upright trunk atop two relatively spindly legs is not well understood, Coleman says.

Coleman and Ruina s little robot suggests that gravity, inertia and ground contact may also contribute to how well we walk.

Maybe a pile of sticks, tied together the right way, can actually do what appears to be highly coordinated motion, says Ruina.

Powered Like a Slinky

Coleman and Ruina s robot is powered by gravity, much the way a Slinky is. But what makes it far more worthy of study is its ability to move in three dimensions up and down, forward and backward, and from side to side.

The three-dimensional aspect of the Cornell robot is an advance over the two-dimensional devices previously used to study walking, says Dr. Rodger Kram of the Department of Integrative Biology at the University of California at Berkeley. Those devices only go backwards and forewards.

When we walk, we rock side to side, notes Kram.

Philip Martin, who designs and studies artificial legs at Arizona State University, says the Cornell research may bolster the case for a new generation of prosthetics, called energy-returning limbs. These artificial legs, made of flexible carbon graphite, take advantage of the same forces as the Cornell robot gravity, inertia and ground contact.

Unlike older prosthetic legs, which are heavier and assume the brain takes more control over their use, these new legs spring back to their original shape when the foot lifts off the ground. As the foot comes up, the leg releases energy, much as a stretched-out rubber band does when released.

It puts less demand on the individual, says Martin, to supply the energy to move the artificial limb.

More Efficient Robots

The performance of the Tinkertoy walker also suggests, Ruina says, that more efficient robots can be built. For example, he says, the remote-controlled human robot built in 1996 by Honda that can make decisions based on the surface it is traveling, consumes about 4,000 watts of energy to walk. A robot of (our) type, if built to the same human size, would consume 50 to 100 watts to walk, about what real people use.

The Cornell researchers intend to make their robot more stable and sophisticated. From there, who knows where its walking will take us■

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